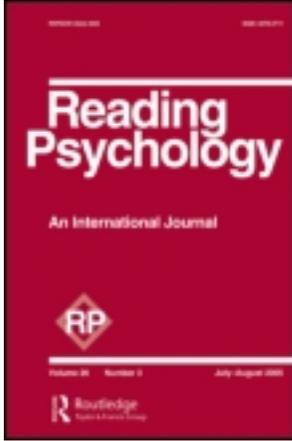


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Susan Chambers Cantrell ^a , Janice F. Almasi ^a , Janis C. Carter ^a & Margaret Rintamaa ^a

^a Collaborative Center for Literacy Development,
University of Kentucky, Lexington, Kentucky
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READING INTERVENTION IN MIDDLE AND HIGH SCHOOLS: IMPLEMENTATION FIDELITY, TEACHER EFFICACY, AND STUDENT ACHIEVEMENT

**SUSAN CHAMBERS CANTRELL, JANICE F. ALMASI, JANIS C. CARTER,
and MARGARET RINTAMAA**

Collaborative Center for Literacy Development, University of Kentucky,
Lexington, Kentucky

This study investigated teachers' efficacy and implementation in the context of a supplemental intervention for struggling adolescent readers. It examined teachers' efficacy at the start of their intervention training and investigated relationships among teachers' efficacy, implementation, and students' reading progress. The efficacy and implementation of 9 sixth-grade teachers and 11 ninth-grade teachers were compared, and student achievement gains were explored. Sixth-grade teachers had higher levels of efficacy, while ninth-grade teachers had higher levels of implementation. Findings indicated teacher efficacy was positively related to students' reading comprehension and overall reading achievement. Implementation was positively related to students' growth in vocabulary.

Introduction

Internationally, attention has focused on improving adolescents' school achievement. At a time when students' advanced educational attainment is increasingly essential for social and economic development, Western countries are grappling with high rates of students who drop out of school before completing the secondary grades (Bridgeland, DiIulio, & Morison, 2006; Smyth, McInerney, & Hattam, 2003). Efforts to address adolescents' poor school performance have included government initiatives focused on curricular and structural changes for this phase of schooling (Cole, Mahar, & Vindurampulle, 2006) as well as attempts to improve adolescents' achievement through teachers' growth and development (Harris, 2000).

Address correspondence to Susan Chambers Cantrell, Collaborative Center for Literacy Development, 120 Quinton Court, Suite 100, Lexington, KY 40509. E-mail: susan.cantrell@uky.edu

In the United States, calls for secondary students' increased educational attainment have centered on improving secondary students' literacy abilities (Heller & Greenleaf, 2007; National Governor's Association, 2005). Secondary students have not performed as well as younger students on national reading assessments (National Assessment of Educational Progress, 2009), and research has shown that secondary teachers in the U.S. often have low efficacy for literacy teaching, in that they do not feel responsible or prepared for addressing the reading needs of students in their classrooms (Greenleaf, Schoenbach, Cziko, & Mueller, 2001; O'Brien, Stewart, & Moje, 1995). Recommendations for improving adolescents' reading achievement in the U.S. include the implementation of intervention programs for secondary students who struggle with reading, but the research base on effective adolescent reading programs is limited (Biancarosa & Snow, 2004; Slavin et al., 2008). Thus, the U.S. government has allocated substantial resources for strengthening the research in adolescent literacy (U.S. Department of Education, 2010).

As school reform efforts have been implemented internationally, researchers have documented dilemmas related to program implementation and school change (Datnow & Castellano, 2000; Smyth et al., 2003; Yates & Holt, 2009). Studies have examined the complexities of balancing teachers' program adherence and adaptations, as well as the ways in which teachers' beliefs influence their implementation of programs and reforms. However, this body of research has not systematically investigated the critical links between teacher beliefs, program implementation, and student learning outcomes (Datnow & Castellano, 2000).

The study described in this paper examines these links in the context of a reading intervention program for secondary students (Deshler & Shumaker, 2005), implemented as part of a federal U.S. initiative to improve adolescents' literacy achievement (Striving Readers, 2010). It investigates relationships among teachers' implementation of the program, teacher efficacy, and student achievement in reading. The research questions that guided this study were as follows: (a) What is the difference in sixth- and ninth-grade teachers' personal efficacy at the start of a strategy-based reading intervention training program? (b) To what extent do teachers implement reading strategy instruction during the first year of the program? (c) To what extent are implementation

fidelity and teacher efficacy related to student gains in reading achievement?

Literature Review

Strategy Instruction

Reading comprehension strategy instruction is grounded in constructivist theories of metacognition, which conceptualize reading comprehension as active text processing (Baker & Brown, 1984; Garner, 1987; Paris, Lipson, & Wixon, 1983). Based on Flavell's (1979) notion of cognitive monitoring, effective reading comprehension instruction involves teaching students to employ specific actions to successfully accomplish reading tasks. When readers are taught to use their metacognitive knowledge to take actions to comprehend text more effectively, they learn to use strategic reading behaviors (Alexander & Murphy, 1999; Baker & Brown, 1984; Paris et al., 1983; Pressley & Afflerbach, 1995).

This knowledge of reading comprehension processes has led to emphasis on making students aware of strategic reading behaviors to promote comprehension (Alfassi, 2004; Dole, Brown, & Trathen, 1996; Lysynchuk, Pressley, & Vye, 1990; Paris & Winograd, 1990). However, strategy instruction can be difficult, because teachers must ensure that students develop declarative, procedural, and conditional knowledge of appropriate strategy use (Paris, Wasik, & Turner, 1996). Often, when teachers initially are trained to implement strategy instruction, they do not implement recommended practices and procedures with high fidelity (Cantrell, Almasi, Carter, Rintamaa, & Madden 2010; Almasi, 2003; Anderson, 1992; Brown & Coy-Ogan, 1993; Duffy, 1993a; Duffy, 1993b; El-Dinary & Schuder, 1993; Pressley, Schuder, SAIL Faculty and Administration, Bergman, & El-Dinary, 1992). Learning to become an effective teacher of strategic processing is a lengthy process that often takes as many as 3 years to learn and feel comfortable implementing (Brown & Coy-Ogan, 1993; Pressley et al., 1992). This can be even more difficult for secondary teachers, who often have little if any preparation at the undergraduate level for addressing students' reading difficulties (Greenleaf et al., 2001).

