

Modeling the Relationships Among Reading Instruction, Motivation, Engagement, and Achievement for Adolescents

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ABSTRACT

This study modeled the interrelationships of reading instruction, motivation, engagement, and achievement in two contexts, employing data from 1,159 seventh graders. In the traditional reading/language arts (R/LA) context, all students participated in traditional R/LA instruction. In the intervention R/LA context, 854 students from the full sample received Concept-Oriented Reading Instruction (CORI) while the remainder continued to receive traditional R/LA. CORI emphasizes support for reading motivation, reading engagement, and cognitive strategies for reading informational text. Seven motivation constructs were included: four motivations that are usually positively associated with achievement (intrinsic motivation, self-efficacy, valuing, and prosocial goals) and three motivations that are usually negatively associated with achievement (perceived difficulty, devaluing, and antisocial goals). Reading engagement was also represented by positive and negative constructs, namely dedication to and avoidance of reading. Gender, ethnicity, and income were statistically controlled in all analyses. In the traditional R/LA context, a total network model prevailed, in which motivation was associated with achievement both directly and indirectly through engagement. In contrast, in the intervention R/LA context, a dual-effects model prevailed, in which engagement and achievement were separate outcomes of instruction and motivation. The intervention R/LA context analyses revealed that CORI was associated with positive changes in motivation, engagement, and achievement relative to traditional R/LA instruction. The discussion explains why there were different relations in the two instructional contexts and demonstrates the importance of simultaneously examining both positive (affirming) and negative (undermining) forms of motivation and engagement.

The first purpose of this investigation was to describe the relationships among reading achievement, motivation, and engagement under the conditions of traditional reading/language arts (R/LA) instruction. We explored whether motivation was associated with achievement directly or whether its connection to achievement occurred through engagement. The second purpose was to examine the relationships among reading achievement, motivation, and engagement under the conditions of a R/LA instructional intervention, consisting of Concept-Oriented Reading Instruction (CORI). We attempted to determine whether an instructional intervention influenced the interrelationships of achievement, motivation, and engagement. In particular, we inquired whether an instructional intervention was associated with achievement through the pathways of either motivation or engagement, or both.

Consistent with prior research (RAND Reading Study Group, 2002), our meaning for *reading achievement* referred to the students' proficiency in reading to answer questions requiring conceptual integrations of text-based content; we focused specifically on comprehension of informational text. Following the distinctions proposed by previous investigators (Fredricks, Blumenfeld, & Paris, 2004), we refer to reading engagement in its behavioral form, consisting of actions and intentions to interact with text for the purposes of understanding and learning. Engagement is the act of reading to meet internal and external expectations. Such engagement may be positive, referring to reading with effort, purpose, and intention to learn, which we term *dedication*, or it may be negative, referring to students' intents and actions that enable them to evade reading tasks or activities, which we term *avoidance*.

Reading motivations include students' goals, values, beliefs, and dispositions toward reading, as portrayed in prior reviews (Guthrie, Wigfield, & You, 2012). We selected a limited set of constructs consisting of intrinsic motivation (interest and enjoyment in reading), self-efficacy (confidence), valuing reading (perception that reading is important), and prosocial goals (intentions to interact socially in reading). Because these motivations correlate positively with achievement, we refer to them as affirming motivations. A contrasting set of motivations is perceived difficulty (feeling incompetent), devaluing (perception that reading is useless), and antisocial goals (intentions to denigrate peers' reading). Because these motivations correlate negatively with achievement, we term them *undermining motivations* (Guthrie & Coddington, 2009). The focal engagement and motivation constructs are defined more fully in the online version of this article.

Background Literature

Motivation has been linked with reading achievement in a variety of correlational, longitudinal, and experimental studies. In correlational studies, intrinsic motivation for school learning has been associated positively with achievement test scores in reading and math for students ages 7–16 years (Gottfried, Fleming, & Gottfried, 2001). For middle school students, cognitive strategies of organizing, rehearsing, and elaborating meaning during reading have been associated with mastery goal orientation, which refers to the attempt to understand texts as deeply as possible (Patrick, Ryan, & Pintrich, 1999). Negative correlations with achievement also occur for the motivations of work avoidance (Baker & Wigfield, 1999) and devaluing (Legault,

Green-Demers, & Pelletier, 2006). Thus, a wide range of positive motivations appear to be linked positively with achievement, while a few negative motivations seem to be linked negatively with achievement.

Measures of behavioral engagement, including self-reported effort (Skinner, Kindermann, & Furrer, 2009), amount of time spent (Guthrie, Wigfield, Metsala, & Cox, 1999), and observed concentration in reading tasks (Jang, 2008), have all correlated with reading achievement. Secondary students' selections of courses in a specific subject matter, an indicator of engagement, have been associated with motivation for learning that subject matter in elementary school. Specifically, students' self-efficacy for reading/English in grade 4 predicted their selection of English courses in grade 10. Belief that reading/English was important in grade 4 also directly predicted taking English courses in grade 10 (Durik, Vida, & Eccles, 2006). Confirming this pattern, 14-year-old students' devaluing of and disinterest in school tasks correlated negatively with time spent studying and correlated positively with intention to drop out of school, an indicator of avoidance (Legault et al., 2006). Although motivation and engagement are associated with reading achievement, it is unknown whether their effects are direct and independent or whether one is mediated by the other during traditional R/LA instruction. The first purpose of this study was to address that issue.

Can instruction influence motivation, engagement, and achievement? Several motivation-supporting practices in classroom instruction have been correlated with students' motivation, as described in a review (Gambrell, 2002). For example, autonomy support is a widely documented classroom practice that influences students' motivation (Greene, Miller, Crowson, Duke, & Akey, 2004; Ryan & Deci, 2009). Based on self-determination theory, autonomy support refers to teaching that is "related to the children's intrinsic motivation, self-esteem, and beliefs about their intellectual competence" (Deci & Ryan, 1985, p. 255). Autonomy support consists of providing students with opportunities for choice or self-direction while minimizing the use of controlling pressures. Shih (2008) reported that Taiwanese eighth graders who perceived autonomy support in the classroom were likely to show relatively high levels of behavioral engagement in the forms of listening carefully, persisting with hard problems, and participating in class discussions.

Providing relevance during instruction has also been observed to increase motivation. Lau (2009) found that when middle and high school students perceived that instruction was relevant to their lives, they showed relatively high volumes of reading activity (reading engagement) and achievement. Instructional supports for social motivation, such as arranging for

peer interaction during learning, have been found to be associated with students' intrinsic motivation and active participation in learning (Furrer & Skinner, 2003).

Instruction that enables students to learn to set realistic goals during reading and to evaluate their progress increases self-efficacy and achievement in reading tasks (Schunk & Zimmerman, 2007). Thus, instructional emphases on autonomy support, relevance, collaborative learning, and self-efficacy support are each associated with appropriate motivation constructs in correlational and experimental research. However, it is unknown whether the effects of instructional intervention on reading achievement are direct or are mediated by motivation and/or engagement in middle school classrooms. Examining this issue was the second purpose of this study.

