

Engaging Struggling Adolescent Readers to Improve Reading Skills

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Abstract

This study examined the efficacy of a supplemental, multicomponent adolescent reading intervention for middle school students who scored below proficient on a state literacy assessment. Using a within-school experimental design, the authors randomly assigned 483 students in grades 6–8 to a business-as-usual control condition or to the Strategic Adolescent Reading Intervention (STARI), a supplemental reading program involving instruction to support word-reading skills, fluency, vocabulary, and comprehension, and peer talk to promote reading engagement and comprehension. The authors assessed behavioral engagement by measuring how much of the STARI curricular activities students completed during an academic school year, and collected intervention teachers' ratings of their students' reading engagement. STARI students outperformed control students on measures of word recognition (Cohen's $d = 0.20$), efficiency of basic reading comprehension (Cohen's $d = 0.21$), and morphological awareness (Cohen's $d = 0.18$). Reading engagement in its behavioral form, as measured by students' participation and involvement in the STARI curriculum, mediated the treatment effects on each of these three posttest outcomes. Intervention teachers' ratings of their students' emotional and cognitive engagement explained unique variance on reading posttests. Findings from this study support the hypothesis that (a) behavioral engagement fosters struggling adolescents' reading growth, and (b) teachers' perceptions of their students' emotional and cognitive engagement further contribute to reading competence.

Keywords: adolescent literacy, reading intervention, reading engagement, experimental design, comprehension

Engaging Struggling Adolescent Readers to Improve Reading Skills

The roughly one-quarter of U.S. eighth graders who score below basic on national assessments of reading (NCES, 2015) struggle with the reading demands of secondary school. They are challenged by expectations that they summarize textbook passages, use context to determine word meaning, and make text-based inferences. For many adolescents with reading difficulties, gaps in decoding and fluency compromise basic comprehension (Catts, Compton, Tomblin, & Bridges, 2012; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Verhoeven & van Leeuwe, 2008). As a consequence, adolescent reading interventions often target word- and sentence-level skills in addition to skills related to meaning construction. Despite calls for increased attention to the needs of struggling adolescent readers (Biancarosa & Snow, 2004; Kamil et al., 2008), however, the impacts of existing multicomponent interventions have often been modest, especially when moved to scale in low performing schools and with teacher, rather than researcher, implementation (Edmonds et al., 2009; Scammacca et al., 2007; Solis, Miciak, Vaughn, & Fletcher, 2014; Wanzek et al., 2013).

Student motivation and engagement are frequently cited as barriers to the success of adolescent literacy interventions (Kamil et al., 2008; Manset-Williamson & Nelson, 2005; O'Brien, Beach, & Scharber, 2007; Solis et al., 2014) but specific strategies to foster motivation and reading engagement have been rarely central to intervention design. Although there are engagement-focused approaches to adolescent literacy instruction (e.g., Applebee, Langer, Nystrand, & Gamoran, 2003; Greenleaf & Hinchman, 2009; Guthrie, McRae, & Klauda, 2007), involving peer talk about text and exploration of text meaning and value, struggling readers also need instruction in word and sentence level processes that underlie skilled reading. Multicomponent reading interventions often include isolated practice on basic reading skills but

rarely embed basic skills work in more cognitively challenging and engaging literacy activities. As a consequence, students may fail to see the relevance of skills work and may lack adequate opportunities for applying new skills in meaningful and cognitively demanding contexts.

Theoretical Foundations for STARI

This study reports on the impacts of a new approach to intervention for adolescents with reading difficulties, the Strategic Adolescent Reading Intervention (STARI). STARI addresses components essential for skilled reading (decoding, fluency), while also teaching meaning-making strategies important for literal and deep comprehension. Figure 1 displays our model of how the STARI intervention is designed to promote engaged reading and subsequent growth in reading skills. Our model draws upon and adapts the engagement framework presented in Guthrie, Wigfield, and You (2012, p. 624, Figure 29.1).

Given the limited effectiveness of many existing interventions, we designed a program that would connect reluctant readers with cognitively challenging texts and activities while simultaneously developing basic reading skills. With student motivation at the center of concerns about the efficacy of adolescent reading interventions, we planned intervention activities that reflect research on student motivation and directly examined the contribution of student engagement when investigating program impacts on reading skills.

Growth in Reading Skills in Adolescence

By early adolescence, successful comprehension requires the integration of multiple linguistic and cognitive processes (Cain & Oakhill, 2012; Cromley & Azevedo, 2007). Adequate skills in decoding, morphosyntax, and sentence structure are critical for making meaning from text. To understand a class reading in humanities, for example, students first need to confidently

decode both higher and lower frequency words and parse academic sentence structures (Fang, Schleppegrell, & Cox, 2006). Morphological analysis skills, such as the ability to recognize adjectival and nominalizing suffixes, are important for assigning syntactic roles to key words, a process that affects readers' ability to extract literal propositions from the text and construct a comprehensive textbase (van Dijk & Kintsch, 1983). As readers produce a situation model (Kintsch, 1998; Zwaan & Radvansky, 1998), they integrate background knowledge with the literal textbase (Graesser & McNamara, 2011; Zwaan, 1994). All of these processes are vulnerable for adolescents with gaps in basic reading skills (Brasseur-Hock, Hock, Kieffer, Biancarosa, & Deshler, 2011; Cirino et al., 2013).

Improvements in reading subskills, however, are not sufficient for deep comprehension. Effective intervention needs to expose adolescents to texts and reading tasks that are complex and open-ended enough to support sophisticated reasoning. With a few exceptions (e.g. Reading Apprenticeship and Adolescent Literacy, Greenleaf & Hinchman, 2009), interventions for struggling readers present students with simplified texts and routine tasks (Compton, Miller, Elleman, & Steacy, 2014; O'Brien et al., 2007). In Wilson Just Words, for example, students practice decoding and writing dictated nonsense words. Connected texts used for reading practice are brief and designed to highlight particular spelling patterns. In most intervention programs, component skills are practiced in isolation, without applications to challenging and motivating content. Adolescents receiving reading intervention are infrequently asked to engage in the kind of independent meaning construction with complex text that typifies skilled reading.

Engaged Reading and the Design of STARI

Reading motivation refers to an individual's values, beliefs, attitudes, and goals related to reading (Conradi, Jang, & McKenna, 2014; Guthrie & Wigfield, 2000; Unrau & Quirk, 2014).

Reading motivation declines markedly as students move through the early years of schooling and into adolescence (McKenna, Kear, & Ellsworth, 1995; Unrau & Schlackman, 2006), a pattern that particularly affects boys (De Naeghel et al., 2014; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Kelley & Decker, 2009; McGeown, Duncan, Griffiths, & Stothard, 2015), low-income students (Guo, Sun, Breit-Smith, Morrison, & Connor, 2015), and African American and Latino students (Guthrie, Coddington, & Wigfield, 2009; Guthrie & McRae, 2012; Ryan & Deci, 2000a, 2000b). In programs for adolescents with reading difficulties, weak motivation is often seen as a barrier to engaging participants in activities that have the potential to improve reading skills (Kamil et al., 2008; Solis et al., 2014). Research on Concept-Oriented Reading Instruction (CORI), however, has documented key features of reading programs that can support motivation. These include relevance: topics and texts that connect to students' lives (Guthrie, 2004; Guthrie, Klauda, & Ho, 2013); integration of skills and content through a thematically-organized curriculum; experiences of success through accessible text and increasing independence in skills application; and collaboration: opportunities for students to work together on meaning construction (Guthrie et al., 2007; Guthrie, 2008; Guthrie & Klauda, 2014). CORI program characteristics that build motivation, not always present in traditional remedial programs, directly influence the design of STARI. Figure 1, adapted from Guthrie et al., 2012, page 624, illustrates the motivation-enhancing features of STARI and the pathway through which these features are theorized to promote reading engagement and in turn, growth in reading skills.