The strategy-based intervention that is the focus of this study is the Learning Strategies Curriculum, developed by the University of Kansas Center for Research on Learning, as one component of the Strategic Interventions Model (Tralli, Colombo, Deshler, & Schumaker, 1996). The Learning Strategies Curriculum was developed to assist adolescents with learning disabilities in the general education classroom and is divided into three strands: (a) acquisition, (b) storage, and (c) expression. The acquisition strand is designed to help students derive information from text. The storage strand is designed to help students identify and remember important information. The expression strand focuses on helping students develop writing or academic competence. Each strand includes specific strategies that are taught through eight instructional stages: pretest and commitments, description, model, verbal practice, controlled practice and feedback, posttest and commitments, and generalization. A number of studies have demonstrated the effectiveness of these strategies (Clark, Deshler, Schumaker, Alley, & Warner, 1984; Kline, Shumaker, & Deshler, 1991; Lee & Von Colln, 2003; Lenz & Hughes, 1990; Moran, Schumaker, & Vetter, 1981; Schumaker & Deshler, 1992; Woodruff, Schumaker, & Deshler, 2002).

In the current study, the Learning Strategies Curriculum was a supplement to the regular curriculum, wherein students received the regular language arts curriculum plus an extra 50 to 60 minutes of Learning Strategies Curriculum per day, in a separate class, over the course of the school year. The program, as implemented in this study, included strategies from each of the three Learning Strategies Curriculum strands: Word Identification, Visual Imagery, Self-Questioning, and Paraphrasing from the acquisition strand; LINC'S Vocabulary Learning Strategy from the storage strand; and Sentence Writing from the expression strand.

Cantrell et al. (2010) examined the impact of the Learning Strategies Curriculum on sixth- and ninth-grade students' reading achievement and strategy use over the course of one year and found positive impacts on sixth-grade students' reading achievement and strategy use. However, they found no impacts on ninth-graders' achievement or strategy use. Explanations for the differences in sixth- and ninth-grade impacts on student outcomes were not readily evident based on the Hierarchical Linear Model (HLM) analyses used in the study,

though the authors speculated that other factors beyond intervention implementation may have contributed to the results. The purpose of this study is to explore links among intervention implementation, teacher characteristics, and student outcomes to gain insight into the factors that may contribute to student achievement.

Implementation Fidelity

School change literature has long recognized the importance of measuring intervention implementation (Fullan, 2001; Fullan & Pomfret, 1977; Hall & Loucks, 1977). However, intervention research in education often neglects implementation fidelity, and aspects of fidelity are rarely related to outcomes in educational intervention research (O'Donnell, 2008). In effectiveness studies, it is essential to examine the extent to which the intervention was implemented with fidelity so that appropriate conclusions may be drawn from the research findings (Durlak & DuPre, 2008; Institute of Educational Sciences, 2009). If student outcomes do not improve after participation in an intervention, one of two explanations may be attributed: (a) the intervention was not implemented as it was designed or as the developer intended, or (b) the intervention, as designed, is not effective.

Definitions of implementation fidelity to interventions are varied in the education literature (Century, Rudnick, & Freeman, 2010; O'Donnell, 2008). A common element of many definitions is the extent to which interventions are implemented as planned or intended by the developer (Berman & McLaughlin, 1976; Fullan, 2001; Loucks, 1983; Scheirer & Rezmovic, 1983). Others define fidelity as just one component of implementation, when implementation is conceptualized as encompassing fidelity, duration, intensity, and quality (National Research Council [NRC], 2004). Researchers in the field of educational psychology have identified fidelity, or treatment integrity, as a multidimensional construct comprising different aspects. Dane and Schneider (1998) identified five dimensions of fidelity: adherence, exposure, quality, participant responsiveness, and program differentiation. Little research exists on these dimensions of fidelity, and studies rarely link fidelity dimensions to program outcomes (Sanetti & Kratochwill, 2008). Further, studies often neglect to

consider the moderation of other variables that may influence implementation and outcomes (Durlack & DuPre, 2008). For instance, provider characteristics, such as self-efficacy, have been related to program implementation. Thus, researchers have pointed to the need for research on the dimensions of fidelity and their relationship to outcomes, including consideration of other variables that might moderate those relationships.

There is some debate about the importance of implementation fidelity in the educational research community, particularly related to the dimension of adherence, or “the extent to which specified program components were delivered as prescribed in program manuals” (Dane & Schneider, 1998, p. 45). As Dane and Schneider describe, this debate contrasts a fidelity perspective with the notion that supports adaptations of interventions to best meet local needs. Some research supporting an adaptation perspective suggests that insistence on strict adherence may result in lower levels of implementation due, in part, to participants’ animosity (Meyer, Miller, & Herman, 1993). Similarly, school change research has indicated that the most effective programs were those in which participants made program modifications to better serve local needs (Berman & McLaughlin, 1976). While these studies suggest that some adaptation is beneficial, at least the critical features of an intervention should be delivered as planned to constitute an acceptable level of implementation fidelity (Century et al., 2010; Dane & Schneider, 1998).

In this study, we examine implementation fidelity in terms of teachers’ adherence to the critical components of the Learning Strategies Curriculum, as those components are described in program manuals and as they were understood and communicated by the program trainer. In this way, we do not specifically address issues of instructional quality but instead focus on teachers’ use of the critical instructional procedures (NRC, 2004). As well, we consider the ways in which self-efficacy, as a characteristic of intervention teachers, relates to student outcomes in reading.

