Scalable and Sustainable Technologies for Reading Instruction and Assessment

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**CATEGORIES:**
Reading

**PROJECT OVERVIEW:**
***Purpose:*** This project implemented and evaluated the efficacy of the Colorado Literacy Tutor (CoLit), a program of individualized, computer-aided reading instruction. CoLit has the potential to dramatically improve reading achievement in the State of Colorado and to be inexpensively scaled to school systems in other states. The goal was to prepare students to read with fluency and comprehension well beyond current national norms and to become skilled at acquiring new knowledge through reading.

***Intervention:*** We developed two sets of tools: one based on speech and animation technology, and one based on language comprehension theory and technology.

The first kind of tutor, called the *Foundations to Literacy* focuses on decoding practices, with over 40 unique tutored skills sets that lead the student to great reading skills by starting with each student's current ability and building from there. It includes a 3D animated talking head or Virtual Tutor synchronized with recorded or synthesized speech, paired with illustrations, printed words, letters, or letter combinations, and sounds, depending on the decoding skill addressed by a particular tutor. Children look at the images, listen to the words or letters, see how the words are spelled, pronounce them, use letter components to build words, and receive feedback. *Foundations to Literacy* also includes books, in which the patient and responsive Virtual Tutor provides feedback and asks relevant questions to build comprehension.

The second kind of reading tool is *Summary Street*(R), designed to improve language comprehension by teaching summarization skills to grades 5-12. This tool is based on a statistical theory of meaning, Latent Semantic Analysis. Comprehension training is achieved by letting children write summaries of instructional texts on topics from their school curriculum using their own words. *Summary Street*(R) automatically compares their writing with the text they are summarizing and provides feedback about the content and adequacy of their summaries.

***Setting:*** This project has extended the technology development and application to comprehension training within a comprehensive program of reading instruction and learning. The program has been evaluated in a diverse set of schools in Colorado that included urban, suburban and rural districts, and demographics that included Caucasian, Afro-American, Hispanic and Native American populations.

***Research Design:*** The evaluation study employed an experimental design at the classroom level (that is, random assignment of classes to condition) with two groups: an experimental group, and a control comparison group that received the normal reading curriculum without the addition of our literacy tutors. In addition, survey data were collected about practices in participating classrooms, literacy and technology beliefs

and practices by students outside of school, and the technology knowledge and teaching experience of participating teachers. State standards test scores, standardized reading test scores, pre/post assessments developed by investigators, and information concerning each student's assignment to ILPs and other special reading related accommodations were also collected for each student.

The sample for this study included classes of children in grades K-12 over a three-year period. Classes were drawn from all levels of SES school districts. Approximately 4300 children participated in the study for at least some part of these three years. Teachers received professional development, coaching, and help from a trained liaison to assure that the interventions were properly implemented. Analyses included analyses of covariance, correlations and hierarchical linear modeling.

***Findings:*** Analyses of this project are still underway. Findings thus far indicate that:

- *FtL* helped struggling readers to learn decoding skills in grades K-1.
- *FtL* also helped young readers to improve passage comprehension.
- Summarization, a reading skill that promotes deep comprehension of texts, can be taught via *Summary Street*(R).
- Students who used *Summary Street*(R) to write summaries covered content better than those of control groups who wrote summaries with a word processor, but had no experience writing summaries with *Summary Street*(R).
- The beneficial effect from using *Summary Street*(R) also transferred to independent summary writing.
- Initial scale-up evaluation results indicated that use of *Summary Street*(R) can significantly improve scores on high stakes state standards testing for reading and writing.

- *Summary Street*(R) is especially effective for medium-to-low performing students.

  Further analyses will look at contributing factors in more detail.

**PROJECT PUBLICATIONS:**

Caccamise, D., Franzke, M., Eckhoff, A., Kintsch, E., & Kintsch, W. (in press). Guided practice in technology-based summary writing. In D. S. McNamara & A. C. Graesser (Eds.), *Reading Comprehension Strategies: Theory, Interventions, and Technologies*. Erlbaum: Mahwah, NJ.

