

An Internet-Delivered, Individually Differentiated Reading Program: Effects on  
Students' Literacy Achievement and Technology Skills

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Purpose- The present research investigated the effects of a technology enhanced learning system designed to facilitate students' reading and technology skills, an area in which there is a paucity of high-quality research (Patterson, Henry, O'Quin, Ceprano, & Blue, 2003). The program examined is an Internet-based learning system that provides daily reading passages to students in grades 2-8. *Central to the program's design is its capacity to deliver reading materials that are on students' individually differentiated reading levels.* In other words, on any given day all students in a classroom receive a reading selection via the Internet on a single topic (e.g. hurricane Katrina), however, the exact reading level of the selection and its follow-up activities are determined by each student's individual reading ability. The present research investigated the effects of this program on students' literacy and technology skills during a one-year intervention.

Theoretical Framework- This investigation is framed from a cognitive processing theoretical framework. A cognitive processing theoretical framework aims to articulate the cognitive elements that comprise the reading process, as well as factors that enhance and impede those aspects of efficient reading. Early cognitive processing theories include the works of Gough (1972), LaBerge & Samuels (1974) and Rumelhart (1977). More recent conceptualizations include the work of Adams (1990), Rumelhart & McClelland (1986), Seidenberg & McClelland (1989), Coltheart, Curtis, Atkins, & Haller (1993), and Coltheart & Rastle (1994). Taken together, the cognitive processing theoretical perspective suggests that text difficulty is one of the central components affecting cognitive processes during reading. When texts are too difficult for students, word identification processors cease to become efficient, vocabulary processors are unable to provide meanings for decoded words, and context processors are unable to construct coherent messages (Adams, 1990). A cognitive processing theoretical perspective suggests that students receiving texts at their correct, individualized level of reading will demonstrate greater reading achievement than students receiving grade level material. While this premise forms the rationale for using leveled books during guided reading instruction (Pinnell & Fountas, 1996), it has not been sufficiently investigated with the use of Internet-delivered reading texts.

## Method

Subjects. 219 5<sup>th</sup> grade students from a small, northeast city participated in the project. 69.9% of the population was white, 17.8% was Hispanic, 5.5% was black and 7.5% was other race. The median household family income was \$41,566. 33.4% of the district's students qualify for free and reduced lunch. Students from 11 classrooms participated in the study. Class size ranged from 20 to 25. Pre-test differences between students in the 11 classrooms were non-significant.

Materials. The program is an Internet-based learning system that provides daily-reading passages and follow-up activities differentiated to each individual student's independent reading level. The reading passages are based on current news events, and topics include national and world events, science, technology, trends, and sports. The follow-up activities are comprehension, vocabulary, and writing assignments. The product contains a tracking feature that allows the program to provide the correct level of material to students.

Procedure. The research design tested the program in two conditions-- differentiated and non-differentiated. The differentiated condition provided access to the program using its full capability, that is, it provided students with reading materials and follow-up activities at their individual level of reading ability (four classrooms, n=84). The non-differentiated condition provided access to the same reading material and follow-up activities, but all materials were presented at the students' grade of difficulty (three classrooms, n=51). Additionally, the study included a control condition in which students did not receive any exposure to the learning system (four classrooms, n=84). The program was implemented from October 2003 to June 2004, and followed the standard, program use of two 40-minute computer lab sessions per week.

## Data Sources

Scholastic Reading Inventory. The Scholastic Reading Inventory (SRI) is a reading assessment tool published by Scholastic Inc. The tool provides reading passages and four, forced-choice options to complete sentences, and assesses students' skills in the areas of word identification, vocabulary, and comprehension. According to Scholastic, Inc. the SRI has been validated in four scientific investigations, including a norming study with a sample of over 500,000 students.

TerraNova. The TerraNova, 2<sup>nd</sup> Edition (2000) is a widely used, standardized, norm referenced test composed of multiple sub-tests that can be individually administered. The Reading Composite subtest consists of questions in the areas of reading and vocabulary that yield separate sub-scores. The Language Composite sub-test consists of questions in the areas of language and language mechanics that yield separate sub-scores.

The SouthEast and Islands Regional Technology in Education Consortium Student Survey. The SouthEast and Islands Regional Technology in Education

Consortium (SEIR\*TEC) Student Survey is designed to assess students' level of familiarity and use with a variety of technological applications. The survey consists of five categories of questions, all of which have four, forced-choice response selections.

## Results

Scholastic Reading Inventory. Students in the differentiated group had significantly greater gains on the Scholastic Reading Inventory than students in the control group ( $p < .01$ ). On average, students in the differentiated group gained 53.38 points, while students in the control group gained 5.26 points. The undifferentiated group improved an average of 27.84 points. The result for the undifferentiated group was not significantly different from either of the other two groups.

TerraNova. Students in the differentiated group had significantly greater gains on the Language section of the TerraNova than students in the control group. Differentiated students performed significantly better on the Language Composite score ( $p < .01$ ), the Language subscore ( $p < .02$ ), and the Language Mechanics subscore ( $p < .05$ ). For the Reading section of the TerraNova, differentiated students had greater gains than the control group on the Reading Composite score, Reading subscore, and Vocabulary subscore. However, these differences were not statistically significant at  $p < .05$ .

SEIR\*TEC Student Survey. For this survey, students in the differentiated group reported a significantly greater increase in experience using personal computers ( $p < .01$ ), word processing programs ( $p < .05$ ), multimedia productions ( $p < .01$ ), educational software ( $p < .01$ ), web browsers ( $p < .05$ ), use of computers in the computer lab ( $p < .01$ ), and use of computers in the classroom ( $p < .01$ ).

## Discussion

The purpose of the present investigation was to evaluate the effects of a year-long intervention of an Internet-delivered, individually differentiated reading program on fifth grade students' performances. The major findings of the study were that students in the differentiated classrooms significantly outperformed students in the control classrooms on the following measures: the Scholastic Reading Inventory ( $p < .01$ ), the TerraNova Language Composite score ( $p < .01$ ), the TerraNova Language subscore ( $p < .02$ ), the TerraNova Language Mechanics subscore ( $p < .05$ ) and the SEIR\*TEC Student Survey for knowledge of personal computers ( $p < .01$ ), word processing programs ( $p < .05$ ), multimedia productions ( $p < .01$ ), educational software ( $p < .01$ ), web browsers ( $p < .05$ ), use of computers in the computer lab ( $p < .01$ ), and use of computers in the classroom ( $p < .01$ ). Students in the differentiated classrooms also outperformed the control group on the TerraNova's Reading Composite score, Reading subscore, and Vocabulary subscores, although not to a statistically significant degree. There were no cases in which students in the undifferentiated condition significantly outperformed students in the control condition. This finding suggests that the critical factor associated with students' success was reading at their correct level of difficulty, rather than Internet-delivery or time-on-

task, (e.g. the non-differentiated condition). The importance of the present work is that the Internet may hold the potential to provide students with easy and inexpensive access to reading materials at their correct level of reading difficulty. It appears that such access is strongly associated with improved reading achievement.

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