Variables and Hypotheses

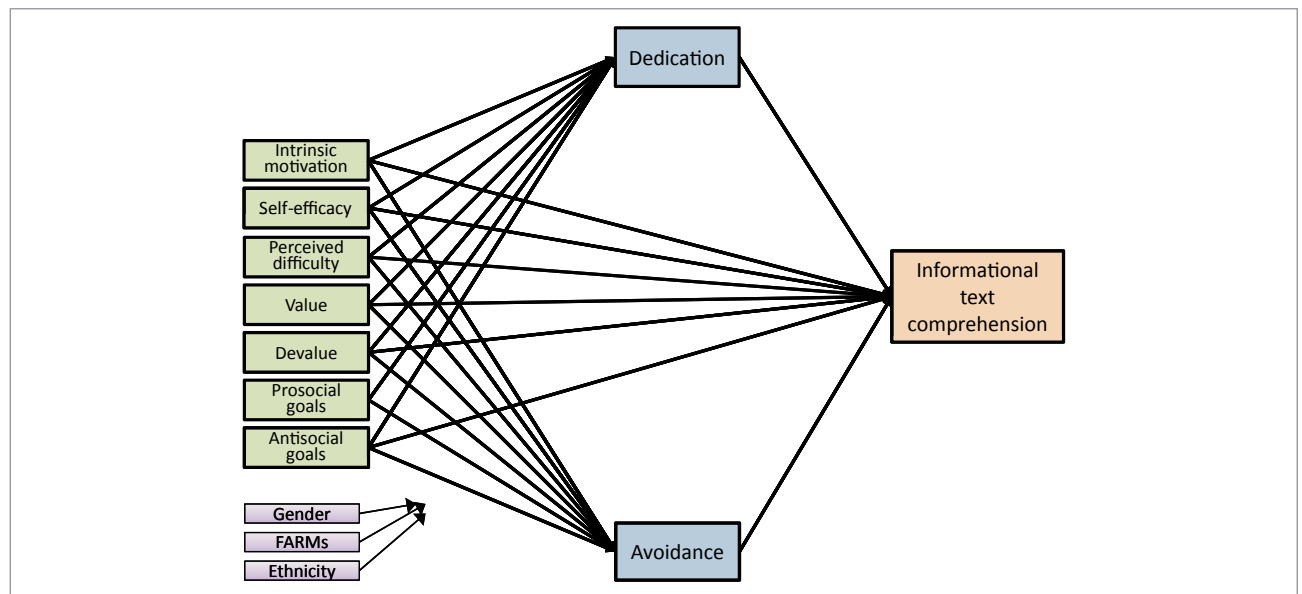
Motivation and engagement variables used in the present study are presented in Figure 1, which is termed the *total network-traditional R/LA conceptual model*. Within the model, there are seven motivational variables, including intrinsic motivation, self-efficacy, perceived difficulty, value, devalue, prosocial goals, and antisocial goals. Two variables represent behavioral engagement, namely, dedication and avoidance, and one variable represents achievement,

consisting of informational text comprehension (ITC). We controlled for the relations of gender, free and reduced-price meals (FARMs), and ethnicity to each motivation, behavioral engagement, and achievement variable in the model because of the known correlation of these demographic variables with the constructs in the study (Guthrie et al., 2012; National Center for Education Statistics, 2011). The total network-traditional R/LA model was investigated for all grade 7 students' traditional instruction prior to an intervention. This model contains pathways linking motivation to engagement and achievement, and links of engagement to achievement.

The first hypothesis was that in the traditional R/LA context, the indirect effects of motivation on achievement are more important than the direct effects. That is, motivations would be associated with achievement only by pathways through engagement. This was termed the *full mediation-traditional R/LA model*. We tested the quality of this model by comparing it with the total network-traditional R/LA model.

The second hypothesis was that in the traditional R/LA context, the direct effects of motivation on achievement are important, as are the direct effects of motivation on engagement, but the direct effects of engagement on achievement are not important. This model was termed the *dual effects-R/LA model*. We tested the quality of this model by comparing the dual effects-R/LA model with the total network-traditional R/LA model.

FIGURE 1
Total Network-Traditional Reading/Language Arts Conceptual Model



Note. FARMs = Free and reduced-price meals.

The third hypothesis concerned the relations of motivation, engagement, and achievement in what we termed the *intervention R/LA context*. It stated that the effects of instructional intervention on learning are mediated through either motivation or engagement, or both, and the direct effects are not important. This was termed the *full mediation–intervention R/LA model*. We tested the quality of this model by comparing it with a total network–intervention R/LA model, which is identical to the total network–traditional R/LA model, except it adds an instructional variable (CORI or control) with direct links to motivation, engagement, and achievement.

The fourth hypothesis was that instruction and motivation influence learning and engagement as different (twin) outcomes relatively independently, which is represented in the dual effects–intervention R/LA model. The conceptual version of this model is identical to the dual effects–traditional R/LA model, except that instruction is added and the controlling variable of ITC in the preintervention assessment is added. We tested the quality of the model by comparing it with the total network–intervention R/LA model.

This study is important because it investigates the patterns of instruction, engagement, and motivation that are associated with achievement through the testing of the four hypotheses previously stated. The results may assist educators in designing instructional goals and targets for reading education.

Method

Participants

Schools and Teachers

Participants were all seventh-grade R/LA teachers ($n = 20$) in the four public middle schools of one school district in a mid-Atlantic state. Chi-square tests indicated that the CORI and control teachers did not differ significantly in gender ($F = 80\%$), ethnicity (EA = 95%), number of years of teaching experience (more than three years = 25%), highest degree obtained (BA = 75%), or certification in English, language arts, and/or as a reading specialist (70%).

Students

The data used in this study came from the 1,159 seventh graders taught by the participating teachers in 57 separate classes; 53% were boys and 47% girls. The students' ethnicity was 78% European American, 19% African American, and 3% Asian. Twenty-four percent of the students qualified for FARMs, and 9% qualified for special education. Less than 1% of the students were enrolled in classes for English as a second language.

The student sample was representative of the student population in the school district. Chi-square tests indicated that the 854 students in CORI and 305 students in the control group did not differ significantly in gender or FARMs status. A significant association occurred between instructional condition and student ethnicity, $\chi^2 = 35.421(df = 3, p < .001)$. African American students were more likely to be in the CORI group than in the control group.

Measures

Reading Achievement

The researcher-developed ITC assessment, administered both pre- and postintervention, was designed to measure understanding of science texts on animal and plant survival. Two forms were developed, each containing five passages followed by five multiple-choice questions with four answer options. These passages included two 100–110-word passages with Flesch–Kincaid reading grade levels of 4.7–7.3; two items for these passages required paraphrasing a sentence, and a third item for each assessed understanding of a word in context, a phrase, or a basic concept. The other three passages on each form ranged from 300 to 350 words and had Flesch–Kincaid grade levels of 7.2–12.0. One item each for these passages involved identifying the main idea, demonstrating subconcept understanding, engaging in causal reasoning, selecting the best summary of a paragraph, or selecting the best full-passage summary. One of the longer passages was common to both test forms; otherwise, the passages and items on each form were unique.

A former director of science education for a school district in a major U.S. city, uninvolved in the creation of the test, rated the test passages of one form on scientific validity on a 3-point scale. All passages received the most positive rating for scientific validity, indicating that they were factually accurate, included interrelated concepts appropriate to the topic, and were well organized. He also classified the items, which underwent minor revisions after his review, into the five item types listed previously. His classifications matched those of the test authors 90% of the time. The reliability indexes (Cronbach's α s) for ITC, across the two forms and two assessment times, ranged from .78 to .82.

Test form administration was counterbalanced so approximately equal numbers of students of each gender and ethnicity and from each school received each test form and so every student received a different form at each test point. The number of correct scores on each form was equated for difficulty at each test point, using the linear equating method for tests with linking items (Crocker & Algina, 1986).

To measure preintervention reading fluency, a variable employed only in a preliminary analysis as

described in the Results section, we employed Form B of the Woodcock–Johnson III Reading Fluency Test, which measures speed and accuracy in reading simple sentences. Students have three minutes to read silently as many sentences as they can and indicate whether each one is true or false. We modified the individual/small-group test instructions to enable whole-class administration by having the administrator review the practice exercises with the whole class and by adding reminders for students to keep their test booklets closed before the time limit started and once it finished. Standardized scores were used in analyses. Both forms have internal consistency coefficients of ≥ 0.90 for ages 12 and 13 and one-year test–retest correlations of $.70$ (McGrew, Schrank, & Woodcock, 2007; Schrank, Mather, & Woodcock, 2004).