Engaging and accessible texts. The interest level of the texts students read has been demonstrated to affect both reading engagement and reading comprehension (Ainley, Hidi, & Berndorff, 2002; McGeown et al., 2015; Oakhill & Petrides, 2007). Text features associated with higher reader interest include importance/value, personal relevance, and novelty (Ivey &

Broaddus, 2001; Tatum, 2006; Wade, Buxton, & Kelly, 1999), characteristics that are also associated with better recall of key text propositions (Clinton & van den Broek, 2012; Flowerday & Shell, 2015). In selecting novels and non-fiction books for STARI, personal relevance and interest to young adolescents, text characteristics associated with reading engagement, were assessed through pilot work using potential texts in book groups involving non-study students.

Text accessibility, defined as text that is well-matched with students' current reading abilities, also affects reading engagement. In an experimental context, adolescents presented with texts at their instructional level reported significantly higher engagement and interest than when reading texts whose challenge level exceeded their reading ability (Fulmer & Tulis, 2013). Expectancy-value theory (Wigfield & Eccles, 2000) posits that students are more motivated to engage in a task such as reading when they see themselves as competent. Thus texts that are accessible are likely to promote greater feelings of self-efficacy, especially for adolescents with reading difficulties, who generally report lower levels of perceived competency when reading grade level text (Klauda, Wigfield, & Cambria, 2012; Wolters, Denton, York, & Francis, 2014).

In addition to the impact of text characteristics, reader motivation is affected by broader features of instructional design (Hidi & Renninger, 2006; Paige, 2011; Schraw & Dennison, 1994), such as the reading topics and tasks that are set for students and classroom participation structures.

Relevance/importance and integration. STARI is organized into a series of thematic units chosen to be not only interesting but also of relevance and importance in young adolescents' lives. In an influential study by Assor and collaborators, teacher behaviors that demonstrated the relevance of academic topics to students' lives were important in promoting student engagement with schoolwork (Assor, Kaplan, & Roth, 2002). STARI topics that reflect

students' cultural and personal identities such as the Harlem Renaissance, the immigration debate, or non-traditional families, communicate to students that the curriculum is not generic but personalized, designed to be relevant for them (Tatum, 2006). Intrinsic motivation, an important determinant of both reading engagement and growth in reading skills, is supported when students read with interest and curiosity (Schiefele, Schaffner, Möller, & Wigfield, 2012). In contrast to the isolated skills practice that often characterizes remedial reading curricula, STARI directly links work on component skills—decoding, fluency, and morphological analysis—with cognitively challenging unit themes. The integration of basic skills activities with demanding, highly relevant content, demonstrates for students the ways that component reading skills provide access to topics of value and importance (Guthrie et al., 2009). To promote interest and engagement, decoding and morphological analysis strategies were taught with words connected to STARI unit themes. For example, in STARI unit 2.2 on September 11 and the Iraq War, students applied syllable division rules to *collapse*, *accuse*, and *Saddam*. Students then practiced reading words with the newly taught patterns in engaging nonfiction texts about the aftermath of September 11.

Peer collaboration and voice. Finally, STARI was designed to promote social interactions that foster student engagement. STARI uses four types of peer collaboration: partner-assisted fluency practice, reciprocal teaching of comprehension strategies, partner reading and responding to novels and non-fiction texts, and peer debate, in which teams gather text evidence and build arguments. While peer-assisted learning has well-documented benefits for reading skill development (e.g., Fuchs et al., 2001; Spörer & Brunstein, 2009), peer reading contexts may impact achievement in part through increasing reading motivation. When students collaborate with peers on academic tasks, they come to feel a greater sense of relatedness which

can act as a motivational resource in sustaining effort in the face of challenge (Furrer & Skinner, 2003). Attitudes towards reading often become more positive after peer-assisted learning activities because students experience greater social support for learning (Kim, Thompson, & Misquitta, 2012). In addition, peer contexts in STARI encourage students to articulate personal stances on a text and then compare stances with those of partners or classmates. Presenting and discussing individual reactions to text is a practice that reflects reader response theories of sense-making (Rosenblatt, 1987). In doing so, students experience a positive sense of autonomy in meaning production which can overcome passivity and support feelings of competence (Ryan & Deci, 2000).

Reading Engagement Fosters Reading Skill

A central theoretical rationale for STARI is that reading engagement contributes to growth in students' reading skills (Guthrie, Wigfield, & You, 2012; Guthrie & Klauda, 2014). The construct of engagement has been defined as "involvement, participation, and commitment to some set of activities" (Guthrie et al., 2012, p. 601). Engaged reading incorporates behavioral, emotional, and cognitive processes (Fredricks, Blumenfeld, & Paris, 2004; Unrau & Quirk, 2014) such as reading involvement, interest, and active problem-solving. In addition, recent research suggests that 'agentic engagement,' for example "students' constructive contribution into the flow of organized discussion," may also contribute to student achievement (Reeve, 2013; Reeve & Tseng, 2011, p. 258). There is growing evidence that reading engagement is a key mechanism underlying the effects of innovative reading programs. Research on Concept-Oriented Reading Instruction (CORI), a program with features that support motivation, engagement, and strategy use, indicates that reading improvement in CORI is largely mediated through gains in participants' reading engagement (Guthrie, et al., 2007; Taboada,

Tonks, Wigfield, & Guthrie, 2009; Wigfield et al., 2008).

In Figure 1, drawing on a framework proposed by Guthrie and collaborators, we hypothesize that students' behavioral engagement—that is, their observed involvement and participation in literacy activities—directly impacts growth in reading skills (Guthrie et al., 2012, Figure 29.1, p. 604). Measures of behavioral engagement have included observations of student effort, attention, and persistence in academic tasks as well as teacher and student self-reports of effort and task persistence (Guo et al., 2011; Guthrie, Wigfield, Metsala, & Cox, 1999; Skinner, Kindermann, & Furrer, 2009). By elementary and middle school, students who exhibit behavioral engagement in literacy activities are reading and responding to more text than classmates who are less engaged. Thus behavioral engagement in reading results in greater text exposure, with demonstrated benefits for students' efficiency of word reading, development of academic vocabulary, and confidence in deriving meaning from text (Mol & Bus, 2011; Schaffner, Schiefele, & Ulferts, 2013).

Guthrie, Wigfield, and You (2012) review studies that reveal significant associations between a variety of measures of reading engagement and reading skill. Behavioral engagement measures have typically included quantitative indicators of observable actions (e.g., time spent reading, involvement in literacy activities). However, as Unrau and Quirk (2014) have argued, “appearing engaged does not guarantee that a student is actually engaged” (p. 266), underscoring the importance of using more direct assessments of student engagement during academic learning time.

For adolescents, behavioral engagement is likely to lead to greater reading competence if students are not merely reading but also participating in literacy activities that contribute to better understandings of text. Behavioral engagement in STARI was assessed through individuals' rates

of completion of STARI workbook activities. Most workbook activities in STARI require students to first read specific pages of unit novels or nonfiction and then form coherent representation (Rapp & van den Broek, 2005), recording workbook responses that document their understandings. STARI workbook activities focus student attention on key content in the texts read, such as emerging character traits or important non-fiction concepts, often through text-focused discussion with a partner. Representative STARI workbook pages, demonstrating the types of literacy activities that students routinely engaged in, are shown in Figure 4 and 5 (also described in greater detail in the methods section). We theorize that STARI workbook completion, our measure of behavioral engagement, drives improvement in reading skills through the combined impacts of practice with component skills (such as morphological analysis), text exposure, and experience with content-focused interactions with text (Goldman & Snow, 2015; McKeown, Beck, & Blake, 2009).