Teacher Efficacy

The concept of teacher efficacy is grounded in the sociocognitive theories of Bandura (1977; 1986), who contended that teachers are strongly affected by their beliefs about their potential

to impact student learning, and that those beliefs relate directly to their effort and persistence with students. Bandura asserted that motivation is primarily influenced by two factors: outcome expectations and efficacy expectations. Outcome expectations are an individual's beliefs about the consequences of a certain action, and efficacy expectations are an individual's beliefs about her own abilities to influence or achieve the desired outcome. In teaching, efficacy relates to a teacher's beliefs about her own abilities to influence student learning, and a teacher's efficacy expectations are directly related to the effort and persistence she is willing to exhibit toward ensuring student success, despite perceived barriers. The attribute of personal teaching efficacy (Ashton & Webb, 1982) has been associated with change and innovation implementation (Berman & McLaughlin, 1977), as well as with student achievement (Ashton & Webb, 1986).

In their study of schoolwide improvement programs in the late 1970s, Berman and McLaughlin (1977) determined that teacher efficacy was the most important predictor of successful change implementation. Since that time other researchers have confirmed the essential nature of teacher efficacy in educational change (Ghaith & Yaghi, 1997; Guskey, 1988; Ross, 1994; Smylie, 1988; Stein & Wang, 1988). In these studies, teacher efficacy has been linked to positive teacher attitudes toward implementation of mastery learning (Guskey, 1988) and teacher success in implementing mainstreaming (Stein & Wang, 1988). As well, Smylie (1988) highlighted the importance of teacher efficacy in enabling teachers to change their practices, in that personal efficacy was directly related to teacher change.

In literacy, research with elementary teachers has demonstrated that teacher efficacy is related to positive teacher practices in teaching reading and writing (Graham, Harris, Fink, & MacArthur, 2001; Tschannen-Moran & McMaster, 2009), but little is known about the importance of teacher efficacy for literacy teaching as it pertains to content area middle and high school teachers. In one study of secondary content teachers, Cantrell and Hughes, (2008) measured efficacy and implementation at the beginning and end of the school year and found that personal teaching efficacy was related to initial implementation of content literacy practices at the beginning of the implementation year, but that the relationship between efficacy and implementation had

diminished by the end of the school year in which the study was conducted. That is, teachers with higher efficacy were more willing than lower-efficacy teachers to adopt the recommended content literacy practices early in the year, but high- and low-efficacy teachers' implementation of content literacy was similar toward the end of the year.

Although these studies of teacher efficacy and literacy instruction hold valuable insights for teacher development, they do not indicate the extent to which teacher efficacy with literacy influences students' literacy achievement. As secondary schools in the U.S. begin to implement interventions with students who experience reading difficulties, and as similar reform efforts are initiated internationally, it is important to consider the factors that might influence teachers' success with implementing the interventions as well as factors that might influence student outcomes. The relationships among teachers' efficacy, their adherence to the intervention program, and student achievement are particularly relevant when the intervention is strategy-based, given that reading strategy instruction is complex and difficult to implement (Brown & Coy-Ogan, 1993; Pressley et al., 1992).

Methods

This exploratory study uses descriptive and causal-comparative methods to examine teachers' efficacy and the implementation of strategy-based intervention during the first year of the Striving Readers project in one southeastern U.S. state. In addition, causal-comparative methods are used to investigate relationships among teacher efficacy, implementation, and student achievement in reading.

Participants

The participants in this study included 20 middle and high school teachers and their sixth- and ninth-grade students. The teachers were hired especially to teach a pull-out, supplemental reading intervention program to sixth- and ninth-grade students. Instruction occurred in the supplemental reading class for 50 to 60 minutes each day, during which teachers were expected to focus exclusively on the Learning Strategies Curriculum.

TABLE 1 Demographics of Intervention Teachers

Grade	Mean Experience	Certification			Highest Degree Earned			
		Reading	English	Social Studies	Elem. Ed.	BA	MA	MA ± 30 hrs.
6th	13.8 (7.76)	4	3	0	2	0	5	4
9th	9.3 (4.73)	1	4	5	1	3	4	4
Total	11.3 (6.51)	5	7	5	3	3	9	8

Note: Literacy teachers who stayed in the position for less than 1/2 of a semester are not included in these statistics.

Of the 24 teachers who served as intervention teachers in the Striving Readers project, all data sources were available for 20 teachers who served as participants in this study. Four of the initial 24 teachers did not complete a teacher efficacy survey, so data collected from these teachers are not included in this study. Nineteen of the participants were female, and all of the participants were white. These teachers worked in 10 middle schools and 9 high schools in rural areas. Table 1 illustrates additional demographic information that suggests that on average, sixth-grade teachers had more years of experience, more preparation in reading, and higher levels of education than did ninth-grade teachers.

In all, the teachers served 109 sixth-grade and 141 ninth-grade students who were reading at least two grades below grade level. Of the sixth-grade students, 58% were male, 91% were white, 53% received free or reduced lunch, and 23% had Individualized Education Plans for special education services for a reading or writing disability as determined by their districts and schools. Of the ninth-grade students, 61% were male, 89% were white, 56% received free or reduced lunch, and 24% received special education services for a reading or writing disability.

Measures and Procedures

DESCRIPTION OF INTERVENTION

During this year of the project, participating teachers received intervention training from a certified Learning Strategies Curriculum professional development specialist. During the

professional development, teachers were trained to teach six strategies of the Learning Strategies Curriculum: Word Identification, Visual Imagery, Self-Questioning, LINC'S Vocabulary Strategy, Sentence Writing, and Paraphrasing. These strategies were selected for focus because, as a group, they represented each strand of the model (acquisition, storage, and expression) and provided students with tools for word recognition, comprehension, vocabulary, and writing. The Word Identification strategy is designed to help students learn how to decode multisyllabic words to aid in comprehension. The Visual Imagery Strategy is designed to help students construct mental pictures while reading. The Self-Questioning Strategy focuses on helping students learn to ask questions about a text and predict answers. The Paraphrasing Strategy is designed to help students read a paragraph and identify the main idea and supporting details. The LINC'S vocabulary strategy is designed to help students identify and define words in text. The Sentence Writing Strategy is designed to help students learn to write various types of sentences.