Reading Motivation and Engagement

We used the Motivations for Reading Informational Books in School (MRIB-S) questionnaire to measure the following seven motivation constructs prior to and after the six-week intervention: intrinsic motivation, valuing of reading, self-efficacy, prosocial goals, devaluing of reading, perceived difficulty, and antisocial goals. We also used the MRIB-S to measure the two engagement constructs of dedication and avoidance. The questionnaire contains seven items theoretically representative of each construct, except for dedication, which was represented by 12 items. All items were answered on a 4-point Likert scale (“Not at all true of me,” “Not very true of me,” “Somewhat true of me,” and “Very true of me”), with higher values indicating higher levels of the underlying construct. The items intended to represent each scale each underwent a principal components analysis with varimax rotation. These analyses supported the formation of an individual scale for each construct. All items were retained with the construct they were expected to represent, except the antisocial scale was reduced to three items; two items were removed due to loading less than $.40$ in the factor analysis and two due to item–total correlations less than $.30$ in a subsequent reliability analysis. Student scores on each scale were the mean value of their responses to the items comprising it.

For measurement purposes, the motivation and engagement constructs were defined as follows, with their Cronbach’s α from the pre- and postintervention assessments in parentheses. Intrinsic motivation ($\alpha = .82/.83$) was defined as student enjoyment of reading (Ryan & Deci, 2009). Valuing of reading ($\alpha = .85/.88$) was conceptualized as students’ belief in the importance of reading informational books in school settings (Wigfield & Cambria, 2010). Self-efficacy ($\alpha = .82/.86$) was defined as students’ beliefs about their ability to accomplish such academic tasks as reading informational books in classroom contexts (Schunk & Pajares,

2009). Prosocial goals ($\alpha = .78/.81$) refers to students’ intentions to follow school/class rules and the desire to cooperate with teachers and peers in classroom settings (Wentzel & Looney, 2007). Dedication ($\alpha = .90/.87$) was conceptualized as a form of behavioral engagement emphasizing persistence, effort, and time spent in reading informational books in school (Guthrie et al., 2012).

Devaluing of reading ($\alpha = .87/.88$) was conceptualized as the belief that reading informational books in school contexts is not important for academic success or one’s future life (Legault et al., 2006). Perceived difficulty ($\alpha = .85/.87$) referred to the perception that informational books read for school are hard to comprehend (Chapman & Tunmer, 1995). Antisocial goals ($\alpha = .69/.65$) was conceptualized as the intention to avoid interacting with other students in reading and to promote the devaluing of reading informational books (Ho & Guthrie, in press). Avoidance ($\alpha = .83/.85$) referred to a form of behavioral engagement consisting of aversion to reading informational books in school settings (Nicholls, 1990; Wigfield & Guthrie, 1997).

Student Background Variables

We used student demographic variables that are established correlates of reading achievement and motivation as control variables. Student ethnicity status was a dummy-coded variable with European American/Asian coded as 0 and African American/Hispanic/American Indian as 1. Students’ FARMs status represented income, with those eligible for free or reduced-price lunches coded as 1, and those who were not coded as 0. For gender, males were coded as 0 and females as 1.

Design and Preliminary Analyses

The first phase of the investigation was a correlational study using structural modeling of the effects of motivation and engagement on achievement under typical instructional conditions in middle school (traditional R/LA context). The analyses used preintervention motivation, engagement, and achievement data. The second phase of the study was an equivalent-groups quasi-experimental design using integrated instruction (CORI) with multiple outcomes of motivation, engagement, and achievement, which were structurally modeled. As subsequently detailed, there were no preexisting differences between the CORI and control groups on cognitive or motivation variables, and demographic variables were used as covariates (Shadish, Cook, & Campbell, 2002). In both phases, hypotheses in the form of structural models were tested against total network structural models.

In the second phase, two experimental conditions were assigned to students in classes within schools. One of four schools was randomly designated as the

control and three as CORI. Consistent with previous studies, students in the respective schools participated in the program assigned to them, with the individual as the unit of statistical analysis (Guthrie, Wigfield, & VonSecker, 2000; Purcell-Gates, Duke, & Martineau, 2007). To examine possible preexisting differences among the instructional groups, we conducted a multivariate ANOVA. Preintervention measures of all the variables used as motivation, engagement, and achievement variables in the modeling were dependent variables in the MANOVA.

The demographic variables used as controls in the modeling, including gender, FARMs, course level (honors or regular), and ethnicity, were covariates, and the instructional variable (CORI. vs. control) was the fixed effect in the MANOVA. Significant effects were observed for the covariates consisting of gender: Wilks's $\Lambda = .91$, $F(9, 1,006) = 11.45$, $p = .000$; ethnicity: Wilks's $\Lambda = .93$, $F(9, 1,006) = 8.32$, $p = .000$; FARMs: Wilks's $\Lambda = .95$, $F(9, 1,006) = 5.66$, $p = .000$; and course level: Wilks's $\Lambda = .90$, $F(9, 1,006) = 11.95$, $p = .000$. However, the effect for CORI versus control was not statistically significant: Wilks's $\Lambda = .98$, $F(9, 1,006) = 1.65$, $p > .05$. Thus, the experimental and control groups showed no preexisting differences.

Data Collection Procedure

Preintervention assessments were administered to all students in April 2009, the week before CORI commenced, by the students' R/LA teachers in their usual classrooms, with oversight by project personnel. The assessments occurred during two 45-minute periods within the same day. In the first period, ITC and MRIB-S Part 1, which included the intrinsic motivation, avoidance, self-efficacy, and perceived difficulty scales, were administered; in the second period, Woodcock-Johnson III Reading Fluency and MRIB-S Part 2, which included the value, devalue, prosocial goals, antisocial goals, and dedication scales, were administered.

The postintervention assessments were administered to all students in the same manner in June, the week after CORI ended. The present study used pre- and postintervention ITC, motivation, and engagement data and preintervention fluency data. Student and teacher demographic data were obtained from the central office of the school district. Preintervention data were used in the first phase to test hypotheses 1 and 2, and the postintervention data were used in the second phase to test hypotheses 3 and 4.

Instructional Conditions

We next present six motivational practices included in CORI for 42 classes in three middle schools. Each practice has been investigated at the elementary school

level (Guthrie, McRae, & Klauda, 2007), except emphasizing importance, which was added for middle school students.

Enabling Success

Within CORI for middle school, the first way that teachers enable success is by providing readable texts, consisting of materials that students can read aloud with at least minimal expression, can understand literally, and can relate to other texts that they have read on the topic. Other practices to assure success include the following: teacher feedback regarding success, videos that support text comprehension, helping students recognize their own content knowledge expertise, and guiding students in setting realistic goals for interaction with text. This support enhances self-efficacy, focusing on students' beliefs in their capacity to perform well on increasingly difficult literacy tasks (Schunk & Pajares, 2009).

Providing Choice

Providing choice is a motivational support system in CORI for middle school that enables students to develop self-direction in literacy. To increase intrinsic motivation, teachers provide the following forms of student self-direction within the six-week CORI program: self-selection of books or sections of books, student input into topics or the sequence of topics, options for demonstrating learning from text, and selection of partners for teams. As small as these choices may appear, they enable students to feel a stronger sense of investment and to commit larger amounts of effort to their reading (McRae & Guthrie, 2009; Zhou, Ma, & Deci, 2009).

Fostering Collaboration

The structure for small-team interaction was collaborative reasoning, based on research by Chinn, Anderson, and Waggoner (2001). Teachers initiated the following activities: partners or small groups exchanging ideas and sharing expertise based on their reading, student-led discussion groups and book talks, team projects such as poster making, and peer conferencing and student feedback. For example, students were given five minutes to discuss with their partners the inferences that they had generated from reading three pages of text on the conceptual question of the day. In each 90-minute lesson, teachers arranged for students to work in whole group, partnerships, and small teams to bolster the motivation of prosocial goals for reading.

Emphasizing Importance

Emphasizing importance focuses on enhancing students' value for literacy activities. This brings students' attention to the benefits of reading. For example, after a lesson in which students viewed a video of plant-animal

interactions, read a text, practiced a strategy of learning from texts, such as summarizing, and shared their new learning with their partners, the teacher asked, “What were your sources of new learning today?” Students responded by saying, “the video,” “my partner,” or “my writing.” Soon they discovered that the text enabled them to gain knowledge most effectively in this topic on this day. Awareness of the value of reading often comes as a surprise to students. Brief tasks can increase perceived value and course achievement (Hulleman, Godes, Hendricks, & Harackiewicz, 2010), and brief teacher explanations can increase perceived text value and enhance engagement in reading (Jang, 2008).

