Transfer Effects of a Reading Comprehension Strategy on Achievement and
Teacher Judgments Across Grades 3-7 [1,2]

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Abstract

This multi-year study implemented a three-part reading comprehension strategy based on consensus research from cognitive science and reading/educational psychology in content-oriented (integrated) and in traditional reading/language arts settings in grades 3-4-5 to assess transfer effects to grades 6-7. Findings showed the intervention (a) could be implemented with fidelity, (b) had a direct positive effect on student ITBS reading comprehension and science achievement and teacher judgments of student reading proficiency in grades 3-4-5, and (c) and resulted in a magnified treatment transfer effect in grades 6-7 on the same three measures. Discussed are the implications for practice and future research for improving content area reading comprehension.

Objectives

In their recent publication, the RAND Reading Study Group (Snow, 2002) reported student proficiency to comprehend subject-matter text has remained a significant educational problem in grades 4-12 – the grade levels at which cumulative and meaningful learning in content areas is emphasized and reading to learn becomes a critically important. Additionally, the RAND (Snow, 2002) and other national reports (e.g., National Reading Panel, 2000), reviewed a substantial number of research studies in the fields of reading and educational/instructional psychology investigating different aspects of teaching reading comprehension (see also Block & Pressley, 2002; Farstrup & Samuels, 2002; Gersten, Fuchs, Williams, & Baker, 2001). In evaluating such research, RAND recommended as major research priorities the need to address content-area reading comprehension and the transfer of reading comprehension strategies to content-area reading in applied school settings.

With the preceding context in mind, the present multi-year, IES-funded study (Project R305G04089) was designed to determine whether the integration of consensus research findings from cognitive science and reading/educational psychology could accelerate student reading comprehension and content-area learning at the upper elementary level (grades 3-4-5) in a form that is transferable to middle school (grades 6-7). In doing so, the study embedded a three-part *Reading Comprehension Strategy* (see Vitale & Romance, 2007) within two instructional settings in grades 3-4-5: (a) a content-oriented, science-teaching model integrating reading and writing (Romance & Vitale, 2001, 2008) and (b) traditional reading curriculum (Scott-Foresman, 2002) emphasizing narrative reading.

Theoretical Framework

One intent of this study was to integrate interdisciplinary research from applied cognitive science that complements and enhances recognized research in the field of reading. A particular emphasis was on how research-based characteristics associated with expertise (Bransford, Brown, & Cocking, 2000) could provide a foundation for developing reading comprehension proficiency in a form that is equivalent to meaningful comprehension (see Vitale & Romance, 2007). Such a perspective magnifies the role of prior

knowledge as a primary factor in meaningful student learning. In this regard, the development and subsequent access/use of prior knowledge in reading comprehension can be considered in a fashion paralleling their importance in the development of expertise (Bransford et al., 2000) and for cumulative content-area school learning (Hirsch, 1996, 2001).

With this in mind, two approaches for linking the study of reading comprehension and content-area learning can be distinguished. In the first approach, the development of in-depth, content-area understanding serves as a vehicle for enhancing subsequent learning success (i.e., comprehension) through a variety of different instructional activities which include content-area reading. These approaches involve integrating reading instruction within content-area settings (see Guthrie et al., 1998; Guthrie et al., 2007; Guthrie & Ozgungor, 2002; Guthrie, Wigfield, Barbosa et al., 2004; Guthrie, Wigfield, & Perncevich, 2004, Romance & Vitale, 2001, 2008). Additionally, these approaches emphasize having a coherent, concept-oriented curriculum (see Kintsch, 1998, 2004; Schmidt et al., 2002) within which reading is one of several instructional modes that provides knowledge to be learned. Primarily, this approach emphasizes amplifying the role of conceptual frameworks as forms of prior knowledge that facilitate new meaningful learning (i.e., comprehension in learning tasks) through concept mapping (see Romance & Vitale, 2008).