Given that engagement incorporates multiple dimensions, research should ideally capture the range of dimensions that are relevant to academic success (Sinatra, Heddy, & Lombardi, 2015). For reading, there are clearly aspects of students' emotional and cognitive engagement that contribute to and extend the impacts of behavioral engagement. Most importantly these include enjoyment and interest in reading and active problem-solving while reading (Schiefele et al., 2012). The Reading Engagement Index-Revised (REIR; Wigfield et al., 2008) measures emotional and cognitive dimensions of engagement through teacher ratings, complementing more direct measures of students' behavioral engagement (Fredricks & McColskey, 2012). Thus, in addition to examining whether student behavioral engagement contributed to growth in reading, we collected intervention teachers' reports of their students' emotional and cognitive engagement in literacy on the REIR and explored whether these dimensions of student

engagement added to our ability to predict reading gains.

Finally, observations of STARI classrooms by research assistants enabled us to characterize overall levels of participant responsiveness, for example, the degree to which students asked and answered peer and teacher questions, consistent with a broad conceptualization of behavioral engagement.

Research Aims and Hypotheses

Many correlational studies have explored the complex interrelationships among reading practices, student motivation, engagement, and reading skills. In this experimental study, however, we assess the impact of a year-long, engagement-oriented intervention on multiple reading skills, examining the mediating effect of students' behavioral engagement on reading skills, and the contribution of teachers' perceptions of students' emotional and cognitive engagement to reading gains. Our intervention and research design address two of the central gaps in the reading engagement literature: the absence of experimental approaches to investigate potential impacts of reading engagement on growth in reading skills, and limited research focused on low-income students, students of color, and struggling readers (Guthrie, Wigfield, & You, 2012).

Our analyses address three research questions:

- (1) *What is the intent-to-treat (ITT) estimate of the STARI intervention on multiple dimensions of reading skill for struggling readers in Grades 6 to 8?* Using ordinary least squares regression analysis, we examined whether students assigned to STARI performed better than control group students on multiple dimensions of reading skill.
- (2) *Do levels of students' behavioral engagement in the STARI intervention mediate improvement in reading skill?* Using instrumental variables analysis, we examined whether

students' participation and involvement in STARI literacy activities mediated improvement on multiple dimensions of reading skill.

(3) *Do levels of teachers' ratings of student engagement among STARI students explain unique variance in posttests?* We tested whether teacher ratings of engaged reading also predicted posttest reading scores among STARI students, controlling for the effects of students' prior reading skill and school quality.

Method

Context for the Study

Four school districts in the northeastern United States served as research sites, including two large urban districts and two rural/suburban districts. Our goal was to recruit a district sample that represented a range of settings for implementing reading intervention, although all of the participating schools were Title I schools, reflecting moderate to high levels of family poverty. Districts volunteered to be part of the study and solicited schools to participate (in the case of the larger districts) or had all their middle schools participate in the two smaller districts. Schools had moderate to high poverty levels, based on the percentage of students eligible for free or reduced-price lunch (49% to 90%).

Sampling and randomization. In each of the 8 participating middle schools, students scoring below proficient on the spring 2013 Massachusetts Comprehensive Assessment System (MCAS) English language arts assessment were eligible to participate in the study. Eligible students scored at or below the 30th percentile for all test-takers in the state. Students in substantially separate special education classes, students who were level 1 or 2 English language learners, and students whose special education plan required an intensive, rules-based phonics intervention were excluded from study participation.

We used a randomized treatment-control, pretest-posttest design to address our primary questions. After identifying students comprising the target population for the STARI intervention, we assigned each eligible student a random number and assigned students into the available seats in intervention classrooms following their rank orders. In essence, this within school lottery procedure is equivalent to random assignment because student assignment to STARI or control classrooms is based on the random lottery number. We checked the fidelity of placement into STARI and control classrooms by conducting on-site visits in the fall, winter, and spring of the 2013-14 school year, and confirmed that students were in the classrooms based on our random assignment protocol. This randomization procedure has been successfully implemented in middle schools in which the number of struggling adolescent readers needing supplemental instruction exceeds the number of available spaces in intervention classes (Cantrell, Almasi, Carter, Rintamaa, & Madden, 2010).

Participating students and teachers. As illustrated in Table 1, STARI served a racially and linguistically diverse student population with moderate to high poverty levels, based on eligibility for free or reduced-price lunch. There were no statistically significant differences by condition for student-level demographic variables, including free lunch status, English learner status, and special education status (all p 's > .05). Information on the number of eligible students, the selection probabilities, and the resulting intervention and control sample sizes is presented in Table 2. The number of eligible students and available slots in each intervention classroom varied across schools.

Certified teachers were recruited from participating schools to implement STARI instruction. The 12 STARI teachers' experience ranged from 6 to 35 years with a mean of 16.18 years ($SD = 7.78$). One had attained only a bachelor's degree, ten had a master's degree, and one

had a doctorate. All twelve teachers were female, and nine were European American, with one African-American, one Latina and one Native American. All were fully qualified in the area of their main teaching assignments, which included reading, middle school English, and middle school special education.

In the following section, we describe the Business-as-Usual (BaU) condition and then summarize the procedures for implementing professional development activities and measuring fidelity of implementation.

Procedures

Business-as-Usual (BaU) condition. The BaU condition varied across sites since schools implemented a variety of supplemental interventions for struggling readers. One of the complexities inherent in a field trial spanning eight schools and four districts is the variety of business as usual approaches across sites. Seventy percent of students who were eligible for STARI but randomly assigned to the control condition ($n = 214$) received an alternative literacy intervention. Schools in all four districts offered teacher-developed reading or writing classes as one possible BaU condition; in two schools, these classes were taught by teachers who also taught STARI. Some schools offered externally developed reading interventions as BaU, such as Wilson Just Words. We obtained course schedules to code the student's control class as (a) nonacademic (e.g., physical education, art) (b) general academic support (e.g., study skills), or (c) alternative literacy intervention. Overall, the control group students were either assigned to an alternative literacy course (70%) and/or received some form of general academic support (30%) in the BaU condition (e.g., state test preparation, AVID). We used this information to examine whether treatment effects were moderated by the type of BaU condition.

Professional development and coaching. Teachers were introduced to the program through a three-day summer institute that addressed traits of struggling adolescent readers; STARI lessons on decoding and morphology; STARI fluency routines; and key practices for guided reading and partner reading: preteaching vocabulary, setting an engaging purpose for reading, silent reading of “chunks,” interactive discussion, and encouragement of text-based reasoning.

Teachers also received regular in-class guidance from one of three project literacy coaches. Coaches observed and offered feedback, modeled instructional strategies, and consulted through email and telephone calls. In addition, STARI teachers met in district-based professional learning communities to discuss implementation challenges and participated in three statewide network meetings each year, focused on supporting student talk about text.

Description of STARI curriculum

Structure and scope. Students received the STARI intervention during an elective period or whole-school intervention period. Number of class periods per week for STARI ranged from 3-5. STARI was taught for the entire school year.