Affording Relevance

Relevance refers to linking books and reading activities to students’ personal experiences (Assor, Kaplan, & Roth, 2002). Such links can be tied to long-term history, such as students’ cultural experiences in their ethnic group, or to a personal interest. In CORI for middle school, we give context through videos related to the conceptual theme. For example, in week 1 of this intervention, we presented a video on predation in which a cheetah captured a gazelle on the Serengeti Plain. The students then read a paragraph on predation in cheetahs and drew inferences from the text. Text is made relevant by connecting it to a vivid personal encounter with the phenomenon through video. Linking a readable trade book to this interesting event projects the enjoyment of the video into the text. Over six weeks, students are weaned from the relevance-generating event (video) and learn to find interest in the texts themselves.

Thematic Unit

For this grade 7 CORI unit, the theme was diversity of plants and animals in community interactions. The superordinate idea was symbiosis, including such concepts as mutualism and parasitism. Students were given a big question for each week, as well as related questions daily. Texts for whole-class instruction, individual guided reading, and group projects were selected to be theme relevant. Strategy instruction is placed within the context of the conceptual theme. Furthermore, motivational supports such as choice are not global but contextualized in the content question of the day. In this thematic environment, students experienced multiple motivational supports, including success, choice, collaboration, importance, and relevance, which enabled them to use a variety of motivations for gaining knowledge from informational texts.

The CORI framework included teaching inferencing, summarizing, and concept mapping. Inferencing instruction consisted of requesting students to make connections from sentences within a paragraph to their

background knowledge and individual sentences. Summarizing instruction consisted of asking students to locate several keywords and supporting facts in a text ranging from one paragraph to a section of a chapter to a whole chapter of a trade book. With this information, students wrote summaries of two or three sentences for one paragraph, increasing in length as texts were extended. Concept-mapping instruction consisted of teaching students to chart the main idea, key concepts, and supporting evidence or examples of a text in a pyramidal structure. Students generated and wrote links among all elements. For each strategy, the teachers modeled for the whole class using a grade-level text. The teachers next provided guided reading with leveled texts for small groups of four to six students daily. Students then practiced each strategy using new texts with the purpose of answering broad guiding questions on the theme of symbiosis.

Traditional instruction was provided to the 15 classes comprising the control group in one middle school in the same school district as CORI. R/LA instruction consisted of 90 minutes daily of work in a literature anthology by a leading publisher. Typically, teachers first asked students to read silently for 10–15 minutes. Individual students then read aloud in round-robin or a selected order for 10–15 minutes. Last, teachers led a discussion of the literary text, emphasizing character development with attention to plot, symbols, and theme. Informational texts, consisting of biographies, letters, and historical background, were read prior to the literature. After silent reading, students participated in a whole-class discussion of the main ideas of these texts.

Instructional Fidelity and Professional Development

Professional development was provided for three half-days to all CORI teachers, beginning with a mini CORI lesson in which teachers experienced the same motivational supports and strategy instruction that CORI provides students. Two staff members worked with the full group and school teams to provide professional development in affording motivational support, implementing strategy instruction, selecting books for diverse students, and managing groups. Use of portfolios, rubric-based feedback, and project-referenced grading were discussed.

To determine instructional fidelity, which referred to the extent that teachers implemented the CORI principles, we constructed an observation rubric consisting of the following:

- Strategy instruction—Modeling (The teacher utilizes CORI materials and resources to model reading strategy according to the guide.)

- Strategy instruction—Guided practice (The teacher supports students in small groups; support is scaffolded to meet varying needs of the students.)
- Strategy feedback (The teacher utilizes a rubric; the teacher provides specific feedback to students for improvement.)
- Motivational support (The teacher implements motivational practices as set forth in the guide; the teacher is explicit about motivational practices.)
- Reading engagement (The students are engaged in reading for at least half the class time.)
- Richness of portfolio (The students complete portfolio charts according to the guide.)

Each instructional characteristic was rated according to the following:

- 5 = Totally implemented CORI model
- 4 = Fully implemented with occasional weaknesses
- 3 = Generally implemented, mostly like the CORI model
- 2 = Short periods of adequate implementation
- 1 = Only occasionally and partially like the CORI model
- 0 = Not observed, no evidence of practice
- NA = Not applicable in lesson observed

A member of the research team observed each of the CORI teachers for a full class period of 90 minutes at least once during the first three weeks of implementation and at least once during the second three weeks. The median correlation among the items on the observation rubric was .54 ($p < .05$), showing adequate internal consistency. Ratings correlated with those of another investigator who observed each classroom at .61 ($p < .05$).

Means and standard deviations for each aspect of the instruction were as follows:

- Modeling— $M = 2.21$, $SD = 0.25$
- Guided practice— $M = 3.52$, $SD = 0.76$
- Feedback— $M = 3.38$, $SD = 0.79$
- Motivational support— $M = 3.12$, $SD = 0.63$
- Reading engagement— $M = 3.60$, $SD = 0.86$
- Richness of portfolio— $M = 3.95$, $SD = 0.60$

Thus, all means were above the generally implemented level, except for modeling, which was at the level of short periods of adequate implementation. This occurred because modeling decreased in frequency in the second half of the implementation, as recommended in the

teacher's guide. The mean implementation quality was acceptable for this study.

Fidelity was described for the traditional R/LA instruction, which served as a control condition during the intervention. One expert observer rated each R/LA teacher in a three-level rubric as commendable, adequate, or needing improvement. All of the teachers were at or above the adequate level, confirming that the goals, contents, management, and assessments of the district were fully implemented.

Analytic Rationale

The analytic procedure consisted of comparing structural models that represented each hypothesis against a total network model in which all variables influenced achievement directly and indirectly. The value of using structural equation model comparisons to test the hypotheses was that this procedure permits the test of statistical importance for a subset of variables (e.g., mediators) within a complex system of relations among variables. The rationale for using path analysis containing measured variables rather than latent variables is based on the priority of comparability across demographic variables and forms of literacy. In structural equation modeling, latent variables are weighted by their constituent items (Hancock & Mueller, 2010). However, if a construct such as avoidance is represented by the sum of its items (i.e., measured), the construct contains the same constituent weights when it is used to characterize students of different ages (e.g., 7 years vs. 15 years). Items in a latent trait of avoidance would likely be weighted differently for students of different ages, and consequently the construct of avoidance would possess a different qualitative meaning for the two age groups.

Results

Structural Equation Modeling Approach

LISREL 8.8 was used to conduct structural equation modeling analyses of the proposed models with maximum likelihood estimation. The total network-traditional R/LA conceptual model is presented in Figure 1. Consistent with current conventions, rectangles represent observed variables, and lines with an arrow represent each path being estimated. Rectangles receiving the ends of the arrows are considered endogenous or outcome variables, whereas rectangles preceding the arrows are considered exogenous or predictor variables. Rectangles both sending and receiving arrows are considered mediating variables, as they explain a portion of the variance in the outcome variable besides the predictor variable.

Model Assessment

Several fit indexes were used to assess model fit (Kline, 2005; Tabachnick & Fidell, 2007), including the chi-square statistic, Akaike information criterion (AIC), comparative fit index (CFI), standardized root mean residual (SRMR), and root mean square error of approximation (RMSEA). The chi-square statistic is an indicator of badness of fit; thus, it is desirable for the chi-square significance value to be greater than .05, indicating lack of badness of fit. Models with lower AIC values indicate better model fit. CFI values closer to 1 (usually .90 or higher) indicate better fit, whereas SRMR values lower than .08 indicate better model fit (Hu & Bentler, 1999). Models with RMSEA values less than .05 are considered to have good fit, values ranging from .05 to .08 indicate reasonable fit with error, and values of .10 or above suggest poor fit (Hu & Bentler, 1999; Kline, 2005). Nested models are compared using the chi-square difference test, where a significant p -value of the difference in the chi-square values between the parent model and the nested model would suggest that the parent model is significantly better than the nested model (Kline, 2005).

