Title:
A Research-Based Framework for Improving Literacy by Increasing Content-Area Instruction in Elementary Schools: Implications for Curriculum Policy

Authors:
Michael R. Vitale, *East Carolina University*
Nancy R. Romance, *Florida Atlantic University*

Abstract (114 words)

An emerging trend in systemic school reform involves applying research-based advancements in content teaching and learning to elementary school curriculum. This paper presents a rationale for changing curricular policy to increase the instructional time allocated to teaching science and other content areas at the elementary levels as a means for improving student reading comprehension. Overviewed are the lack of success in reform-based approaches to content-area reading comprehension, along with evidence and perspectives that offer reasons why the lack of an emphasis on content area teaching is a significant barrier to school reform. Identified are research-validated curricular approaches as a means for advocating an increased amount of instructional time for science instruction in grades 3-5.

Objective

This paper identifies issues in curriculum policy having implications for increasing the amount of time science is taught in elementary schools as a means to improve student reading comprehension in a fashion that increases their preparation for success at the secondary level. The major objectives of the paper are as follows:

* To overview the lack of success in reform-based approaches to reading comprehension in preparing in preparing students to be successful learners in high school content area courses (e.g., science, history, literature).
* To review research evidence and related theoretical perspectives (primarily from cognitive science) that offer reasons why the lack of an emphasis on content area teaching in elementary schools is a significant barrier to systemic school improvement.
* To identify research-based curricular approaches that address specific factors, trends, and issues associated with recognized problems in reading comprehension and that increase the amount of instructional time devoted to in-depth content area teaching in general and science instruction in particular.
* To summarize the findings and implications of a multi-year research and development initiative (e.g., Author_1 & Author_2, 2001; 2005) for teaching in-depth science in a large urban school system through which students receive 2 hours of science instruction each day into which reading and language arts are integrated- an approach that provides a concrete example illustrating how an increased emphasis on science instruction in elementary schools can be framed within a rationale for improving achievement in reading comprehension and writing (see also Guthrie & Ozgungor, 2002; Klentschy et al, 2004).
* To describe work-in-progress involving a multi-year NSF/IERI-funded collaborative university-school district project that approaches grade 3-5 school reform within a curriculum policy framework that uses content-area instruction in science to develop student reading comprehension through meaningful science learning to increase student success at the secondary level.

Perspectives/Theoretical Framework

Trends and Issues Associated with Recognized Problems in School Reform

Despite a continuing national emphasis on educational reform of over 20 years, student achievement in developmental reading (e.g., decoding, fluency) and reading comprehension (e.g., meaningful learning from text) have remained significant educational problems (e.g., AFT, 1997; Feldman, 2000; National Reading Panel, 2000), particularly with low socioeconomic status (SES) students who depend on school to learn. When reaching high school, many students representative of all SES strata do not have sufficient academic preparation in prior knowledge or reading comprehension proficiency necessary to perform successfully in content-oriented courses (e.g., NAEP, 2002; North Carolina End-of-Course Test Report, 2006).

A major issue in school reform that has received increasing attention has been the curricular impact of state-mandated reading assessment programs that, within an accountability framework, have reduced the instructional time allocated to in-depth content-area instruction in elementary schools. Jones et al (1999) and (CEP, 2005) both reported that to improve achievement on state-developed minimal-skills reading tests, schools devoted more instructional time to reading test preparation by re-allocating it from science and other curricular areas.

Under accountability pressures, the appeal to educators in reducing or eliminating content area instructional time to improve reading achievement is understandable. However, of greater long-term importance are the negative curricular implications for content-oriented courses as a whole (e.g., science, history, economics, government) that become manifest at the high school level. For example, in NC, despite substantial improvement in reading achievement across grades 3-8, performance on state mastery tests in key high school content courses (e.g., science, history, government) has not improved, with the achievement gap on high school course tests between white and low SES/minority students continuing to be substantial.

Within the context of standards-based school reform (e.g., AFT, 1997; Feldman, 2000; Kauffman et al, 2002; Roeber, 1999; Schmidt et al, 2002), a number of complementary perspectives suggest how the substantial lack of success in high school reform is understandable. In content-oriented high school courses, student prior knowledge is a major determinant of successful learning (see Bransford et al, 2000; Hirsch, 1996, 2003). When students do not have the prior levels of understanding required for success, teachers are faced with the problem of replacing portions of high school courses with remedial instruction on the prerequisite knowledge students have not acquired in the preceding grades.

A related perspective as to why students have not developed adequate prior knowledge at elementary and middle school levels is that "teaching reading comprehension" is currently a major curricular emphasis, despite the fact that reading comprehension itself is not a "content area" curriculum. In this context, how reading is defined for assessment purposes is instructive. In the well-established NAEP testing program (see Dougher et al, 1999), the framework for reading assessment has minimal relevance to the requirements students face when they are reading content-area textbooks and other content-oriented materials. Further, NAEP skills can be addressed superficially through non-content-oriented basal reading materials that cannot engender meaningful academic learning because they have no academic content by design (see Walsh, 2003).

To the detriment of overall K-12 educational reform, the opportunity cost of allocating student instructional time to reading programs that emphasize non-content materials is that such time replaces opportunities for students to interact with the very forms of content-oriented instruction and associated reading materials that would provide a knowledgeable foundation for future success in high school courses. In particular, it is understandable why schools with low-SES students are forced to allocate substantial amounts of instructional time to test-specific preparation to reach state accountability achievement goals. But, it is also understandable that when such low-SES students reach high school, they perform poorly on content-based tests.