Teachers received training in implementing the Learning Strategies Curriculum over two and one-half days during the summer prior to the school year and six half-day sessions across the school year. During the summer professional development prior to the start of school, teachers were taught the Word Identification and Self-Questioning strategies. During December, they were taught Visual Imagery and LINC'S Vocabulary, and in January and February they were taught to implement Sentence Writing. Finally, in April they learned to teach Paraphrasing. Across the year, teachers were free to select from their repertoire of Learning Strategies Curriculum strategies to best meet the needs of their students. Throughout the academic year, the teachers were supported by external coaches who made monthly site visits to schools and provided advice and feedback about teachers' implementation of the program.

Each strategy of the Learning Strategies Curriculum had a corresponding instructional manual giving detailed instructions for how to teach it and document student progress. Each manual included eight critical instructional stages common across the strategies: pretest and make commitments, describe, model, verbal practice, controlled practice and feedback, advanced practice and feedback, posttest and make commitments, and

generalization. Manuals provided teachers with language and ideas for engaging students in activities around each instructional stage.

CLASSROOM OBSERVATIONS

During the spring of 2007 each intervention teacher was observed for one class period on two different scheduled occasions. The purpose of these observations was to determine the extent to which intervention teachers implemented the Learning Strategies Curriculum intervention with fidelity, particularly the extent to which the teachers adhered to the strategies and eight instructional stages. Because teachers were observed both early in the year and later at different points in the teachers' strategy training cycle, observations were geared toward assessing strategy implementation generally rather than toward assessing the use of particular strategies in instruction. Throughout the year, teachers were free to select whichever LSC strategy they believed their students most needed and to reinforce multiple strategies over time. Thus, it was not expected that teachers would implement certain strategies at certain times. Observers noted the strategies that were taught during the observation sessions, and observation data coders used their knowledge of the LSC strategies and eight instructional stages to make decisions about whether teachers were adhering to the program.

Research reviews have documented numerous methods for assessing implementation fidelity, including observations, interviews, and participant reports (Durlak & DuPre, 2008; Fullan & Pomfret, 1977; Scheirer & Rezmovic, 1983). Observations are considered the most objective measure of fidelity, and observation data are often collected in explicit units of analysis, such as time periods (Scheirer & Rezmovic, 1983). In studies where fidelity is determined by observers who also deliver the professional development, multiple observations over the professional development period are possible, but observers' objectivity can be threatened (Domitrovich, Gest, Gill, Jones, & DeRousie, 2009; Downer, Locasale-Crouch, & Hamre, 2009). In this study, observers were external to the intervention program, and limited resources made it unfeasible to conduct many observations. While few observations limit the extent to which generalizations can be made about

implementation, one to three observations are often used when observers are external to the program (Bradshaw, Reinke, Brown, Bevans, & Leaf, 2009; Chard et al., 2008; Hahn, Noland, Rayens, & Christie, 2007). In this study, the observation component was strengthened by establishing reliability through full census sampling, in which all of the teachers in the population were observed (Scheirer & Rezmovic, 1983).

During observations, research assistants took detailed field notes at 5-minute intervals. After each observation, teachers were interviewed to lend clarity to the observations. These interviews served simply as a secondary data source to help observers better understand the lesson they observed, so they could identify critical lesson elements. The interviews did not provide information that was unique to the observation, so interviews were not analyzed separately.

The research assistants first received training from the Learning Strategies Curriculum program trainer to recognize the critical elements of the Learning Strategies Curriculum (the strategies and stages of instruction) and next received training by the lead researchers to take field notes that captured the essential elements of instruction throughout the lesson. This training consisted of lecture related to taking field notes, watching video segments, practice taking field notes, and critique. Sample field notes were shared, critiqued, and refined, and four data codes were developed to characterize the range of instructional behaviors observed in the intervention classrooms. Those codes included: (a) Learning Strategies Curriculum, (b) Other Literacy Activities, (c) Nonliteracy Activities, and (d) Behavior Management. The Learning Strategies Curriculum code covered any of the critical elements of the intervention, including focus on any of the targeted strategies using the eight stages of instruction.

Three members of the research team sought interrater reliability for coding the observation protocols. First, the two coprincipal investigators established interrater reliability using 10.5% of the data ($n = 4$ observations). Interrater reliability was 89.8%; coders identified disagreements and came to consensus after discussion. Then, the coprincipal investigators trained one research assistant to code the intervention observations in a similar manner. An additional five observations were used to establish reliability among the three coders (13.2% of total data). Interrater

reliability was 84% among all three coders, and disagreements were discussed until coders reached consensus. The research assistant then coded all remaining intervention observations.

To determine teachers' fidelity to the Learning Strategies Curriculum intervention in terms of their rate of adherence to the program's critical elements, the number of minutes spent engaged in the Learning Strategies Curriculum Activities (strategies and eight stages of instruction), Other Literacy Activities, Nonliteracy Activities, and Behavior Management Activities were computed. The proportion of instructional time spent on each type of activity was determined by dividing time spent on each activity by the total instructional time. This computation yielded an adherence rate of implementation fidelity.

GROUP READING ASSESSMENT AND DIAGNOSTIC EVALUATION (GRADE)

The GRADE is a norm-referenced, standardized test of reading achievement that yields standard Normal Curve Equivalent scores. The GRADE components and subtests for sixth and ninth grades include vocabulary, sentence comprehension, passage comprehension, and listening comprehension, and subscores are provided for comprehension and vocabulary (Williams, 2001). Word-level skills are not measured on the GRADE. All subtests use a multiple-choice format. The vocabulary subtest requires students to identify synonyms for words underlined in sentences. The sentence comprehension subtest requires students to complete a sentence with a missing word. The listening comprehension subtest requires students to listen to a passage and select appropriate responses, while the passage comprehension subtest requires students to read longer passages and answer comprehension-based questions.

Fugate and Waterman (2004) found the GRADE's reliability adequate for educational decision making. Reliability coefficients across test levels, test forms, and subject grade levels are consistently .90 or better for the total test score, including subtests of vocabulary, sentence comprehension, and passage comprehension. Alternate forms reliability ranged from .81 to .93, while test-retest reliability coefficients ranged from .88 to .93. In the fall of the academic year, all sixth- and ninth-grade students were administered the GRADE (form A), and students who scored at least two grades

below grade level were selected for treatment. In the spring, sixth and ninth graders were administered the GRADE (form B).