Assumptions

Univariate and multivariate assumptions (normality, linearity, homoscedasticity, lack of outliers, multicollinearity, and singularity) were assessed through a variety of methods. To assess normality, we examined means, standard deviations, frequency range, standardized values of skewness and kurtosis, box plots, normal Q-Q plots, detrended Q-Q plots, and histogram plots for each variable. All variables appeared to be normally distributed. The assumptions of linearity and homoscedasticity, evaluated through inspection of bivariate scatterplots, also appeared to be met.

No outliers were identified through the visual inspection of the scatterplots. Examination of studentized residuals, leverage values, Cook's D values, and Mahalanobis distance values indicated potential multivariate outliers. However, no case met all criteria to be considered an outlier; thus, no cases were excluded from the analyses. The tolerance values for all the variables in the models ranged from .192 to .695 with VIFs ranging from 1.440 to 5.206. It is suggested that variables with a combination of tolerance value less than .10 and a VIF value higher than 10 become problematic with respect to multicollinearity (Kline, 2005; Meyers, Gamst, & Guarino, 2005). We did not have any such combination of tolerance and VIF values, thus we conclude that our data did not show excessive multicollinearity. This is further supported through inspection of the correlation matrix, with intercorrelations less than .90. Finally, all variables had squared multiple correlation values less

than 0.9999, indicating that they each accounted for independent variance.

Descriptive Statistics

Means, standard deviations, and correlations of variables from preintervention in April and postintervention in June are presented in Table 1. At preintervention, students' mean intrinsic motivation was 1.98, which is lower than the midpoint of 2.50 for this 1–4 scale; it is thus evident that students disliked informational texts. However, students reported positive self-efficacy with a mean of 2.91, prosocial goals with a mean of 2.72, and dedication with a mean of 2.81. They also reported valuing the text slightly more than devaluing the text ($M = 2.65$ and 2.59 , respectively). Students' perceived difficulty had a mean of 2.22, antisocial goals had a mean of 1.66, and avoidance had a mean of 2.70.

At postintervention, students' intrinsic motivation was 2.15, which is slightly higher than their reported preintervention intrinsic motivation but still below the midpoint of 2.50. Furthermore, students showed positive self-efficacy, with a mean of 3.07, and stated that they respected and supported their peers' informational text reading, with a mean of 2.79 for prosocial goals. Students reported both valuing and devaluing the texts at similar levels ($M = 2.59$ and 2.57 , respectively). At postintervention, students' mean for perceived difficulty intervention was 1.97 and mean for antisocial goals 1.58, which are slightly lower than the preintervention means. Students reported somewhat high dedication ($M = 2.88$) and moderate avoidance ($M = 2.55$) toward reading at postintervention.

Similar correlations among motivations were shown for pre- and postintervention data. Results showed positive associations among intrinsic motivation, valuing, self-efficacy, and prosocial goals. We refer to these as affirming motivations because they are usually correlated positively with achievement, which is consistent with previous research (Guthrie & Coddington, 2009). Correlations among devaluing, perceived difficulty, and antisocial goals were also positive, which we refer to as undermining motivations because of their expected negative correlations with achievement (Ho & Guthrie, in press).

It is noteworthy that ITC correlated negatively with intrinsic motivation. In other words, in comparison with low achievers, high achievers disliked the text. This phenomenon also occurred in a study with two text types: Intrinsic motivation for informational text correlated negatively with comprehension, whereas intrinsic motivation for literary text correlated positively with reading comprehension (Ho & Guthrie, in press). The affirming motivation of value correlated negatively with comprehension, whereas self-efficacy

TABLE 1
Means, Standard Deviations, and Correlations in Innovative Reading/Language Arts Context (Pre- and Postassessment)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Intrinsic	—	.45**	-.32**	.74**	-.71**	.60**	-.27**	.63**	-.73**	-.13**	.00	-.18**	-.16**	-.10**	.24**
2. Self-efficacy	.34**	—	-.74**	.50**	-.40**	.50**	-.29**	.61**	-.47**	.22**	-.01	-.03	.04	.27**	.25**
3. Perceived difficulty	-.23**	-.71**	—	-.37**	.39**	-.36**	.33**	-.47**	.51**	-.21**	.06	.06	-.02	-.28**	-.29**
4. Value	.60**	.42**	-.28**	—	-.81**	.72**	-.40**	.79**	-.71**	-.12**	.06	-.18**	-.16**	-.09**	.17**
5. Devalue	-.61**	-.31**	.34**	-.74**	—	-.58**	.43**	-.67**	.81**	.11**	-.02	.18**	.16**	.09**	-.19**
6. Prosocial goals	.45**	.38**	-.20**	.61**	-.47**	—	-.43**	.75**	-.57**	-.01	.16**	-.06	-.05	.02	.14**
7. Antisocial goals	-.21**	-.22**	.24**	-.36**	.45**	-.39**	—	-.51**	.44**	-.11**	-.18**	.00	-.02	-.15**	-.07*
8. Dedication	.52**	.50**	-.35**	.78**	-.62**	.63**	-.42**	—	-.68**	.03	.11**	-.12**	-.06	.07*	.23**
9. Avoidance	-.66**	-.42**	.46**	-.59**	.72**	-.40**	.41**	-.60**	—	.00	.03	.13**	.10**	-.03	-.23**
10. Informational text comprehension (pre)	-.05	.26**	-.30**	-.03	.00	.06	-.17**	.11**	-.17**	—	-.07*	.30**	.30**	.72**	.06
11. Gender	.02	-.02	.06*	.11**	-.06	.22**	-.18**	.16**	-.04	-.05	—	-.05	-.10**	-.06	-.03
12. Ethnicity	-.13**	-.03	-.00	-.14**	.15**	-.01	-.02	-.06	.05	.28**	-.06	—	.36**	.23**	-.17**
13. Free and reduced-price meals	-.17**	.04	-.05	-.09**	.01**	-.01	-.07*	-.02	.01	.31**	-.08**	.34**	—	.32**	-.05
14. Informational text comprehension (post)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.11**
15. Instruction	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M (pre)	1.98	2.91	2.22	2.65	2.59	2.72	1.66	2.81	2.70	16.02	—	—	—	—	—
SD (pre)	0.60	0.57	0.65	0.65	0.74	0.58	0.66	0.62	0.68	4.62	—	—	—	—	—
M (post)	2.15	3.07	1.97	2.60	2.57	2.79	1.58	2.88	2.55	16.06	—	—	—	16.30	—
SD (post)	0.68	0.63	0.67	0.74	0.79	0.63	0.61	0.65	0.73	4.68	—	—	—	4.64	—

Note. N = 1,020 (pre), N = 970 (post). Preassessment is shown in the lower left. Postassessment is shown in the upper right.
 *p < .05. **p < .01.

correlated positively with reading comprehension, and prosocial goals showed no relation. Generally, undermining motivation (perceived difficulty, anti-social goals) variables showed negative correlations with reading comprehension, as expected, although devalue positively correlated with it. The two behavioral engagement variables correlated with motivation and comprehension variables primarily in the expected directions. That is, dedication positively correlated with affirming motivations, and reading comprehension and avoidance positively correlated with undermining motivations; avoidance, however, did not correlate with reading comprehension.

Planned Analysis

To examine our research questions, we specified three models: total network, full mediation, and dual effects. These models were examined in two contexts: traditional R/LA (preintervention in April) and intervention R/LA (postintervention in June). Thus, we analyzed a total of six models: total network–traditional R/LA, full mediation–traditional R/LA, dual effects–traditional R/LA, total network–intervention R/LA, full mediation–intervention R/LA, and dual effects–intervention R/LA. The intervention R/LA models included preintervention ITC scores as a control variable and modeled the effects of CORI instruction on students’ motivation, behavioral engagement, and reading comprehension. The rationale for these two contexts is that it is possible that variables

correlated with current reading comprehension performance may differ from those associated with change over time during instructional intervention.

