Translating Theory to Practice: Technology Solutions to Solve Practical Issues for Teaching Reading Comprehension at the Secondary Level

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Abstract: We describe a theory- and evidence-based curriculum that improves reading comprehension skills needed to learn from difficult informational text and the theory's translation into an online program that allows for individualized instruction for greater scalability in today's technology-enhanced classrooms. Feature design is based on cognitive science, user input/experiences, and a configuration of highly flexible web-applications to provide interactive features necessary to adapt a teacher-led curriculum into one that is automated and tied to student achievement.

Introduction

The overall goal of our theory-based curriculum, BRAVO, is to teach students how to understand and learn from challenging, informational texts (IES Award #R305A110467). This requires effortful processing. Skilled readers with rich background knowledge on the topic may rely on comfortable, automatic processing to get the meaning of text. However, average to struggling readers need to rely on conscious problem-solving skills to deeply comprehend and learn from the text. Providing simplified texts or even texts that are within a student's comfortable reading level may help initially pique interest and motivation, as Guthrie, Klauda, & Ho (2013) argue, but this approach can also encourage passive comprehension and create a false sense of understanding. Instead, students need experience with difficult, real-life materials and the tools to deal with them. This is what the BRAVO curriculum has been developed to provide for middle/high school students. An implementation efficacy study, conducted in traditional teacher-led classrooms, showed significant promise at improving reading comprehension skills for struggling and average readers. However, this study also demonstrated a need for more individualized instruction that can best be achieved via electronic means of delivery to capture individual needs for instruction and practice. This research and development program has generated several important questions and possible answers for designing a curriculum that both improves learning effectively and is designed with teacher input and student experiences, increasing the likelihood of broader adoption of the curriculum.

BRAVO Curriculum

The BRAVO curriculum is based on Kintsch's (1998) model, which posits that readers engage in parallel processing during reading to create a textbase and a situation model. The textbase represents the information presented directly in the text, whereas the situation model represents deeper connections between the textbase, the reader's topic knowledge, and inferences they generate that go beyond the text. Specifically, our curriculum methodically teaches students advanced reading skills that include local cohesive linguistic strategies such as anaphora; global cohesive techniques such as text structures, transition words, and bridging inferences to help readers build a reliable textbase as well as the inferencing, questioning, and use of organizational supports to integrate the textbase content into a situation model, the deepest level of processing. Instruction and exercise of these components of reading comprehension is made possible because the instruction is uniquely embedded into a series of texts designed to build knowledge in a subject domain, in this case Ecology. Furthermore, this curriculum aligns with the growing consensus among educational researchers about the need to embed comprehension instruction in content area classes (e.g., Guthrie et. al., 2013; Mckeown et al., 2009; Romance & Vitale, 2011). Heller and Greenleaf (2007) state that

> …policymakers and education leaders should make it clear that content area teachers do have the responsibility to provide instruction in the kinds of reading and writing that are specific to the given academic disciplines… (p. 25-26).

However, trying to convince practitioners to blend comprehension instruction with content learning is a major obstacle, especially since many science teachers emphasize a hands-on approach to science education (e.g., observation, doing experiments, recording, analyzing, and presenting results—usually orally). Norris and

Phillips (2003) point out that although these instructional methods are all important for achieving scientific literacy, this approach often comes at the expense of textbased learning and communication of abstract concepts and theories. As a result, many students are severely unprepared for further academic training and/or professional careers (cf. Sullivan, 2016). An important aspect of scientific literacy is the ability to communicate with broader audiences through writing, and to read and evaluate what others have contributed on a topic of interest. Thus, reading skills are as crucial to science domains as they are to literature, history and social science expertise. The bottom line is that students need a lot more practice in reading and learning from complex materials, well before they fill out their college applications.

Practical barriers to implementation and scaling

Our initial findings and motivation for this project indicate that while this theory-based curriculum can be efficacious, there are practical issues that can only be addressed through technology and personalized learning. These practical issues include: 1. Reading teachers' discomfort with topics other than stories/literature. 2. Variability in secondary students in their reading comprehension skills from needing little guidance to needing extensive instruction and practice. The complete language arts curriculum for a struggling reader would slow down a general education content area class (e.g. science) to an unacceptable level. 3. Content area teachers are often not trained, evaluated, or comfortable teaching language arts in their class.

eBRAVO Web Application

The eBRAVO project addresses these issues with individualized instruction; practice and online instructional support is the driver of our continuing development and the focus of this poster (IES Award #R305A170142). The direction for this work comes from classroom implementation of BRAVO in Colorado and California at the middle school level, as well as qualitative analysis of teacher focus groups and workshops. We outline what teachers say they want regarding useful technology and literacy instruction; what they do and do not already do in their classrooms; how that aligns with what is still needed; and our strategy for integrating this information into a highly usable and effective learning tool for use in today's secondary classrooms.

Moving beyond the traditional classroom implementation of the BRAVO curriculum, eBRAVO relies on a web application to provide an adaptive, *personalized learning experience* to aid learners in reading comprehension while providing specific domain knowledge in a (STEM) subject area such as ecology. As such, the software must be flexible to support a number of varying workflows, be able to deliver a variety of content, be able to adapt its presentation and pacing based on inputs from the learner, and provide timely feedback and reporting to students and teachers.

Summary

This poster will illustrate the alignment of the teacher/student-centered needs with the technology design to individualize instruction, transforming this traditionally teacher-led, 8-week reading comprehension curriculum, into an online tutoring system and finally to online assistive technology for use in content area classrooms.

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