TEACHER EFFICACY SURVEY

A teacher efficacy survey was administered at the start of the project, before teachers had engaged in any professional development in the Learning Strategies Curriculum, to determine intervention teachers' sense of personal efficacy for literacy teaching. Items were drawn from teacher efficacy instruments (Gibson & Dembo, 1984; Hoy & Woolfolk, 1993; Woolfolk & Hoy, 1990), but some questions from the original surveys were altered to reflect a reading emphasis (see Appendix). All items used a 6-point Likert scale, ranging from 1 = strongly agree to 6 = strongly disagree, and responses were coded to indicate high efficacy for high scores. As part of the larger Striving Readers project, the survey was given to all teachers in the Striving Readers schools ($n = 719$). Based on this administration, the scores were averaged across all 40 items; $M = 3.89$. $SD = 0.64$, range = 3.52. Cronbach's alpha, indicating internal reliability of the personal efficacy scale, with the revisions described above, was 0.922. In an item-level analysis for the current study, Cronbach's alpha was greater than .90 for each item.

DATA ANALYSIS

Relationships among implementation fidelity, teacher efficacy, and student achievement were explored by examining descriptive data. For teacher efficacy, a mean was calculated for both sixth and ninth grades based on teachers' total personal efficacy scores. For teacher implementation, an overall implementation percentage was determined by dividing the total number of minutes for which teachers adhered to the LSC program by the total number of instructional minutes for all teachers. For student achievement, gain scores were calculated from the fall and spring GRADE scores for overall reading, vocabulary, and comprehension for each student; these scores were averaged for each class, and the mean gain for the students in each class was ascribed to the teacher.

Each of the 20 teachers was categorized twice: once based on their implementation fidelity level and once based on their level of personal efficacy. Cut-off points for dividing the teachers

into groups were established based on the calculated averages for teacher efficacy and for implementation. Specifically, if teachers implemented Learning Strategies Curriculum at a higher level than the sample's mean implementation level of 62.68% (SD = 26.01) of class time for the two observations overall, their implementation level was considered higher. If they implemented Learning Strategies Curriculum 62.68% or less of the overall class time, their implementation level was categorized as lower. Similarly, teachers whose efficacy scores were > 4.63 , the mean score for the sample (SD = 0.57), were categorized as having higher efficacy, while teachers whose efficacy scores were ≤ 4.63 were categorized as having lower efficacy. It must be noted here that these designations of "higher" and "lower" for each teacher were not based on a pre-established standard but were relative based on the efficacy and implementation of the other teachers in the study.

In addition to the descriptive analysis, regression analyses were conducted to explore relationships among teacher efficacy, implementation fidelity, and student achievement for sixth grade. There was insufficient power for a regression using data from ninth grade. The regression analyses were conducted for spring student achievement scores, with efficacy, implementation, and fall achievement scores as dependent variables. These regression models included the actual scores for efficacy and implementation (continuous variables), and the average student spring and fall score for each teacher's class.

Results

Teachers' Personal Efficacy and Implementation of Strategy Instruction

Since previous research on the impacts of the Learning Strategies Curriculum intervention suggests differential impacts for sixth- and ninth-grade students (Cantrell et al., 2010), this study sought to explore differences in teachers' efficacy and implementation to contextualize these student outcomes. The first research question examined the difference in personal efficacy between sixth- and ninth-grade intervention teachers at the start of the intervention training program. As Table 2 shows, sixth-grade teachers had higher levels of personal efficacy for teaching literacy than

TABLE 2 Overall Results and Numbers of Teachers at High and Low Levels of Efficacy and Implementation Grades 6 and 9

Grade	Efficacy			Implementation		
	High	Low	Mean Efficacy Score	High	Low	Percent Implementation Time
6th	7	2	4.93 (.50)	4	5	53.1%
9th	3	8	4.37 (.52)	7	4	69.5%

Note. For 6th grade, $N = 9$. For 9th grade, $N = 11$.

ninth-grade teachers. Seven of 9 sixth-grade teachers had higher than average efficacy, while just 3 of 11 ninth-grade teachers exhibited higher efficacy on the survey. The mean efficacy scores on the survey reflect these differences, with sixth-grade teachers scoring in the higher range overall and ninth-grade teachers scoring in the lower range.

The second research question examined teachers' implementation of strategy instruction. During this initial implementation year, ninth-grade teachers adhered to the Learning Strategies Curriculum at higher levels than sixth-grade teachers. Table 2 shows the numbers of teachers who implemented the Learning Strategies Curriculum program at higher and lower than average levels, and this table indicates the overall percentage of time that the two groups of teachers implemented the program with fidelity. Sixth-grade intervention teachers had an overall implementation score of 53.1% over the two observations, while ninth-grade intervention teachers had an overall score of 69.5%. This means that sixth-grade teachers spent a combined 53.1% of their intervention class time directly focused on the Learning Strategies Curriculum, while ninth-grade teachers spent 69.5% of the intervention class time, overall, directly focused on the Learning Strategies Curriculum.

While the overall percentage of time that teachers spent implementing the Learning Strategies Curriculum program with fidelity is in the higher range for both groups, Table 2 shows that a greater proportion of ninth-grade teachers implemented the program with fidelity than sixth-grade teachers. Of the sixth-grade teachers in the study, four of nine were rated as higher implementers and five of nine were rated as lower implementers. In

contrast, of the 11 ninth-grade teachers, 7 were rated as higher implementers and 4 were rated as lower implementers based on the amount of time they spent implementing the intervention with fidelity.