The total network–traditional R/LA model is essentially a saturated model; however, to allow the model to be overidentified and have meaningful estimation, we removed one path from it: the path from prosocial goals to ITC (see Figure 1). We chose to remove this path for three reasons: First, the relationship between prosocial goals and ITC is empirically weak in the context of multiple variables (Ho & Guthrie, in press); second, this was also shown to be the case in our data because it had the lowest (and nonsignificant) correlation; third, this removal enables us to obtain model fit indexes. From the total network–traditional R/LA model, we then specified the subsequent models, which also do not include the removed path (prosocial goals → ITC) to make comparisons between the nested models.

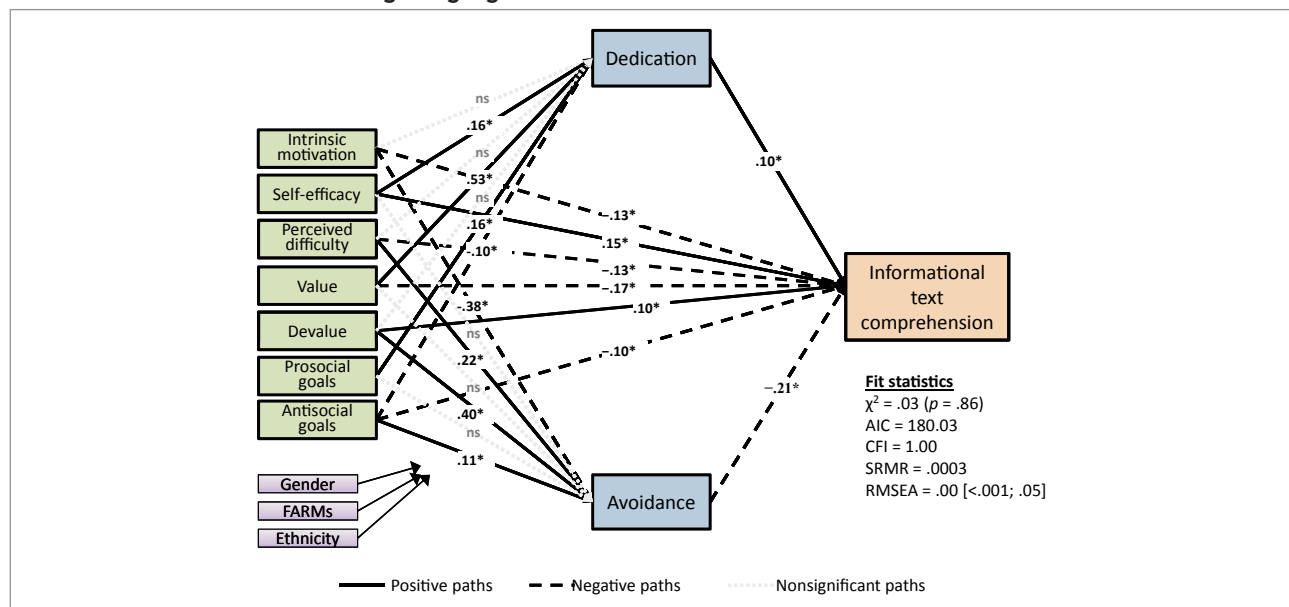
Next, we summarize the analysis of each of the six models. Table 2 displays the fit indexes for each model. The initial statistical analysis addressed the issue of the fit of the total network–traditional R/LA model. This model overall showed excellent fit, as indicated by several fit indexes (Kline, 2005). For this model, $\chi^2(1) = .03$, $b = .86$; AIC = 180.03, CFI = 1.00, SRMR = .0003, and RMSEA = .00, 90% confidence interval (CI; <.001; .05). In general, undermining motivations were positively related to avoidance and negatively related to reading comprehension, whereas affirming motivations

TABLE 2
Fit Statistics

Model	Fit Indexes					Model chi-square comparison
	$\chi^2(df)$ (p-value)	AIC	CFI	SRMR	RMSEA (90% CI)	Change in $\chi^2(df)$
<i>Traditional reading/language arts models (April)</i>						
Total network	0.03(1) (.86)	180.03	1.00	.0003	.00 [<.001; .05]	–
Full mediation	119.51(7) (.00)	287.51	.99	.034	.13 [.11; .15]	$\Delta\chi^2 = 119.48$ $\Delta df = 6; p = .001$
Dual effects	27.26(3) (.00)	203.26	1.00	.009	.09 [.06; .12]	$\Delta\chi^2 = 27.60$ $\Delta df = 2; p = .001$
<i>Intervention reading/language arts models (June)</i>						
Total network	0.13(1) (.72)	238.13	1.00	.0004	.00 [<.001; .06]	–
Full mediation	65.64(10) (.00)	285.64	1.00	.016	.08 [.06; .09]	$\Delta\chi^2 = 65.51$ $\Delta df = 9; p = .001$
Dual effects	1.11(3) (.78)	235.11	1.00	.001	.00 [<.001; .04]	$\Delta\chi^2 = .98$ $\Delta df = 2; p > .05$

Note. AIC = Akaike information criterion. CFI = comparative fit index. RMSEA = root mean square error of approximation. SRMR = standardized root mean residual.

FIGURE 2
Total Network–Traditional Reading/Language Arts Model



Note. AIC = Akaike information criterion. CFI = comparative fit index. FARMs = Free and reduced-price meals. RMSEA = root mean square error of approximation. SRMR = standardized root mean residual.

were positively related to dedication and reading comprehension.

This model with its standardized path coefficients is depicted in Figure 2. Within this model, self-efficacy ($b = .15$) was positively related to reading comprehension, whereas intrinsic motivation ($b = -.13$), perceived difficulty ($b = -.13$), value ($b = -.17$), and antisocial goals ($b = -.10$) were all negatively related to ITC. Additionally, students' affirming motivations significantly predicted dedication; specifically, self-efficacy ($b = .16$), value ($b = .53$), and prosocial goals ($b = .16$) were all positively related to dedication. Conversely, students' undermining motivations significantly predicted avoidance; namely, perceived difficulty ($b = .22$) and devalue ($b = .40$) positively predicted students' reported avoidant behaviors, whereas intrinsic motivation ($b = -.38$) negatively predicted avoidance. The total amounts of variance (R^2) explained in this model were approximately 69% for dedication, 66% for avoidance, and 26% for ITC.

Model Comparisons

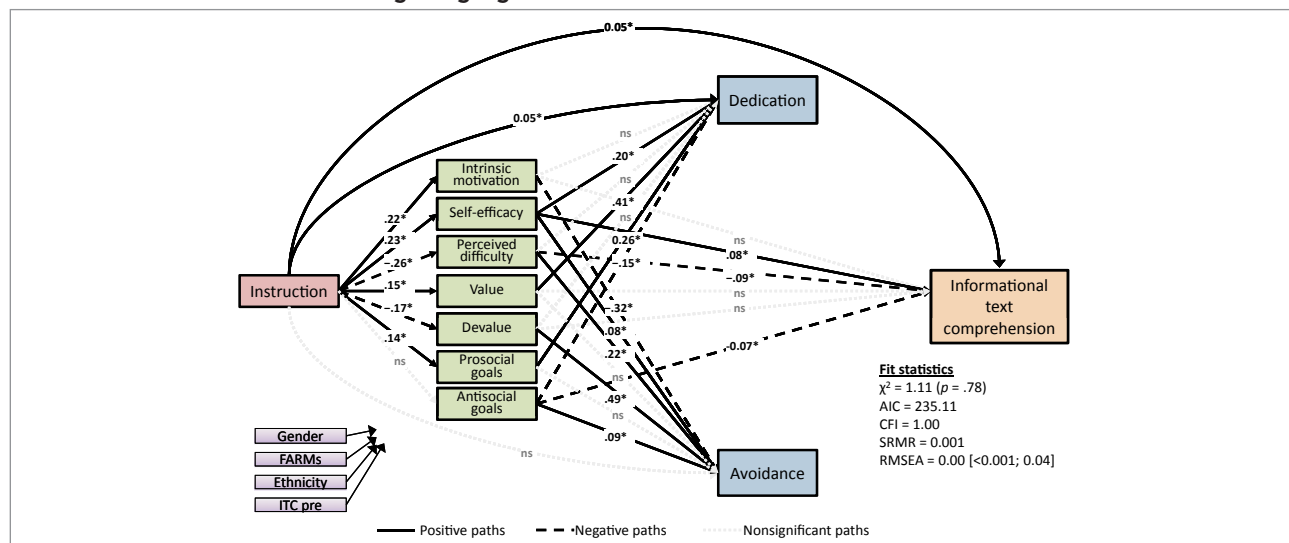
We tested the first hypothesis by comparing the full mediation–traditional R/LA model to the total network–traditional R/LA model. The full mediation–traditional R/LA model, which differed from the total network model in having no direct links from the motivation variables to ITC achievement, demonstrated

poor fit to the observed data, as evaluated through several fit indexes. For this model, $\chi^2(7) = 119.51$, $p = .00$; $AIC = 287.51$, $CFI = .99$, $SRMR = .03$, $RMSEA = .13$, 90% CI [.11; .15]. The chi-square difference test ($\Delta\chi^2 = 119.48$; $\Delta df = 6$; $p = .001$) further demonstrated that the total network–traditional R/LA model fit significantly better than this model. Therefore, the full mediation–traditional R/LA model was rejected.