In the second and more traditional approach for the study of reading comprehension (e.g., Block & Pressley, 2002; Farstrup & Samuels, 2002; Gersten et al., 2001), the emphasis has been on the use of narrative curriculum content (i.e., stories) common to basal reading series as vehicles for developing general student reading comprehension proficiency, typically through the use of reading comprehension strategies.

In providing a means for linking the two approaches, Trabasso and Bouchard (2002) reviewed 205 studies of 12 distinct cognitive strategies for improving reading comprehension (e.g., comprehension monitoring, graphic organizers, prior knowledge, question generation, story structure, summarization, vocabulary instruction). Their conclusion emphasized the importance of episodic content knowledge as a basis for reader-constructed deeper understanding, the related use of graphically-oriented story mapping (see also Williams, 2002) as a means for guiding student explication of understanding, and the related role of student summarization involving identification and organization of core concepts and themes in material that is read. Further, Trabasso and Bouchard noted the importance of multiple strategy instruction taught through dialogue-rich teacher modeling/guidance as a means for improving student reading comprehension proficiency. In identifying future research directions, they emphasized the importance of conducting reading comprehension strategy research in content-area instruction and in focusing on the issue of enhancing the transferability of reading comprehension strategies (see also Farstrup & Samuels, 2002; Gersten et al., 2001).

The specific research questions in the present study were:
- Did the three-part reading comprehension strategy implemented in grade 3-4-5 result in:
  - greater overall achievement in reading comprehension and science-content understanding?
  - more positive teacher judgments of student reading proficiency in comparison to demographically similar control schools?
  - transfer longitudinally to middle school (grades 6-7) student achievement in reading comprehension, science understanding, and teacher judgment of reading proficiency?
- Did the effect of the reading comprehension strategy upon student achievement in reading comprehension or science depend upon whether they were embedded into the Science IDEAS model or a traditional reading/language arts narrative environment?

Method

Participants. The multi-year study interventions were implemented in grades 3-4-5 on a schoolwide basis in six elementary schools in a large, diverse school system in southeastern Florida. Three schools used the integrated content-area model (Science IDEAS) and three used traditional

reading/language arts instruction. Three demographically similar schools served as controls.

Participating grade 6-7 students were identified as previously being enrolled in grade 5 in one of the participating experimental or control schools. For data analysis purposes, these students comprised a virtual grade 6 and grade 7 for each of the nine schools. Because there was no treatment intervention in grades 6 or 7, the performance of these grade 6-7 students was considered as a transfer effect resulting from the grade 3-4-5 interventions.

Instruments. Student outcome measures for the study consisted of ITBS Reading and ITBS Science, administered by teachers within a 2 week-interval during the last month of the school year. Teachers also completed of Student Reading Proficiency Judgments at that time.

Experimental Interventions. The experimental interventions consisted of two components. The first was the instructional settings (traditional reading/language arts, science-focused) and the second, the multi-part reading comprehension enhancement strategies used within experimental schools in these two settings. Science IDEAS (Romance & Vitale, 2001, 2008) served as the content-oriented intervention and the district-adopted Scott-Foresman Reading/Language Arts Series (Scott-Foresman, 2002) as the intervention emphasizing narrative reading. Both were implemented using a daily 2-hour time block that experimental schools allocated to reading/language arts or Science IDEAS. In Science IDEAS classrooms, reading and writing was integrated with in-depth science instruction.

The multi-part *Reading Comprehension Strategy* used in the study was implemented as a three-part procedure consisting of (a*) a text analysis sub-strategy*, (b) a *propositional concept mapping (or story mapping) sub-strategy*, and (c) a *summarization writing sub-strategy*, all of which have a strong research base (see Dreher, 2002; Snow, 2002; Trabasso & Bouchard, 2002). Each of these procedures were modeled and/or guided for students by teachers until students were able to engage productively in each sub-strategy. All three sub-strategies were generally applicable to informational and narrative text material in that they reflected key characteristics of expert readers. However, as Table 1 shows, students in the traditional group worked with story-mapping rather than concept mapping.