STARI was delivered as a series of thematic units, organized around an essential question, such as “how can we find a place where we really belong?” In Unit 2.2, students traced this question while reading Jacob Lawrence’s narrative of the Great Migration, first person accounts of race riots in Northern cities as the African American population grew, poems of the Harlem Renaissance, and fictionalized experiences of contemporary young people in the Bronx. Each unit included a central novel and one or more full-length works of nonfiction. Unit topics, such as sports in society, the war in Iraq, and the immigration debate, were designed to be of high interest, personally relevant to adolescents, and complex enough to support discussion and

debate. For each unit, teachers received project-authored student workbooks for fluency, decoding and comprehension practice, unit novels and non-fiction books, slides, and detailed daily lesson plans. A lesson plan sample appears in Figure 2, illustrating the types of scaffolds provided for teachers implementing the curriculum.

Core novels in STARI were accessible, ranging from about 600-800 lexiles in difficulty, to match the reading skills of middle school students who perform at or below the 35th percentile (MetaMetrics, 2009; Stenner, Burdick, Sanford, & Burdick, 2007). Research documents that adolescents are more engaged and feel more competent when reading text that is well aligned with their current reading skills (Fulmer & Tulis, 2013; Wolters et al., 2014). Novels were also selected, however, for characteristics of cognitive challenge, the degree to which readers must work through plot and character ambiguities, resolve diverse perspectives, and use specific background knowledge to bridge gaps in the text (Eco, 1984). We theorized that these challenging text characteristics would promote classroom talk about text and help move struggling readers beyond very literal and limited responses to text. In *The Skin I'm In*, for example, a bullied girl takes part in a vicious attack on a teacher who tries to befriend her. *The Big Nothing* alternates between the perspectives of a middle schooler struggling with social problems and his older brother serving in the Iraq war.

STARI lessons began with a decoding, morphology, or comprehension mini lesson, followed by 15 minutes of oral reading fluency practice with project-authored nonfiction. After fluency practice, students engaged in silent reading and discussion of unit novels and nonfiction, alternating blocks of teacher-led guided reading and partner reading and responding. Classroom debates on issues related to unit themes occurred in the middle and end of each STARI unit.

Figure 3 shows the integration of reading fluency, decoding and comprehension instruction, guided reading, and discussion and debate across a typical 8-week STARI unit.

Decoding and fluency strand. To increase reading rate, partners timed each other during repeated reading of short topical passages linked to unit themes (O'Connor, Swanson, & Geraghty, 2010; Rasinski, Homan, & Biggs, 2009), tracking incremental improvement. Words with spelling patterns taught in decoding and morphological analysis lessons were loaded into the fluency passages to provide repeated exposures to challenging words. Partner discussion activities, emphasizing contrasting perspectives on the text, concluded each two-day fluency cycle. For example, after reading a fluency passage about restricted combat roles for women soldiers during the Iraq war, students recorded their own opinions on the policy and then compared views with their fluency partner.

Comprehension strand. STARI teachers directly modeled the Reciprocal Teaching strategies: summarizing, clarifying, predicting, and questioning (Palincsar & Brown, 1984; Spörer, Brunstein, & Kieschke, 2009) in read-alouds and guided reading. Because struggling readers often engage with texts at only a literal level (Laing & Kamhi, 2002; McMaster et al., 2012), students also learned to ask and answer questions while reading that required bridging and elaborative inferences (Raphael & Au, 2005).

Students were prompted to apply comprehension strategies during guided reading, as in this example from the teacher lesson plans for unit 1.1:

What happened to Maleeka on her way home from Charlese's house? Let's summarize.

What is important? What is new? What should we remember?

Students were also prompted by their partners to apply comprehension strategies during partner reading of novels and nonfiction. Figure 4 shows a partner activity in which partners

collaborated on the Reciprocal Teaching strategy of clarifying unfamiliar words or phrases. Figure 5 shows a completed student workbook page in which students posed questions to a partner about a nonfiction passage.

Background knowledge. The cognitively complex texts in STARI make substantial demands on readers' background knowledge. Before reading each novel, STARI students were immersed in nonfiction readings that built topic-specific vocabulary and schemata. These included short fluency passages as well as full-length nonfiction books, selected for close connection to the unit novel. For example, students read Laban Carrick Hill's *Harlem Stomp! A Cultural History of the Harlem Renaissance*, and shorter passages about the Great Migration and Langston Hughes before reading the young adult novel, *Bronx Masquerade*, in which teens and their English teacher explore poetry of the Harlem Renaissance.

Discussion and debate. STARI lessons incorporated diverse opportunities for talk about text: partner fluency passage discussion, discussion of novels and nonfiction during partner reading, teacher-led guided reading discussions, and unit debates. STARI classroom practices reflect what researchers have called "dialogically oriented" approaches to meaning construction (Aukerman & Schuldt, 2015; Nystrand, 1997; Reznitskaya & Gregory, 2013). Rather than orient to the teacher's account of textual meaning, students worked to articulate their own understandings and in doing so, often moved away from more literal and limited responses. For example students offered highly original and detailed interpretations of which character held the power in the social conflicts depicted in Unit 1.1's novel, *The Skin I'm In*. Research on the impact of classroom talk about text points to particular benefits for students with initially weaker comprehension skills (Murphy, Wilkinson, Soter, Hennessey, & Alexander, 2009),

Because STARI novels and nonfiction books were selected for their ability to promote discussion: ambiguous story characters, unexpected plot developments, or representation of contrasting positions, students were encouraged to express personal perspectives on the texts read. Reading activities were also designed to elicit divergent perspectives on what was read. For example, in unit 1.1, students were prompted:

Read the first page of Chapter 12 with your partner. Turn and talk: Is Char really Maleeka's friend? Do you agree or disagree about this?

In similar fashion, unit debates were built around questions on which students might legitimately disagree, e.g., should young teens work? In debate teams, students re-read unit texts, collecting evidence to support their position and prepared and presented debate speeches. For the unit 1.2 debate on young teens working, for example, students synthesized information and perspectives from the Gary Soto short story, "First Job," from a news story about teen worker deaths on a farm owned by Monsanto, and from personal narratives about first jobs in the news program, Story Corps. Responding to contrasting peer perspectives, a practice supported in varied reading activities in STARI, has been demonstrated to enrich readers' understanding of what they have read (Newell, Beach, Smith, & VanDerHeide, 2011).

Distinctive features of the STARI intervention included integration of basic skills instruction into thematic units (e.g., bullying, the war in Iraq, diverse families), engaging and cognitively challenging texts, use of short texts to build background knowledge and confidence for longer texts, multiple opportunities for students to talk about text meaning, and a focus on developing and contrasting personal stances on text content.

Fidelity of implementation. We evaluated the quality of STARI implementation by collecting data on both teachers and students. Fidelity of implementation was operationalized

using observational data from teachers' delivery of the STARI curriculum and students' engagement with the STARI activities (Yoshikawa, Weisner, Kalil, & Way, 2008).

Teachers' implementation of STARI lessons: Classroom observations. Research assistants who were experienced teachers observed each STARI classroom at least twice, once in fall 2013 and again in spring 2014. The classroom observation tool assessed (a) teachers' adherence to core STARI lesson components; (b) teachers' quality of implementation, specifically use of practices hypothesized to promote student talk about text; and (c) student responsiveness during fluency work, guided reading, and partner reading with novels and nonfiction. Seventeen percent of fall and spring observations were conducted by the program developer as well as a research assistant, and inter-observer reliability was moderate to high ($K = .84$).