Relationships Among Implementation, Efficacy, and Achievement

Previous literacy research has suggested that initial efficacy levels and program implementation are related (Cantrell & Hughes, 2008), but the extent to which these teacher characteristics are relevant to student achievement has not been explored in the reading program effectiveness research. This study sought to explore relationships between teachers' efficacy, implementation, and students' achievement to inform future studies of program effectiveness. Since the teacher data set is small in this study, descriptive statistics were used to initiate the exploration of potential relationships. Based on the relative scores of all of the teachers in the sample, most of the sixth-grade teachers in this study had high efficacy and low implementation (see Table 3). Total reading GRADE gain scores for sixth grade (averaged at the class level) indicate teachers with higher efficacy achieved higher gain scores than teachers with lower efficacy, regardless of their implementation level. Sixth-grade teachers with high efficacy and high implementation achieved the highest gain scores overall, followed by teachers with high efficacy and low implementation. There were no sixth-grade teachers in the study with low efficacy and low implementation.

Ninth-grade teachers were unevenly distributed across the various efficacy-implementation levels, with only three ninth-grade teachers exhibiting high efficacy. Five of the nine ninth-grade teachers exhibited lower personal efficacy but achieved higher levels of program implementation as measured by time. It is interesting that, of the teachers with lower personal efficacy, high-implementing teachers achieved higher gain scores than teachers with lower implementation.

The descriptive statistics in Table 3 illustrate relationships for the reading comprehension and vocabulary subtests. Sixth-grade teachers with higher efficacy demonstrated greater average student spring comprehension scores. For vocabulary, sixth-grade teachers with high implementation levels demonstrated greater

TABLE 3 Mean NCE Changes and Standard Deviations for Classes of Teachers With Various Combinations of High and Low Efficacy and High and Low Implementation

	High Efficacy		Low Efficacy	
	High Implementation	Low Implementation	High Implementation	Low Implementation
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
6th grade				
Total reading	16.78 (5.063)	9.25 (6.426)	8.42 (0.035)	—
Comprehension	19.77 (3.148)	13.63 (3.950)	10.50 (1.329)	
Vocabulary	11.36 (6.162)	1.07 (8.029)	4.63 (4.144)	
No. of teachers	2	5	2	0
9th grade				
Total reading	8.82 (1.301)	13.30	13.88 (3.254)	7.55 (1.885)
Comprehension	8.34 (0.152)	10.00	10.07 (4.888)	5.02 (2.900)
Vocabulary	11.71 (3.407)	17.88	18.57 (4.670)	11.89 (0.849)
No. of teachers	2	1	5	3

TABLE 4 Summary of Multiple Regression Analyses for Spring Classroom Total Reading Scores

	6th Grade				
	B	SE B	β	<i>t</i>	<i>p</i>
Fidelity	0.088	0.114	0.332	0.775	0.474
Efficacy	10.220	3.961	0.756	2.580	0.049
Fall class reading scores	1.654	1.290	0.624	1.283	0.256

Note. $N = 9$, $R^2 = 0.723$.

average spring student scores on the vocabulary subtest than high-efficacy teachers with low implementation. It is interesting that for the reading comprehension subtest (and the overall reading score), the group that demonstrated the highest average student spring scores was the group of sixth-grade teachers with high efficacy and high implementation, while the group that demonstrated the lowest average spring student scores was the group of ninth-grade teachers with low efficacy and low implementation. For the vocabulary subtest, the group that demonstrated the highest average spring student scores was the group of ninth-grade teachers with low efficacy and high implementation, and the group that demonstrated the lowest average spring student scores was the group of sixth-grade teachers with high efficacy and low implementation.

These subgroup mean comparisons are presented for illustrative purposes, but it is important to note that the descriptive data are limited by small numbers of teachers. For ninth grade, the number of teachers in some efficacy-implementation cells is particularly small, so further statistical exploration of the data for ninth grade is not appropriate. However, based on power analyses conducted on the sixth grade data, further exploration of the relationships among efficacy, implementation, and reading achievement is warranted.

To investigate these relationships, a regression analysis was performed on teachers' average class spring GRADE scores for total reading, reading comprehension, and vocabulary for sixth grade. The regression for personal efficacy, shown in Table 4, illustrates a relatively strong relationship to spring class GRADE total reading scores, $b = 10.220$, $t(9) = 2.580$, $p < .05$, and no

TABLE 5 Summary of Multiple Regression Analyses for Spring Classroom Comprehension Reading Scores

	6th Grade				
	B	SE B	β	t	p
Fidelity	0.050	0.075	0.195	0.670	0.532
Efficacy	7.594	2.553	0.580	2.975	0.031
Fall class reading scores	1.211	0.466	0.742	2.596	0.048

Note. $N = 9$, $R^2 = 0.831$.

significant relationship between implementation and GRADE total reading scores, $b = .088$, $t(9) = .775$, $p = .474$. The post-hoc power calculation for this analysis was .779. Although results should be interpreted cautiously due to the small number of teachers, they indicate that personal efficacy at the beginning of the project may have related to student achievement in reading more strongly than implementation fidelity.

To further explore these relationships, a regression analysis was performed on teachers' average class spring GRADE scores for the comprehension and vocabulary subtests, as illustrated in Tables 5 and 6. For the comprehension subtest the results were similar to the results for the total reading spring GRADE scores. There was a significant relationship between students' reading comprehension gains and teachers' efficacy, $b = 7.594$, $t(9) = 2.975$, $p < .05$, but there was no significant relationship to teachers' implementation level, $b = .050$, $t(9) = .670$, $p = .532$. The

TABLE 6 Summary of Multiple Regression Analyses for Spring Classroom Vocabulary Reading Scores

	6th Grade				
	B	SE B	β	t	p
Fidelity	0.209	0.062	0.869	3.366	0.020
Efficacy	6.524	3.565	0.532	1.830	0.127
Fall class reading scores	0.072	0.486	0.040	0.147	0.889

Note. $N = 9$, $R^2 = 0.713$.

post-hoc power calculation for this analysis was .968. For the vocabulary subtest (see Table 6), the results differed from the overall reading GRADE score regression. There was a significant relationship between teachers' class spring GRADE average for vocabulary and implementation level for sixth grade, $b = .209$, $t(9) = 3.366$, $p < .05$, with a post-hoc power calculation of .758.