Table 1. Multi-Part Reading Comprehension Strategy Intervention

Substrategy	Group	Focus of Substrategy	Required Use
Text-Analysis	Both	Developing student attention toward using prior knowledge and new knowledge gained in reading a passages to build comprehension	Once/week
Concept Mapping	Science	Developing student proficiency in organizing knowledge gained from reading	Once/2 weeks
Writing from Concept Maps	Science	Student use of the knowledge organization represented in the concept maps developed from reading passages to write a coherent and detailed summary	Once/2 weeks
Story Mapping	Narrative	Developing student proficiency to analyze narrative selections using key genre characteristics	Once/2 weeks
Writing from Story Mapping	Narrative	Use of elements identified in the story map to describe the narrative story	Once/2 weeks

In general, the complementary substrategies used in the study (a) represented what expert readers would do in reading with comprehension, (b) was engineered for ease of use by teachers and students, and (c) enabled teachers and students to organize what is being learning around important big ideas and themes useful for comprehension of narrative or informational text.
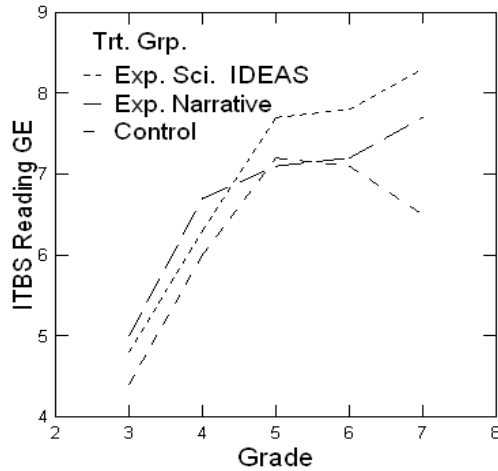
Design/Analysis. Teacher implementation fidelity was monitored on a continuing basis by the project staff through classroom visits and inspection of teacher lesson plans. Separate linear models cross-sectional analyses of grade-equivalent ITBS achievement in Reading Comprehension and Science were

conducted, with Treatment and Grade Level serving as factors in a 3 x 5 design using student demographics (Ethnicity, Gender, Free/reduced Lunch) as covariates. A parallel analysis was conducted for teacher judgments of reading proficiency.
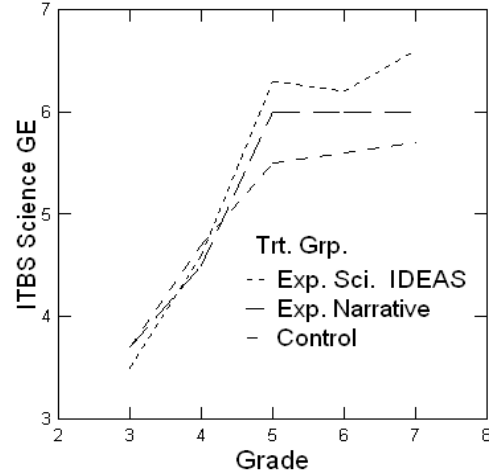
Results and Conclusions

Implementation Fidelity. Percentage of teachers implementing the multi-part strategy with fidelity ranged from 88 to 90 percent for all substrategies except Writing from Concept Mapping (80 percent).