The next analysis tested the second hypothesis by comparing the dual effects–traditional R/LA model to the total network–traditional R/LA model. The dual effects–traditional R/LA model, which differed from the total network model in having no links from engagement to achievement, did not demonstrate excellent fit to the observed data as examined through several fit indexes. For this model, $\chi^2(3) = 27.63$, $p = .00$, $AIC = 203.26$, $CFI = 1.00$, $SRMR = .009$, and $RMSEA = .09$, 90% CI [.06; .12]. The chi-square difference test ($\Delta\chi^2 = 27.60$; $\Delta df = 2$; $p = .001$) demonstrated that the total network–traditional R/LA model was a significantly better fit than this model. Therefore, the dual effects–traditional R/LA model was rejected. For traditional R/LA, the total network model was a better fit than the alternatives.

We next examined the fit of the total network–intervention R/LA model, which is identical to the total network–traditional R/LA model (see Figure 1), with the exception that it additionally included an instructional variable as a predictor of each motivation, engagement,

FIGURE 3
Dual Effects–Intervention Reading/Language Arts Model



Note. AIC = Akaike information criterion. CFI = comparative fit index. FARMs = Free and reduced-price meals. ITC pre = informational text comprehension preassessment. RMSEA = root mean square error of approximation. SRMR = standardized root mean residual.

and achievement variable. This model also included preintervention ITC to examine change in ITC. The total network–intervention R/LA model demonstrated excellent fit as shown by several fit indexes. For this model, $\chi^2(1) = .13$, $p = .72$; AIC = 238.13, CFI = 1.00, SRMR = .0004, RMSEA = .00, 90% CI [$<.001$; .06]. In general, students receiving CORI had higher affirming motivations, dedication, and reading comprehension than students receiving standard school instruction did. Undermining motivations were correlated positively to avoidance and negatively related to reading comprehension, whereas affirming motivations were correlated positively to dedication and reading comprehension.

Next, we tested the third hypothesis by comparing the full mediation–intervention R/LA model to the total network–intervention R/LA model. The full mediation–intervention R/LA model, which removed the direct links from motivation to achievement, demonstrated poor fit according to several fit indexes. For this model, $\chi^2(10) = 65.64$, $p = .00$; AIC = 285.64, CFI = 1.00, SRMR = .016, and RMSEA = .08, 90% CI [.06; .09]. The chi-square difference test ($\Delta\chi^2 = 65.51$; $\Delta df = 9$; $p = .001$) further demonstrated that the total network–intervention R/LA model fit significantly better than this model. This led us to reject the full mediation–intervention R/LA model.

We tested the fourth hypothesis by comparing the dual effects–intervention R/LA model with the total network–intervention R/LA model. The dual effects–intervention R/LA model demonstrated excellent fit with the observed data. For this model, $\chi^2(3) = 1.11$, $p = .78$; AIC = 235.11, CFI = 1.00, SRMR = .001, and

RMSEA = .00, 90% CI [$<.001$; .04]. The chi-square difference test ($\Delta\chi^2 = 0.98$; $\Delta df = 2$; $p > .05$) demonstrated that the total network–intervention R/LA model was not a significantly better fit than this model. This led us to accept the dual effects–intervention R/LA model as the most parsimonious and best fitting representation of the variables in the intervention R/LA context. This model with path coefficients is shown in Figure 3.

Within the dual effects–intervention R/LA model, the significant path coefficients were similar to those found in the total network–intervention R/LA model, with a few exceptions. The total amount of variance (R^2) explained in this model was 76% for dedication, 75% for avoidance, and 56% for ITC. In the dual effects–intervention R/LA model, CORI was associated with ITC more strongly than was traditional instruction ($b = .05$). Regarding students’ motivation, self-efficacy ($b = .08$) was positively related to ITC, whereas perceived difficulty ($b = -.09$) and antisocial goals ($b = -.07$) were negatively related to ITC. Additionally, students’ affirming motivations significantly predicted their dedication such that self-efficacy ($b = .20$), value ($b = .41$), and prosocial goals ($b = .26$) all positively related to this affirming behavioral engagement. Conversely, students’ undermining motivations significantly predicted students’ reported avoidant behaviors; specifically, perceived difficulty ($b = .22$), devalue ($b = .49$), and antisocial goals ($b = .09$) were positively associated with this undermining behavioral engagement. In contrast, intrinsic motivation ($b = -.32$) negatively predicted avoidance, and self-efficacy was positively associated with avoidance ($b = .08$). These relationships are further discussed in the next section.

Discussion

We showed how motivation and engagement related to each other and to achievement under conditions of traditional R/LA instruction and within the context of an instructional intervention, CORI, that emphasizes teacher support for student motivation and strategy instruction for ITC. We extended previous research by examining the full network of relations among instruction, motivation, engagement, and achievement; moreover, we did so in classrooms rather than laboratory settings. Furthermore, the study distinctly focused on an array of affirming and undermining motivations and both positive and negative forms of behavioral engagement. Based on the pathways identified among key constructs, the study extends our previous engagement model (Guthrie & Wigfield, 2000) and bears practical implications regarding critical goals for instruction.

Different Contexts, Different Networks

In the context of traditional instruction, which was implemented for over seven months, motivation was associated with ITC achievement through two kinds of pathways: motivation directly connected to achievement and motivation indirectly connected to achievement through reading engagement, which in turn was directly associated with achievement. This is valuable because at least some empirical sources suggest otherwise. In a literature review (Guthrie et al., 2012), a set of studies suggested the importance of pathways from motivation to engagement and from engagement to achievement but not from motivation directly to achievement. Although each of the individual links was supported as a separate association, the literature review did not include any studies modeling the network of relations among classroom reading motivation, engagement, and achievement.

In the context of instructional intervention, a six-week CORI program, motivation was associated with increased text comprehension but no longer through engagement. Additionally, in this context, CORI was associated with increased motivation, engagement, and achievement directly, as well as with increased achievement indirectly through motivation. These findings are consistent with, but extend, prior research showing instructional and motivational effects in correlational classroom studies (Lau, 2009; Zhou et al., 2009).

Previous experimental studies showing positive effects for motivational support in reading tasks (Hulleman et al., 2010; Jang, 2008; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005) employed brief tasks and situation-specific measures. In those studies, the motivating directions may have elicited situated

motivations for the task (e.g., interest, value) rather than increasing wide-ranging motivational constructs. The current study provides evidence that instructional intervention within a classroom intervention context was associated with increases in generalizable measures of motivation, engagement, and achievement in a domain of reading, namely ITC. The results, however, notably differ from Jang's (2008) study of college students completing a single task in which the instructional variable was the set of directions received for the task. In that study, task-based measures of motivation and engagement fully mediated the instructional effect on task proficiency. In contrast, in the present study, in which students worked 90 minutes daily for six weeks in a multifaceted middle school classroom context and completed domain-relevant measures of motivation, engagement, and reading achievement, there were direct associations of instruction and motivation with achievement.