Discussion

As Western nations grapple with how to best ensure that more students complete secondary school, researchers who study school reform efforts need to attend to teachers' beliefs and implementation and the ways in which these teacher-based factors influence student outcomes (Datnow & Castellano, 2000). The study described in this article, which was part of a U.S. government-funded initiative to improve adolescent literacy, investigated relationships among teacher efficacy, teacher implementation, and student achievement in a reading intervention program for sixth- and ninth-grade students. Because this exploratory study involved a small sample of teachers, it is limited in its ability to be generalized to the larger population of middle and high school teachers. However, the analyses in this study may provide some insight into factors that should be explored when attempting to explain a program's impact on student achievement. Based on the results of these analyses, it appears that, at least for sixth-grade students, teachers' efficacy for literacy teaching may be an important factor in increasing students' reading performance, particularly as it relates to reading comprehension and overall reading ability. Further, this study suggests that teachers' personal sense of efficacy may be more important to improving students' reading comprehension than teachers' fidelity of program implementation in terms of program adherence. Since this study examined teachers' efficacy only at the start of the project, its findings speak only to the importance of teachers' initial sense of efficacy but does not address the relevance of teachers' change in efficacy over the course of the year.

This study suggests that researchers who study reading program effectiveness might do well to give some attention to teacher characteristics such as teaching efficacy. While the results of this small exploratory study must be interpreted with caution, some

speculation about the differences in teacher efficacy for sixth- and ninth-grade teachers is warranted. The ninth-grade teachers had lower efficacy for teaching literacy than the middle school teachers in this study, suggesting that efficacy for teaching literacy may be an issue for high school teachers assigned to work with struggling readers. Research has indicated that secondary teachers do not feel confident in their abilities to address students' needs in reading (Greenleaf et al., 2001; Hall, 2005), and this was particularly true for the high school teachers in this study. In this study, it appears that the sixth-grade teachers entered the intervention training program with more preparation in teaching reading. More sixth- than ninth-grade teachers were certified to teach reading, while nearly half of the ninth-grade teachers were certified to teach social studies. Thus, it is not surprising that sixth-grade teachers entered the project with higher levels of efficacy for literacy teaching.

However, it is surprising that sixth-grade teachers demonstrated lower levels of fidelity to the Learning Strategies Curriculum program than ninth-grade teachers, who were less prepared to teach reading, overall, at the onset of the project. This raises the possibility that teachers who have more preparation, and thus have higher levels of efficacy for teaching literacy, are less reliant on prescribed literacy programs. Previous studies of teacher efficacy and implementation have suggested that teachers with higher efficacy more readily implemented new programs (Cantrell & Hughes, 2008; Guskey, 1988; Ross, 1994; Smylie, 1988; Stein & Wang, 1988), but this was not the case in this study. Although the sixth-grade teachers exhibited higher levels of efficacy at the start of this project, they exhibited lower levels of implementation overall. It is possible that, because they had some prior preparation in reading, the sixth-grade teachers supplemented the Learning Strategies Curriculum with techniques they had learned during that prior preparation, and that those supplemental techniques were highly effective. Ninth-grade teachers had less literacy preparation on which to draw and thus may have felt compelled to adhere to the Learning Strategies Curriculum program. The fact that the observations were scheduled may have influenced ninth-grade teachers to implement what they thought was expected, since they were likely less confident about making adaptations. However, it is worth repeating here that an interpretation of differences in results for sixth- and ninth-grade teachers

is speculative given the small number of teachers from which these results were drawn.

Research on strategy instruction indicates that learning to teach comprehension strategies is difficult and may take multiple years to master (Brown & Coy-Ogan, 1993; Pressley et al., 1992). Thus, teachers who are just learning to implement comprehension strategy instruction may not do so with high fidelity at first (e.g., Almasi, 2003; Anderson, 1992; Brown & Coy-Ogan, 1993; Duffy, 1993a; 1993b; El-Dinary & Schuder, 1993; Pressley et al., 1992). This study supports this notion in that nearly half of the teachers in this study demonstrated low implementation levels during the year. In addition, implementation of literacy interventions may be even more difficult for middle and high school teachers, who typically have little preparation for teaching literacy (Greenleaf et al., 2001; Hall, 2005).

While studies linking implementation to outcomes indicate that implementation fidelity affects student outcomes in positive ways, Durlak and DuPre's (2008) review of these studies suggests that it is unrealistic to expect perfect or near perfect levels of program fidelity. Some studies found that positive outcomes occurred with levels of implementation fidelity as low as 60%, illustrating that programs can achieve impacts with lower levels of adherence. The findings of this study are consistent with that research, particularly in the areas of overall reading and reading comprehension. Higher levels of program adherence were not significantly related to gains in students' reading comprehension or overall reading performance.

In this study, it seemed more important that teachers exhibited higher levels of personal teaching efficacy than that they adhered to the Learning Strategies Curriculum at high levels. This is consistent with research that has linked personal teaching efficacy to improved student achievement (Ashton & Webb, 1986). However, that is not to say that program adherence was unimportant in this study. Within the high- and low-efficacy groups, high implementers' students achieved higher overall reading and reading comprehension gains than did low implementers. However, this relationship between implementation and achievement was not significant in the regression analysis for overall reading or reading comprehension.

The difference in results for comprehension and vocabulary outcomes points to a complex relationship between

implementation fidelity, teacher characteristics such as personal efficacy, and student outcomes. Studies in educational psychology suggest that fidelity and certain teacher characteristics are intertwined (Durlak & DuPre, 2008; Sanetti & Kratochwill, 2009), and some research in literacy illustrates the complex and reciprocal relationship between teachers' personal efficacy and the implementation of new literacy practices (Cantrell & Hughes, 2008; Cantrell & Callaway 2008). The findings of the current study suggest that the complexity in these relationships extends also to student outcomes, and that the relative influence of efficacy and implementation may depend on the outcome that is measured. While vocabulary is one aspect of comprehension, students' vocabularies relate more to the word meanings they know than to the strategic processes they employ to make sense of text (National Reading Panel, 2000). The Learning Strategies Curriculum directly addressed vocabulary development, specifically through the LINC strategy, and it is interesting that, unlike with comprehension and overall reading, teachers' adherence to the Learning Strategies Curriculum was related to vocabulary learning. Similarly, teachers' efficacy was not related to improvements in vocabulary. Thus, this study suggests that while teachers' efficacy was more important than program adherence in students' comprehension and overall reading improvement, teachers' adherence to the program was more important than their efficacy in improving students' vocabulary knowledge.