The adherence measures indicated the extent to which teachers delivered 18 core lesson components during fluency, guided reading, and partner reading in the STARI program. Observation items included in the adherence scale are provided in Appendix A. Selected adherence items included "Students are grouped into partners for fluency work," and "Teacher directs students to silently read particular text chunks [during guided reading] and then stop for discussion." Overall adherence by STARI teachers was high, with a range of 16-18 core practices observed across study classrooms and an average of 17.33 out of 18 core features observed ($SD = .85$). There were no statistically significant differences between schools or districts on the adherence measure. In addition to adherence, observers noted the number of minutes that teachers devoted to each STARI component. Overall, teachers devoted more time to guided reading instruction ($M = 31.92$ minutes per lesson, $SD = 12.17$ minutes) than to fluency instruction ($M = 16.75$ minutes per lesson, $SD = 5.08$ minutes), reflecting recommendations in

STARI lesson plans and professional development. There were no statistically significant differences in allocation of time between observation waves 1 and 2.

Quality of implementation was rated using a nine-item scale, including such items as “Teacher sets a purpose for reading the next section of the novel” and “Teacher asks follow-up questions to elicit fuller or clearer student responses.” Implementation quality items were designed to measure teacher practices that promoted student talk about text and are shown in Appendix A. Across STARI teachers, raters observed an average of 8.58 ($SD = 0.51$ $Min = 8$, $Max = 9$) of the 9 quality indicators.

Student responsiveness was rated using a six-item scale, including such items as “Students ask each other and answer follow-up questions or comment to partner,” and “In discussion of passage meaning, students reference text explicitly.” Overall, raters observed an average of 5.83 ($SD = 0.39$, $Min = 5$, $Max = 6$) of the six student responsiveness behaviors, indicating robust levels of student engagement during STARI literacy activities. Scores on both teacher quality of implementation and participant responsiveness were high and were highly inter-correlated (.81-.84) with each other and with program adherence.

In sum, fidelity observations indicated that STARI teachers adhered closely to the lesson plans, implemented practices designed to promote student talk about text, and fostered students’ responsiveness during lessons.

Students’ behavioral engagement in STARI: Workbook activities. We measured the extent to which students were behaviorally engaged in the STARI curriculum activities by the number of workbook pages that each student completed during the course of the study. Specifically, we coded each student’s unit workbooks to measure how much of the STARI curriculum activities students completed during the school year. Daily assignments for each unit

are organized into workbooks, where students practiced decoding and comprehension skills (e.g., breaking syllables into chunks, summarizing, using context clues to determine word meaning) and responded to short writing prompts after reading sections of unit novels and nonfiction (e.g., assessing predictions about plot development, comparing and contrasting characters). There were a total of 318 workbook pages requiring student responses across three units.

We coded each page of each workbook to determine whether the student had attempted to complete the literacy activities. If a student attempted none of the literacy activities, the page was coded 0. Twenty percent of workbook pages were independently scored by two raters, and interrater reliability was .98 ($K = .96$). For each student, we computed the total number of pages attempted. Treatment group students attempted nearly two-thirds of the total workbook pages ($M = .60$, $SD = .14$, $Min = 0$, $Max = .89$). Six control students also completed workbook pages ($M = .49$, $SD = .15$, $Min = .38$, $Max = .73$), although the majority (97.39%) completed no pages suggesting minimal diffusion of the program across conditions. In the analytic plan, we deal with cross-overs in our instrumental variables analyses (see below under *Data Analysis*).

Reading Engagement Index Revised (REIR). Intervention teachers used the Reading Engagement Index-Revised (REIR; Wigfield et al., 2008) to rate their students' inclination (a) to become distracted easily in reading, (b) to work hard in reading, (c) to be a confident reader, and (d) to use comprehension strategies well. The response format was 1 = not true to 4 = very true. Students in intervention classrooms could therefore receive a score from 4 to 16, and STARI teachers rated each student during a single 15- to 20-minute session at the end of the school year. Cronbach's alpha reliability for the items was .82 for our sample, comparable to reliabilities reported in prior research. The teacher ratings in the REIR have been shown to correlate with

students' self-report of reading motivation (Wigfield & Guthrie, 1997) and with students' reading achievement (Wigfield et al. 2008).

Measures

Reading Inventory and Scholastic Evaluation (RISE). This study examines treatment effects on multiple aspects of reading skill theorized to underlie proficient reading: decoding, morphology, vocabulary, sentence structure, reading fluency, and comprehension. At the beginning of school year 2013-14, all participating students were pretested on the RISE (Reading Inventory and Scholastic Evaluation), an assessment developed by a team of researchers at Educational Testing Service (O'Reilly, Sabatini, Bruce, Pillarisetti, & McCormick, 2012; Sabatini, Bruce, Steinberg, & Weeks, 2015; Sabatini, O'Reilly, Halderman, & Bruce, 2014). In May-June 2014, the RISE was repeated.

The RISE is a 45 to 60 minute web-administered reading assessment that incorporates subtests for six domains that were expected to improve through the STARI intervention.

Word recognition/decoding ($\alpha = .91$) includes 50 items. Students were asked to identify whether the stimulus is a word, a decodable nonword, or a pseudohomophone.

Vocabulary ($\alpha = .86$) includes 38 items. Students must select a synonym or word that is topically associated with the target word.

Morphological awareness ($\alpha = .90$) includes 32 items. Students select which of three morphologically related words fits the syntax and meaning of a given sentence.

Sentence processing ($\alpha = .81$) includes 26 items. Students select the most appropriate word to complete sentences of increasing length and complexity.

Efficiency of reading for basic comprehension ($\alpha = .90$) assesses both reading rate and comprehension through 36 comprehension items presented in a maze format. Students have 3

minutes to read each of 3 nonfiction passages and select appropriate words to fit sentence and passage context.

Reading comprehension ($\alpha = .76$) includes 22 traditional multiple-choice questions on the same three nonfiction passages that students read in the previous subtest.

In research on the RISE by the ETS team, each subtest contributed independently to the prediction of state reading test scores (O'Reilly et al., 2012).

Data Analysis

Intent-to-treat estimates on student reading skills. To address our first question, we generated intent-to-treat (ITT) estimates of the STARI intervention on multiple dimensions of reading skill. In these models, we compare the posttest outcomes for STARI and control students regardless of individuals' amount of engagement with the STARI curriculum. All analyses incorporate the Benjamini-Hochberg correction to account for the comparison-wise type I error rate involving multiple outcome measures with a single comparison group. To account for the unequal selection probabilities across schools (Table 2), we computed analytical weights that were used in the analyses of the intent-to-treat effects of STARI. Within each school site, treatment cases were weighted by the inverse of the selection probability, and control cases were weighted by the inverse of 1 minus the selection probability.

To generate an unbiased intent-to-treat (ITT) estimate of STARI on each of the RISE subtests, we used ordinary least squares (OLS) regression to fit a model of the following form:

$$(1) Y_i = \beta_0 + \beta_1 T_i + \beta_2 X_i + \beta_3 RB_i + \varepsilon_i$$

where Y_i represents the respective RISE posttest score outcome for student i in school j , T_i indicates whether the student was randomly assigned to STARI, X_i is the pretest covariate, RB_i represents the school fixed effect to account for the nesting of students within school sites, and ε_i

represents the error term. The coefficient β_j represents the estimated impact of STARI that educators can expect from implementing the program (since educators cannot control or determine each student's level of engagement).