Figures 1-2. Achievement Trajectories for Experimental (Science, Narrative) IDEAS and Control Schools for ITBS Science and Reading. Since project was implemented in grades 3-4-5, performance of students in grades 6-7-8 represents a treatment-transfer effect.
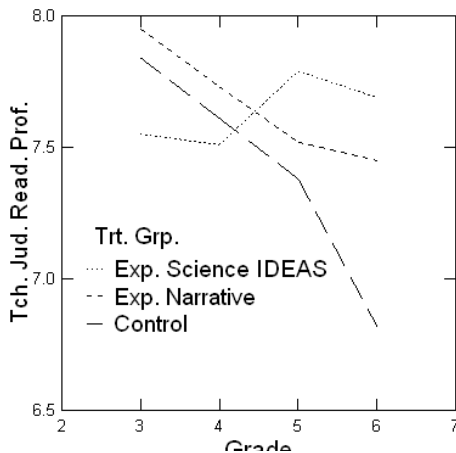

Figure 3. Teacher judgment of year-end reading proficiency. Since project was implemented in grades 3-4-5, performance of students in grades 6-7-8 represents a treatment-transfer effect.

Effect of intervention in grades 3-4-5 on ITBS Reading Comprehension across grades 3-4-5-6-7. Linear models analysis using ethnicity (minority vs. non-minority), gender, and Free/Reduced Lunch as covariates found both the Treatment effect, $F(2, 2497) = 14.01$, p =.000), and the Treatment x Grade interaction significant, $F(8, 2497) = 3.25$, p =.001. Adj. Mean GE: Science IDEAS = 7.0, Narrative = 6.7, Control = 6.2; MSW = 6.09. Figure 1 illustrates the positive transfer effect of grade 3-4-5 intervention to middle school reading achievement in grades 6-7.

Effect of intervention in grades 3-4-5 on ITBS Science across grades 3-4-5-6-7. Linear models analysis using ethnicity (minority vs. non-minority), gender, and Free/Reduced Lunch as covariates found both the Treatment effect, $F(2, 1940)=5.21$, p =.006), and the Treatment x Grade interaction significant, $F(8, 1940) = 2.22$, p =.024. Adj. Mean GE: Science IDEAS = 5.4, Narrative = 5.2, Control = 5.0; MSW = 3.52. Figure 2 illustrates the positive transfer effect of grade 3-4-5 intervention to

middle school science achievement in grades 6-7.

 Effect of intervention in grades 3-4-5 on Teacher Judgment of End-of-Year Student Classroom Reading Proficiency across grades 3-4-5-6. Grade 6-7 teachers were sampled from content-area courses (English, Social Studies, Science) in feeder middle schools. However, due to a low response rate from teachers of grade 7 classrooms, only grade 6 data were included in the analysis. Linear models analysis using ethnicity (minority vs. non-minority), gender, and Free/Reduced Lunch as covariates found both the Treatment effect, $F(2, 1814) = 6.31$, $p = .002$, and the Treatment x Grade interaction significant, $F(6, 1814) = 6.734$, $p = .000$. On 6-point scale (9 = 99-90% Comprehension, 8 = 89-80%, 7 = 79-70%, ..., 4 = 49% or less), adj. scale mean: Science IDEAS = 7.6, Narrative = 7.7, Control = 7.3; MSW = 1.45. Figure 3 illustrates the positive transfer effect of grade 3-4-5 intervention to middle school content-area reading proficiency in grade 6.

 The results of this study demonstrated that the multi-part reading comprehension strategy positively impacted student achievement in reading comprehension (vs. comparison schools) in both experimental settings. In addition, the transfer effects to grades 6-7 magnified the effect of the grade 3-4-5 experimental interventions. Student reading proficiency in grades 5-6 judged by teachers represented a complementary finding. The final paper will include HLM analyses and detailed statistical testing of differences across treatment x grade level combinations (e.g., Science IDEAS resulted in the highest outcomes on the three different measures, but this effect needs to be confirmed statistically in post-hoc testing).

Educational and Scientific Importance

 Discussed will be implications for both practice and research. The general findings suggest that the multi-part reading comprehension strategy is feasible for use by teachers and students in grades 3-4-5 and could have a substantial long-term impact on student achievement. The integration of consensus interdisciplinary research perspectives with those in reading provide a rich foundation for reading comprehension research.

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