Caccamise, D., Snyder, L., Eileen Kintsch, Walter Kintsch (2006). Improving high stakes testing reading and writing outcomes through summarization. Paper presented at the Annual Conference of the Society for Scientific Studies of Reading. Vancouver, BC.

Caccamise, D., Snyder, L. (2005). Constructive Models of Reading Comprehension - The Situation Model and Related Constructs. *Topics in Language Disorders, 25*,1.

Caccamise, D. & Snyder, L. Evidence Based Reading Research: Lessons Learned from www.WhatWorks.ed.gov. ASHA, San Diego, CA, 2005.

Caccamise, D., Snyder, L. Kintsch, E., Kintsch, W. *Summary Street*: Computer Support to enhance comprehension. International Dyslexia

Association, Denver, CO, 2005.

Caccamise, D., Kintsch, W., Cole, R., Snyder, L. The Colorado Literacy Project. The International Reading Association Annual Conference, April 2005, San Antonio.

Caccamise, D., Davis, N., Franzke, M., Johnson, N., Kintsch, E. *Using LSA in the Classroom: Implementing Summary Street in Grades 6-12*. Presented at Annual Conference of the Society for the Scientific Study of Reading, June 2003.

Caccamise, D., Kintsch, W., Cole, R. The Colorado Literacy Tutor: Making Colorado #1 in Student Achievement. Invited address to the Colorado Legislature, Feb. 2003.

Cole, R., Wise, B., Van Vuuren, S. (2006). How Marni teaches children to read. *Educational Technology*.

Kintsch, W., and Kintsch, E. (2005). Comprehension. In S. G. Paris and S. A. Stahl (Eds.), *Current Issues on reading comprehension and assessment* (pp. 71-92). Maywah, NJ: Erlbaum.

Kintsch, E. (2005). Comprehension theory as a guide for the design of thoughtful questions. *Topics in Language Disorders, 25*, 51-64.

J. Ma, J. Yan, R. Cole. CU Animate Tools for Enabling Conversations with Animated Characters, International Conference on Spoken Language Processing (ICSLP), vol. 1, pp. 197-200, Denver, CO USA, September 2002.

Ma, J.; Cole, R., Pellom, B., Ward, W., & Wise, B. (2004). Accurate automatic visible speech synthesis of arbitrary 3D models based on concatenation of diviseme motion capture data. *Computer animation and virtual worlds, 15*, 485-500.

Olson, R., & Wise B. (2006). Computer-based Remediation for Reading and Related Phonological Disabilities. In M. McKenna, L. Labbo, R. Kieffer, & D. Reinking (Eds.), *Handbook of Literacy and Technology, Vol. 2*. Mahwah, NJ: Lawrence Erlbaum.

Snyder, L., Caccamise, D., & Wise, B. (2005). The assessment of reading comprehension: Considerations and cautions. *Topics in Language Disorders, 25*, 33-50.

Snyder, L. & Caccamise, D. (2005). Editors. Reading comprehension s new look. *Theory and technology, 25*, (1).

Schwartz, S.E., Caccamise, D., Cole, R., Wade-Stein, D., Snyder, L., Wise, B., Corson, L. Computer Based Learning Tools for Children with Cognitive Disabilities: Participatory Design Phase. Coleman Institute for Cognitive Disabilities Conference. Boulder, CO. October 2002.

Wise, B. & Snyder, L. (2002). Clinical judgments in language-based learning disabilities. In Bradley, R., Danielson, L., & Hallahan, D. (Eds.) *Identification of Learning Disabilities: Research to practice*. Lawrence Erlbaum: Mahwah, NJ.

Wise, B. (2004). Facts, Fictions, and Factions in the Reading Wars. In M. Joshi (Ed.), *Dyslexia: Myths, Misconceptions, and Some*

*Practical Applications*. Mahwah, NJ: Lawrence Erlbaum.

**ON THE WEB:**
You can learn more about this project by visiting http://www.colit.org.