Effects of students' behavioral engagement on reading skills. To address our second question, we used instrumental variables to examine whether levels of student behavioral engagement mediated the effects of STARI on reading outcomes. The instrumental variables estimates provide an answer to the question: what is the average effect of the STARI treatment for students who actually engaged in the program, as measured by individuals' workbook completion? While the ITT estimate provides an estimate of the impacts of simply being offered a seat in a STARI classroom, the treatment-on-the-treated (TOT) estimate provides an estimate of the average effect for students who were engaged with the STARI program and attempted the daily workbook literacy activities.

The use of instrumental variables rests on several key assumptions (Angrist, Imbens, & Rubin, 1996). First, a valid instrumental variable should be correlated with levels of student engagement. In our first-stage model, being randomly assigned to STARI was strongly correlated ($r = .87$) with student engagement, as measured by the percentage of STARI workbook pages completed. Second, the instrumental variable should be uncorrelated with unobserved factors that influence reading outcomes. Third, the exclusion restriction states that the instrumental variable should influence reading outcomes solely through students' engagement with STARI. In other words, the random assignment variable is a valid instrumental variable if it predicts STARI workbook completion rates and influences posttest scores exclusively through a student's engagement with the STARI program.

We used instrumental variables analysis in two stages. In the first stage model, the student engagement measure (Z_i) was regressed on initial random assignment to STARI or control, pretest, and randomization block:

$$(2) Z_i = \pi_0 + \pi_1 X_i + \pi_2 T_i + \pi_3 RB_i + \delta_i$$

In the second stage model, each posttest reading outcome measure was regressed on the portion of the variability in student engagement with the STARI curriculum that was predicted exclusively by the random assignment variable:

$$(3) Y_i = \beta_0 + \beta_1 X_i + \beta_2 Z_i + \beta_3 RB_i + \varepsilon_i$$

where the posttest reading score is predicted by Z_i and the same independent variables that were included in the first stage model. In model (3), the coefficient Z_i captures the estimated effect of students' level of engagement with the STARI curriculum on reading outcomes.

Unique contribution of reading engagement to reading skill. Third, we used hierarchical regression analysis to examine whether intervention teachers' reports of students' cognitive and emotional engagement explained significant and unique variance in posttest reading skill after pretest scores and school quality were partialled out. These analyses were designed to empirically assess whether reading engagement, in the context of an innovative intervention, contributed unique variance in posttest scores among STARI students.

Finally, we conducted analyses to assess the sensitivity of the results to alternative model specifications and to variations in the counterfactual condition.

Results

Initial Equivalence

Table 3 displays descriptive statistics for each of the RISE pretest and posttest outcomes for intervention and control students who were included in the evaluation at baseline. In

addition, there was also no difference by condition on the average of six RISE pretests, $t(480) = -1.27, p = .20$. Attrition rates were unrelated to condition, $\chi^2(1, N = 483) = 0.005, p = .94$, with no evidence of differential attrition.

Control Group Performance

Table 4 displays the same information for the 402 intervention and control students who completed both pretests and posttests. The annual gain (i.e., the standardized mean difference between pretest to posttest) for control students was smaller on measures of reading comprehension ($d = -.01$), morphology ($d = -.01$), and sentence processing ($d = -.05$), than on measures of efficiency of basic reading comprehension ($d = .07$), word recognition ($d = .07$), and vocabulary ($d = .13$). These results indicate that that control students made small to no gains in reading skills during the course of the school year, although a majority participated in alternative literacy programs. In essence, the treatment effect provides a direct test of whether the “active ingredients” in STARI are more effective than business as usual practices in improving students’ reading skills.

STARI Effects on Student Reading Outcomes

To address our first research question, we examined STARI effects on multiple reading skills. In the intent-to-treat analyses reported in Table 5, the pretest and posttest RISE scaled scores were standardized to a mean of 0 and a standard deviation of 1. Thus, the coefficient for the “Assignment to STARI” variable represents the covariate-adjusted effect size (ES). Students randomly assigned to STARI outperformed control students on measures of word recognition ($d = .20$), morphological awareness ($d = .18$), and efficiency of basic reading comprehension ($d = .21$). Effect sizes for sentence processing ($d = .15$), vocabulary ($d = .16$), and reading comprehension ($d = .08$) were also positive, though not statistically significant.

To address our second question, we examined the effect of reading engagement in its behavioral form, as measured by students' involvement and participation in workbook completion, on posttest outcomes. Workbook completion assessed the degree to which students read and responded to STARI texts and completed other literacy activities (e.g. word analysis activities with words from unit texts). The instrumental variables analyses in Table 6 revealed a statistically significant and substantial mediating effect of students' behavioral engagement on three outcomes, including word recognition ($d = .35$), efficiency of basic reading comprehension ($d = .35$), and morphological awareness ($d = .32$). Stated differently, these estimates suggest that the effects of STARI were greater for students who completed a greater proportion of workbook activities that were part of the daily STARI curriculum activities.

Probing further into the contribution of reading engagement to reading skills, we conducted hierarchical regression analyses to address our third question. In particular, we examined whether teachers' ratings of STARI participants' reading engagement explained unique variance in posttest scores, controlling for students' prior reading skill and school quality. Teacher ratings captured emotional and cognitive aspects of reading engagement that are theorized to predict reading skills. The results in Table 7 indicate that teacher ratings of reading engagement, as measured by individual students' Reading Engagement Index-Revised scores (Wigfield et al., 2008), explained between 2% to 5% additional variance in step 3 of the hierarchical regression models for five of the posttest outcomes. These results indicate reading engagement was a malleable factor that contributed to gains in multiple dimensions of reading skill for STARI students.

Finally, models with school random effects replicated the intent-to-treat results. Results did not vary based on the percentage of control students who received alternative literacy programs versus general academic support (see Supplemental Online Materials).

Discussion

We report results from an experimental study of an innovative supplemental reading intervention designed to address multiple components that contribute to skilled reading. The Strategic Adolescent Literacy Intervention (STARI) was implemented by classroom teachers and targeted middle school students who scored below proficient on the state literacy assessment. Findings indicated that STARI students showed greater gains than control students on measures of basic reading comprehension ($d = .21$), word recognition ($d = .20$), and morphological awareness ($d = .18$). We believe the results provide support for the value of STARI instructional activities and for classroom teachers' ability to deliver STARI components with fidelity. The demonstrated impacts on RISE word reading, morphological awareness, reading fluency, and comprehension, reflect the main instructional focuses of the STARI curriculum.

In designing STARI, our goal was to create an instructional program that contrasted markedly with existing practice in adolescent literacy intervention. Many interventions focus on either word-level skills or reading comprehension processes, or modify only the format (e.g., small-group or computer-mediated), rather than the content of literacy instruction (Cantrell et al., 2010; Scammacca et al., 2013; Slavin, Cheung, Groff, & Lake, 2008). In contrast to typical practice, STARI afforded students with opportunities to strengthen word reading and fluency within stimulating thematic units designed to build student interest and motivation (Guthrie et al., 2007; Klauda & Guthrie, 2015). Consistent with the program theory of change, the intent-to-treat estimates revealed improvements in students' print skills and depth and breadth of word

knowledge, which are important foundations for skillful reading comprehension (Hoover & Tunmer, 1993; Hogan, Bridges, Justice, & Cain, 2011; Ouellet, 2006; Strucker, Yamamoto, & Kirsch, 2007). This group of high needs adolescents appeared to benefit from a focus on the phonics and morphological skills required for reading multi-syllable words with greater accuracy, speed, and understanding. These word level skills are critical for building coherent representations of text (Graesser & McNamara, 2011; Kintsch, 1998; McNamara, Kintsch, Songer, & Kintsch, 1996). STARI students' growth in efficiency of basic reading comprehension ($d = .21$) reflected improvements in word level processes, alongside exposure to instruction in fluency and comprehension strategies.