The current differential findings regarding the network of links among motivation, engagement, and achievement in the traditional and intervention contexts can be explained by viewing engagement as a variable that has stronger long-term than short-term effects on proficiency of ITC. Under usual classroom conditions, students who acquire positive behavioral engagement (investing time, effort, and persistence in reading) become higher achievers. There are also likely to be recursive effects in which higher achievement promotes more behavioral engagement (Morgan & Fuchs, 2007). However, under the time constraints of a brief six-week intervention with integrated instruction, students may become more behaviorally engaged, but that engagement does not have time to increase complex ITC. Only after a sustained period of several months does engagement increase a broad trait of text comprehension proficiency, which was used in this study. Of course, enhanced behavioral engagement may increase competence with a single text-reading task (Hulleman et al., 2010; Jang, 2008), but the task-specific skill may not generalize to a wider range of proficiencies.

A Closer Inspection of the Intervention Context

In the intervention R/LA context, it is evident that CORI instruction was associated with increased ITC directly when motivation and engagement were controlled. This was probably due to the cognitive strategy instruction directed toward inferencing, summarizing, and concept mapping. Instruction was associated with increases in ITC through increasing self-efficacy and decreasing perceived difficulty. That is, the most prominent connection of CORI to motivation for ITC was its

positive relation to students' confidence in their capacity to succeed and its negative relation to their perception that the texts were too challenging to comprehend. Although consistent with prior findings that CORI positively impacts students' reading motivations and achievement (Guthrie, McRae, & Klauda, 2007), this indirect association has not been reported previously.

More prominently, in the intervention R/LA context, instruction had a direct positive association with dedication to read science texts. This was likely due to the relevance of the texts for answering the guiding questions and the cognitive accessibility of the texts based on the use of differentiated texts for students at different achievement levels. Instruction was indirectly associated with dedication through its positive associations with self-efficacy, value, and prosocial goals. This finding extends prior research on individual motivation effects (Hulleman et al., 2010; Jang, 2008; Schunk & Zimmerman, 2007) by showing three positive indirect associations of motivation and engagement independent of one another and independent of the three undermining motivation variables of perceived difficulty, devaluing, and antisocial goals.

It is also noteworthy that in the intervention R/LA context, CORI instruction was associated with less disengagement; that is, students who received CORI reported lower text avoidance afterward. This occurred fully through indirect associations. Instruction was negatively associated with perceived difficulty, which is a motivation linked with increased avoidance, and instruction was negatively associated with devaluing, a second motivation linked with increased avoidance. Furthermore, instruction was positively associated with intrinsic motivation, which is associated with decreased avoidance.

The Importance of Examining Affirming and Undermining Motivations

We suggested previously that certain motivations, such as perceived difficulty, devaluing, and antisocial goals, may be called undermining because they correlate negatively with achievement. Furthermore, these motivations appear to be associated with the engagement and achievement variables relatively independently from the more conventional motivation constructs of self-efficacy, valuing, and prosocial goals. For example, in the dual effects model supported in the intervention R/LA context, value correlated positively with dedication but did not correlate significantly with avoidance or achievement, whereas devalue correlated positively with avoidance but not significantly with dedication. If value and devalue were simply mirror opposites, they would correlate in the opposite directions with the same variables, for example, dedication.

The qualitative differences between affirming and undermining motivation variables may be discerned further by observing that in the dual effects model in the intervention R/LA context, the majority of significant motivational pathways with dedication (75%) consisted of affirming motivations. Furthermore, a majority of significant motivation pathways with avoidance (60%) consisted of undermining motivations. Thus, dedication and avoidance also appeared to be qualitatively distinct constructs. For example, when students are given a textbook reading assignment, some may skim and read superficially. These students are not sufficiently dedicated to persevere in reading deeply, but they do not avoid the task. In this case, they are low in dedication and also low in avoidance. Accordingly, the undermining and affirming motivations have qualitatively different impacts on dedication and avoidance because they are two forms of behavioral engagement.

An explanation for these distinctions between dedication and avoidance may be that dedication tends to be accompanied by advanced cognitive skills and self-regulation during comprehension. In contrast, although students may be strategic in their avoidance (e.g., planning to lose the textbook, deciding to forget reading homework), the cognitive element in such avoidance is minimal. Once a student decides to avoid reading, sustained attention and persistence are unnecessary. Whereas dedication makes learning possible but does not assure it, avoidance is low effort, but it forecloses any possibility of learning and drastically reduces achievement. Thus, because undermining variables promote avoidance, they are likely to impact achievement more strongly than affirming variables are.

It appears that undermining motivations represent a relatively undocumented and vitally important source of energy and direction for cognitive processes of reading comprehension. Although previous researchers have reported the association of achievement with undermining motivations of avoidance (Long, Monoi, Harper, Knoblauch, & Murphy, 2007; Seifert & O'Keefe, 2001) and devaluing (Legault et al., 2006), they have not controlled affirming motivations and have not attempted to compare the effects of undermining and affirming variables on behavioral or cognitive engagement. Because these undermining motivations may have a negative impact, researchers should extend their instructional thinking and call for new forms of instructional thinking. Designing instruction to reduce disengagement may be slightly different from designing instruction to increase engagement.

Study Contributions and Limitations

It is important to clarify what we are and are not learning about instruction from this study. The instructional framework of CORI was compared with the usual

R/LA instruction in the school district, which was the existing standard of practice in R/LA classrooms, consisting of silent reading, questioning, open discussion of themes, explicit strategy instruction, and critical evaluation of the author's craft (Fisher, Frey, & Lapp, 2011). Both frameworks had the goals of increasing reading competencies through 90 minutes of daily instruction. Although both frameworks emphasized ITC, the usual district instruction focused more strongly on literary text and its comprehension. Thus, CORI had a substantial advantage over standard R/LA instruction for increasing the multiple outcomes of informational text motivation, engagement, and achievement. Although the study showed that CORI was positively associated with affirming and negatively associated with undermining aspects of motivation and engagement, as well as linked with gains in ITC, the quasi-experimental nature of the design and disparate emphases of CORI and the usual instruction format limit the causal claims that can be made about the effectiveness of CORI.

Other limitations of this study include the restriction to the domain of informational text reading. Informational text reading is increasingly important in secondary education (Shanahan & Shanahan, 2008) due to the Common Core State Standards. However, motivation for reading informational text is different from motivation for reading literary text, partially due to students' long history of reading fiction for pleasure (Ho & Guthrie, in press). Therefore, the associations of motivation and engagement with achievement may not fully generalize to literary reading. Additionally, the validity of the models supported in the present study may be limited to middle school students. At this age, students are often more oppositional than elementary students are (Strambler & Weinstein, 2010) and may hold more diffused identities than high school students have (Kroger, Martinussen, & Marcia, 2010); thus, undermining motivations may be especially prominent predictors of middle school engagement and achievement.

Also, although the implementation fidelity of CORI was substantial, the agreement between raters of CORI was lower than desirable. Finally, the population studied was a mixture of African American and European American students. Consistent with other studies of different populations' motivation and engagement, results may differ for African American students in urban settings (Hudley, 2009) or Hispanic or Asian students (Unrau & Schlackman, 2006).

Implications for Instruction

The present findings indicate that to facilitate achievement in ITC, and perhaps reading more broadly, middle school educators should set explicit goals of fostering

multiple reading motivations and literacy engagement. In the traditional R/LA instructional context, our findings suggested in particular that working to improve varied facets of students' motivation is important; it may have positive consequences for their engagement of increased dedication and decreased avoidance, as well as impact their level of achievement. Furthermore, higher dedication and lower avoidance were directly associated with greater achievement, therefore suggesting that working to improve engagement may also be an important path to achievement. In the short time span in which CORI was implemented, engagement did not relate to achievement, but again, multiple motivations related to both forms of engagement as well as to achievement. Additionally, instruction directly predicted several motivations, engagement, and achievement. This pattern of findings suggests that improved engagement and achievement as well as motivation are reasonable goals for instructional methods that incorporate explicit, multiple supports for strengthening student motivation.

NOTE

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article.

Table S1. Key Study Constructs.