Description and Research Evidence of the Importance of Knowledge-Based Instruction in Science in Developing Reading Comprehension

Cognitive science foundations of knowledge-based instruction. The theoretical and research foundations of knowledge-based models are well established (e.g., Bransford et al, 2000). Knowledge-based instruction requires (a) the explicit representation of the knowledge to be taught and learned in the form of core concepts and concept relationships and (b) subsequent explicit linkage of all of the specific instructional methods, strategies, and/or activities chosen for classroom use by teachers to the same overall framework of core concept relationships. Within such contexts: (a) curricular mastery is considered and approached as a form of expertise and (b) the development of prior knowledge is the most critical determinant of success in meaningful learning.

A recent publication by the National Research Council, *How People Learn* (Bransford et al, 2000) is a clearly presented overview of these and other major cognitive science perspectives. Particularly stressed in the Bransford et al work as an emergent research trend is the principle that an explicit focus on the core concepts and relationships that reflect the logical structure of the discipline and enhance the development of prior knowledge are of paramount importance for meaningful learning to occur (see also Schmidt et al, 2001).

In emphasizing the critical role of prior knowledge in learning, Bransford et al (2000) reported on differences between experts and novices. This research found repeatedly that expert knowledge (i.e., expertise) is organized in a conceptual fashion that is very different from that of novices and the use of knowledge by experts in application tasks (e.g., analyzing/solving problems) is primarily a matter of accessing and applying prior knowledge (see Kolodner, 1993, 1997) under conditions of automaticity. Also related to this view is earlier work by Anderson and others (e.g., Anderson, 1996, 1993, 1992; Anderson & Fincham, 1994) who distinguished the “strong” problem solving processes of experts that are highly knowledge-based and automatic from the “weak” strategies that novices with minimal knowledge are forced to adopt.

Effectiveness of a knowledge-based model that embeds reading comprehension in science. Science IDEAS is an integrated knowledge-based instructional model (i.e., addressing reading and writing solely within science) that is implemented through a daily 2-hour time block which replaces regular reading and language arts instruction. The Science IDEAS model has been extensively validated in upper elementary settings (Author_1 & Author_2, 2001; 2005). Multi-year findings with over 50 teachers and 1200 ethnically and academically diverse students showed that students receiving Science IDEAS consistently obtained approximately 1/3 greater years growth in reading comprehension (and 1 years growth in science) as measured by nationally normed tests than did comparable students receiving regular reading/language arts instruction (see also Guthrie & Ozgungor, 2002; Klentschy et al, 2004).

In interpreting the transfer effect from gaining an in-depth understanding of science to reading comprehension, Author_2 et al (2002) and Author_2 and Author_1 (2006, in press) offered a knowledge-based perspective following points made by Bransford et al (2000) that emphasize the importance of the development of prior knowledge in general and the work articulated by Kolodner and her colleagues (e.g., Kolodner, 1993, 1997) on case-based knowledge representation and reasoning in particular. From a knowledge-based perspective, the cumulative experiences within Science IDEAS that promote in-depth understanding and the development of an ontological framework (see Dansereau, 1995; Author_2 & Medland, in press) of core concepts and concept relationships within which additional knowledge is first assimilated and then accessed as prior knowledge in new learning can be considered as a form of expertise itself. As a result, from this general constructivist perspective, (see Mintzes et al, 1998), the idea of comprehension and learning is considered to be far broader than reading comprehension per se (see Author_2 & Author_1, in press). With such experience, students are far better prepared to assimilate new information through reading and then access and think about the information in answering questions about it. This cognitive science interpretation considers comprehension as an "effect" resulting from the acquisition of prior knowledge, in comparison to the field of reading which considers comprehension as resulting from "comprehension skills." Included in the paper is a summary of ongoing NSF/IERI funded university-school collaborative scale-up study addressing these key curricular policy issues.

Design/Procedure/Findings

The paper will include the findings of an NSF/IERI scale-up project which at present has been scaled up to 13 elementary schools representing diverse student populations as an update of the results reported by Author_1 & Author_2, 2001, 2005). Included in the analysis will be year-by-year and longitudinal findings comparing achievement patterns of project and control schools on a variety of performance measures (e.g., FCAT SAT-9/10 reading comprehension, ITBS reading comprehension and science achievement, student attitude/self-esteem relating to science learning and reading). Preliminary findings (reported by school) have shown a significant effect on both student achievement and affective responses (see Author_1 & Author_2, 2005); however, the paper will present more detailed longitudinal statistical analyses, including linkage of student performance to implementation fidelity and interactions of instructional models with student demographics (e.g., ethnicity, free/reduced lunch)

Significance/Implications

The rationale of the preceding in support of curriculum policy that would increase the time allocated to science instruction are the following: (a) the preparation of students for meaningful learning in high school should be considered a major reform goal on which minimal progress has yet to be made, (b) the systemic problem explaining the lack of success achieving this goal is the popular misconception that reading is a curriculum in grades 3-5 (i.e., beyond the development of decoding and fluency in grades K-3), and (c) a major barrier to educational reform is the replacement of content-oriented instruction, particularly in science, that emphasizes the meaningful development and subsequent utilization of conceptual prior knowledge. Within this context, research findings have shown that increased time for in-depth instruction in science has the curricular potential to help solve problems associated with reading comprehension to which a substantial amount of instructional time is presently allocated. By becoming effective advocates for the improvement of reading comprehension through science instruction, science educators have the opportunity to make science instruction a key focus of educational reform.

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