The effect sizes are of practical significance and suggest that STARI students showed progress across a range of components that underlie skilled reading (Lipsey et al., 2012; Scammacca et al., 2013; Slavin et al., 2008; Vaughn et al., 2013). Taken together, the general pattern of positive treatment effects across the six outcome measures suggests that STARI promoted simultaneous improvement in the precursor skills that enable adolescents to read for understanding. Current models of reading comprehension—Kintsch's (1988, 1998) construction-integration model, Perfetti's verbal efficiency (1985) theory, and Cromley and Azevedo's Direct and Inferential Mediation model (DIME, 2007)—support the importance of simultaneously developing strengths in word reading, vocabulary, background knowledge, inferencing, and the ability to coordinate and apply comprehension strategies while reading. The range of intent-to-treat estimates provides strong evidence that STARI generated improvements across a broad set of theoretically important and malleable skills that enhance students' ability to form coherent representations of text. Moreover, the pattern of effect sizes is consistent with the hypothesis that STARI had larger effects on posttest measures of constrained skills (e.g., word

recognition, morphological awareness) rather than unconstrained skills such as broad reading comprehension (Paris, 2005).

What, then, are the active ingredients that led to improvement in student reading outcomes? There is a shared consensus among literacy scholars that engagement, particularly behavioral engagement, can foster reading success among struggling adolescent readers (Guthrie et al., 2013; Torgesen et al., 2007). Beyond improvements in word reading ability, fluency, breadth and depth of vocabulary, background knowledge, and the skilled use of comprehension strategies, students must be “engaged and responsive to an intervention” and remain “on task during the reading sessions” (Fogarty et al., 2014, p. 432). Too many adolescent reading programs, however, fail to engage adolescent readers in reasoning about text as part of curriculum activities, including regular opportunities to monitor comprehension during reading, integrate diverse perspectives, and form summaries and inferences. Lovett, Lacerenza, De Palma, and Frijters (2012) suggest that “it is critical that age-appropriate and engaging text materials be used regardless of the limited decoding skills of the group” (p. 164). In addition, Tatum (2008) has argued that “enabling texts” that engage low-income students of color are particularly important features of effective literacy programs and must “move beyond a solely cognitive focus...to include a social, cultural, political, spiritual, or economic focus” (p. 164).

With themes designed to link to students’ social and cultural experiences, and with frequent opportunities to express personal stances on the texts read, particularly in discussion and debate, STARI activities helped to overcome disengagement. Reading motivation was further supported by embedding skills work on decoding, fluency, and comprehension strategies in cognitively challenging texts and tasks.

We used the Reading Engagement Index-Revised (Wigfield et al., 2008) to assess whether engaged readers enjoyed larger gains than less engaged readers in intervention classrooms, controlling for the effects of prior skill and school quality. Teachers' ratings of individuals' reading confidence, focus, effort, and active strategy use explained unique variance in end of program reading scores, controlling for initial skill levels and school quality. Thus even in the context of an intervention with many motivation-enhancing design features, individuals who developed greater confidence and focus experienced greater growth in literacy skills.

Students who attempted more STARI curriculum activities also showed stronger gains in reading skills. To make our results more concrete, consider the characteristics of two STARI students with low and high levels of behavioral engagement, scoring at the 25th and 75th percentile of the workbook completion measure. Brandon, a low-income, African American boy, is a less engaged reader who completed about half of the STARI curriculum and scored .75 standard deviations below the mean for study participants on the reading comprehension posttest and 1.57 standard deviations below the mean for reading engagement, as rated by his teacher. Jovani, a low-income Latino boy, is an engaged reader who completed 70% of the STARI curriculum, scoring 1.5 standard deviations above the mean for STARI participants in comprehension and .66 standard deviations above the mean in reading engagement. The range of individual differences in outcomes for Brandon and Jovani illustrates the relationships between students' uptake and engagement with the curriculum and the varied impacts that can be expected in an intervention like STARI.

Limitations and Future Research

Future work is needed to measure both indicators and facilitators of student engagement. As noted by Unrau and Quirk (2014), indicators of engagement only imperfectly capture how

students actually behave, think, and feel during literacy activities. We used a two-pronged approach to assess reading engagement, but our measures assess indicators rather than facilitators of engagement. Facilitators of engagement are likely to include important aspects of motivation comprising the “thoughts, beliefs, and actions” that propel behavior. In future intervention research with STARI, our aim is to directly measure readers’ self-perceived competence, subjective valuing of literacy-related tasks, and ability to marshal effort to succeed at literacy tasks (Deci & Ryan, 2000; Unrau, & Quirk, 2014, p. 264). Students’ motivation is contextualized, situated, and malleable, and more direct measures of this multi-faceted trait would help us model the complex relationships among instructional contexts, engagement, and growth in reading skill.

The measures in our study, as well as those typically used in intervention research, capture components and reader processes that underlie skilled comprehension (Cutting & Scarborough, 2006) but do not directly measure deep comprehension. Specifically, we define deep comprehension as a broad construct that includes students’ ability to evaluate and synthesize information across multiple texts (Bråten, Ferguson, Anmarkrud, & Strømsø, 2013; Minguela, Solé, & Pieschl, 2015; Sabatini et al., 2014). Future research should explore whether students in STARI first improve their word reading accuracy, understanding of complex morphology, reading fluency, and literal comprehension, and then with further practice and text exposure are able to engage in deeper comprehension of text. Alternatively, STARI may develop foundational reading skills but students may need other kinds of extended intervention and strategy instruction over a longer time span to reach grade level expectations for deeper forms of comprehension. Assessing impacts on deep comprehension tasks would provide direct tests of these hypotheses.

Given the alarmingly high numbers of adolescent readers who cannot read grade level text fluently and with understanding by eighth grade (NCES, 2015), more research is needed to improve the effectiveness and scalability of Tier 2 adolescent literacy interventions. For example, can multi-component adolescent literacy interventions produce durable improvements in reading comprehension, close gaps between struggling readers and typically-developing students, and accelerate the reading skills of the lowest-performing subgroups of students? Answers to these questions will help to build a sturdier evidence base for improving the literacy skills and life chances of thousands of struggling adolescent readers (Fletcher & Wagner, 2014). In a first step toward that end, findings from this study demonstrate the potential to scale-up STARI with fidelity and effectiveness while fostering struggling adolescents' engagement and competence in reading.