The literature on implementation fidelity includes some debate about the value of program adherence versus adapting programs to meet local needs (Dane & Schneider, 1998; Durlak & DuPre, 2008). For the adaptation or adherence debate, this study suggests that program adaptations are associated with higher outcomes for reading comprehension and overall reading, especially when teachers have strong preparation and high personal efficacy. When teachers are well prepared to teach the content and have the belief in their own potential to influence student learning, then they can successfully adapt programs and practices to best meet the needs of their students. This is especially important for the teaching of complex and challenging metacognitive processes such as reading strategy use.

Because the sample of teachers in this study is small, the analyses presented in this article are simply descriptive and

exploratory. The small number of observations, along with the fact that the observations were scheduled, further limit the generalizability of the study. However, the findings point to the need for future research that investigates the influence of teacher efficacy and program implementation on student achievement in more depth. The results of this study suggest that it may be too simplistic to attribute student growth, or lack thereof, to the adoption of a particular program. Evaluations of program effectiveness should include data on teacher factors such as personal efficacy and implementation fidelity.

Research on interventions for students who do not read well is especially relevant, given international emphasis on adolescent achievement, and in light of challenges evident in many adolescents' literacy performance (Biancarosa & Snow, 2004; Bridge-land et al., 2006; Cole et al., 2006; Smyth et al., 2003). Adolescents who read significantly below grade level are more likely to drop out of school (National Center for Education Statistics, 2005), and nearly one-third of students who graduate from high school are not prepared for college-level reading (ACT, 2006). In order to address these pressing issues, schools need useful information on the effectiveness of reading interventions, including the extent to which teacher characteristics and implementation fidelity might affect students' reading comprehension and overall reading performance. This study found that teachers' personal efficacy for literacy teaching was related to students' growth in reading comprehension and overall reading abilities, and these results suggest that attention to teacher efficacy as well as program implementation fidelity is useful in intervention effectiveness research.

While this study focused specifically on adolescents' reading, its findings relating to teacher efficacy and program implementation are relevant to international adolescent reform efforts, more generally, in the U.S. and other nations. Studies have demonstrated challenges that stem from teachers' resistance to program implementation. Teachers' beliefs about school traditions, their own roles as educators, and their experiences are critical elements that influence implementation, for better or for worse (Datnow & Castellano, 2000; Smyth et al., 2003; Yates & Holt, 2009). This study suggests that teachers' personal efficacy beliefs are central to their success with students and should be considered as part of all adolescent school reform efforts.

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Appendix

Teacher Efficacy Items

1. Factors beyond my control have a greater influence on my students' ability to read than I do.
2. I am good at helping all the students in my classes make significant improvement in their reading comprehension.
3. Some students are not going to make a lot of progress this year in reading, no matter what I do.
4. I am certain that I am making a difference in the lives of my students when it comes to reading.
5. There is little I can do to ensure that all my students make significant progress in reading this year.

6. I can deal with almost any reading problem.
7. The amount a student can read is primarily related to family background.
8. If students are not willing to read, I can do little about it.
9. If parents would do more for their children's reading, I could do more.
10. If one of my students could not do a class assignment, I would be able to accurately assess whether the assignment was at the correct level of reading difficulty.
11. If I really try hard, I can get through to even the most difficult or unmotivated students.
12. When it comes right down to it, I really cannot do much about a student's reading because most of a student's performance depends upon his or her home environment.
13. When a student does better than usual in reading, it is often because I exerted a little extra effort.
14. I know how to teach vocabulary effectively. Vocabulary refers to the understanding of word meanings.
15. Even when I try very hard, I do not teach reading as well as I do most subjects.
16. When my students' reading improves, it is most often due to my having found a more effective teaching approach.
17. I know the steps necessary to teach reading in my content area effectively.
18. I am convinced that I am able to successfully teach all relevant subject content to even the most difficult students.
19. I effectively use grouping to engage students in reading in my content area.
20. I am not very effective in monitoring students' reading ability.
21. If students are underachieving in reading, it is most likely due to my ineffective teaching.
22. I generally deal with students' reading problems ineffectively.
23. Even when I try very hard, I do not teach writing as well as I teach most subjects.
24. My good teaching can overcome the inadequacy of a student's reading.
25. I should not be held responsible for the low reading achievement of some students.
26. When a low-achieving student progresses in reading, it is usually due to my extra attention.

27. I understand reading concepts well enough to be effective in teaching it along with content area material.
28. Increased effort in teaching reading will produce little change in some students' achievement in my class.
29. I am generally responsible for the reading achievement of students in my class.
30. Students' achievement in a subject is directly related to my effectiveness in teaching that content area AND my ability to teach reading.
31. If parents comment that their child is showing more interest in a subject at school, it is probably due to my performance.
32. I know how to teach my students to decode unknown words they read in my content area. Decoding refers to the method or strategy a student uses to "figure out" a word.
33. I wonder if I have the necessary skills to teach reading.
34. My effectiveness in teaching reading has little influence on students with low motivation.
35. Given a choice, I would not invite someone in to evaluate my teaching of reading within my content area.
36. When a student has difficulty understanding his/her reading, I am usually at a loss as to how to help the student understand it better.
37. I do not know what to do to get students excited about reading in my content area.
38. I am certain that I know how to enhance students' reading fluency in my content area. (Fluency refers to the ability to read text accurately and quickly and with expression).
39. Even if I teach the content area well, I cannot help some kids to read better.
40. I believe I teach students to question the viewpoint of text appropriately when they read.

If a child does not learn something the first time I will try another way.

Adapted from Gibson and Dembo, 1984; Hoy and Woolfolk, 1993; Woolfolk and Hoy, 1990