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Table 1

Demographic Characteristics of Students by Condition

Measures	STARI		Comparison Group		<i>t</i>	<i>p</i>
	n	% of total	n	% of total		
Special Education	62	30%	98	36%	1.28	0.20
Low Income	143	69%	211	76%	1.81	0.07
English Language Learner	27	13%	52	19%	1.71	0.09
European American	102	49%	141	51%	0.43	0.67
African American	40	19%	55	20%	0.18	0.85
Latino	53	26%	62	23%	-0.73	0.46
Asian	3	1%	7	3%	0.83	0.40
Native American/Pacific Islander	1	0.5%	2	0.7%	0.34	0.73
Mixed/Other	8	4%	8	3%	-0.58	0.56
Total	207		275			

Table 2

Summary of Sampling Frame, Baseline Sample Sizes for Eligible Students, and Selection Probabilities

District	School	STARI Teachers	Eligible Students	STARI	Comparison	Selection probability
A	1	1	44	11	33	0.25
	2	1	20	9	11	0.45
	3	1	29	21	8	0.72
B	4	1	53	19	34	0.36
	5	1	44	19	25	0.43
C	6	2	108	37	71	0.34
	7	2	78	26	52	0.33
D	8	3	107	65	42	0.61

Table 3

Characteristics of Baseline Sample on Pretest Reading Scores, by Condition

Measure	STARI			Comparison Group			<i>t</i>	<i>p</i>
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>		
Word Recognition	207	345.19	25.95	276	344.52	26.02	0.28	0.78
Vocabulary	207	353.83	23.62	276	352.23	22.97	0.74	0.46
Morphology	207	353.55	25.31	275	352.01	24.39	0.67	0.50
Sentence Processing	207	347.82	24.9	276	344.33	25.52	1.51	0.13
Efficiency of Basic Reading	206	344.01	26.26	276	341.57	24.96	1.03	0.30
Reading Comprehension	205	342.81	24.71	276	339.76	23.11	1.38	0.17

Table 4

Pretest and Posttest Reading Scores for the Analytic Sample, by Condition

Measure	STARI					Comparison Group				
	Pretest			Posttest		Pretest			Posttest	
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Word Recognition	172	347.01	25.23	358.47	25.61	230	344.49	25.82	351.91	26.03
Vocabulary	172	356.51	22.05	369.48	20.41	229	352.53	22.72	364.69	22.73
Morphology	172	355.68	25.56	358.40	26.41	229	352.79	23.92	352.10	27.74
Sentence Processing	172	349.27	24.75	346.29	25.72	229	344.87	25.1	339.93	24.36
Efficiency of Basic Reading	172	344.42	25.91	356.99	28.77	229	341.86	24.61	349.08	28.73
Reading Comprehension	170	343.60	24.37	342.34	29.47	228	339.02	22.75	338.23	25.76

Table 5

Summary of Ordinary Least Squares Regression Analyses of the Intent-to-Treat Effect of STARI on Posttest Reading Scores

Measure	Word Recognition	Vocabulary	Morphology	Sentence Processing	Efficiency of Basic Reading	Reading Comprehension
Assignment to STARI	0.20* (0.08)	0.16† (0.08)	0.18* (0.08)	0.15 (0.10)	0.21* (0.09)	0.08 (0.09)
Pretest score	0.62*** (0.04)	0.61*** (0.05)	0.62*** (0.04)	0.39*** (0.05)	0.54*** (0.05)	0.43*** (0.05)
Constant	-0.09† (0.05)	-0.08 (0.06)	-0.10† (0.05)	-0.07 (0.06)	-0.11* (0.05)	-0.04 (0.05)
<i>N</i>	402	401	400	401	401	398
<i>R</i> ²	0.41	0.39	0.41	0.167	0.31	0.19

Note. †*p* < .10, **p* < .05, ***p* < .01, ****p* < .001

Table 6

Summary of Instrumental Variable Estimates of Behavioral Engagement, as Measured by Workbook Completion Rates, on Posttest Reading Scores

Measure	Word Recognition	Vocabulary	Morphology	Sentence Processing	Efficiency of Basic Reading	Reading Comprehension
Workbook completion	0.35** (0.13)	0.25† (0.14)	0.32* (0.13)	0.28† (0.16)	0.35* (0.14)	0.08 (0.15)
Pretest score	0.64*** (0.04)	0.60*** (0.04)	0.62*** (0.04)	0.39*** (0.05)	0.61*** (0.04)	0.46*** (0.04)
Constant	-0.29† (0.16)	-0.10 (0.16)	-0.22 (0.16)	-0.02 (0.19)	-0.25 (0.16)	0.08 (0.18)
<i>N</i>	402	401	400	401	401	398
<i>R</i> ²	0.448	0.389	0.429	0.199	0.404	0.259

Note. †*p* < .10, **p* < .05, ***p* < .01, ****p* < .001

Table 7

Hierarchical Multiple Regression Analyses Predicting Reading Skill From Pretest Scores, School Quality, and Students' Cognitive and Motivation Engagement (N = 169)

Model and entry step	R ²	ΔR ²	β	ΔF	p
<i>Outcome: Word recognition</i>					
1. Pretest	0.27		0.49		
2. School	0.30	0.02		0.80	0.59
3. Engagement (REIR)	0.34	0.05	0.44	11.33**	<.001
<i>Outcome: Vocabulary</i>					
1. Pretest	0.33		0.50		
2. School	0.36	0.03		1.24	0.28
3. Engagement (REIR)	0.41	0.05	0.43	12.46**	<.001
<i>Outcome: Morphology</i>					
1. Pretest	0.44		0.58		
2. School	0.47	0.02		1.06	0.39
3. Engagement (REIR)	0.49	0.02	0.31	6.83*	0.01
<i>Outcome: Sentence Processing</i>					
1. Pretest	0.19		0.41		
2. School	0.25	0.06		1.69	0.11
3. Engagement (REIR)	0.25	0.01	0.16	1.11	0.29
<i>Outcome: Efficiency of Basic Reading Comprehension</i>					
1. Pretest	0.25		0.50		
2. School	0.28	0.13		4.79***	<.001
3. Engagement (REIR)	0.43	0.06	0.49	15.63***	<.001
<i>Outcome: Reading Comprehension</i>					
1. Pretest	0.14		0.37		
2. School	0.23	0.09		2.73*	0.01
3. Engagement (REIR)	0.27	0.04	0.47	9.55**	0.002

Note. †p < .10, *p < .05, **p < .01, ***p < .001. REIR = Reading Engagement Index Revised

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Appendix A: Fidelity of Implementation Protocol**Adherence Scale**

Fluency

1. Fluency work happened/Did not happen
2. Teacher circulates during fluency work and offers support with the process
3. Students are grouped into partners for fluency work
4. Both partners have a chance to read a passage aloud during fluency work
5. Students record elapsed time and WPM during fluency work
6. Students in the class are working in more than one fluency level, A-D
7. Students read phrase-cued passage or challenging phrases and words out loud
8. Students record answers to comprehension questions about fluency passage

Guided Reading

9. Students sit in a group with the teacher with copies of the guided reading book
10. Teacher talks about the new words in a meaningful context
11. Students read silently as directed
12. Students participate in discussion of guided reading novel
13. Teacher directs students to silently read particular text chunks and then stop for discussion
14. Teacher poses literal ("right there") questions
15. Teacher poses "search and think" questions

Partner Work with Novel

16. Students work in partners with the novel and workbook pages
17. Students are reading the novel and/or recording responses in the workbook
18. Students discuss passage or comprehension question for the novel with their partner/table group

Quality Scale

Guided Reading

1. Students are seated so that they face each other and the teacher
2. Teacher leads a summary discussion of the preceding day's guided reading passage
3. Teacher uses a whiteboard or projector to introduce new words before reading
4. Teacher sets a purpose for reading the next section of the novel
5. When directing students to silently read a chunk of the novel, teacher provides a context or a purpose for reading that chunk of text
6. Teacher asks students to re-read or refer back to text
7. Teacher asks follow-up questions to elicit fuller or clearer student responses
8. Teacher explicitly connects speakers' contributions to each other

Participant Responsiveness Scale

Fluency

1. Students ask each other and answer follow-up questions or comment to partner

Guided Reading

2. Students have materials to record new words/mark quotes
3. Students participate in summarizing the previous day's guided reading passage
4. Students participate in discussing the new words for the guided reading passage they will read next
5. Students provide extended responses during discussion of the novel
6. In discussion of passage meaning, students reference text explicitly