The Use of Technology in Literacy Instruction:

Implications for Teaching Students from Low Socioeconomic Backgrounds

Jennifer D. Whitney

HBSK 4072, Section 3

Fall 2007

Almost every aspect of modern life is affected in some way by technology. Many people utilize technology from dawn to dusk to communicate; make decisions; reflect, gain, synthesize, evaluate or distribute information, among many other functions. One would be hard pressed to find a single professional, regardless of career field, going through an entire work day without touching a computer, PDA or other electronic device. However, the same level of technology use cannot be found in many schools, which are meant to prepare students for their future lives and careers in the 'real' world.

School districts struggling with funding issues may not have the financial capability to purchase state-of-the-art hardware or software. Teachers, especially the veterans of the profession who began their careers in an era largely free of technology, may lack adequate knowledge of the various electronic and digital tools available to them or training on how to use those tools effectively. Students may use technology more outside the classroom for enjoyment or communication without ever making the connection to its possibilities for their academic lives.

Research studies regarding the impact of technology on learning are woefully hard to find in today's educational journals and literature. When such studies do exist, they are often limited either in scope of participants or applications, making the results difficult to generalize. The topic of this paper is to review recent literature pertaining to the use of technology in reading instruction. In particular, the paper reports findings regarding effective methods for teaching low-achieving or at-risk student groups.

There are many reasons why a student might be low-performing in reading. This paper focuses on analyses of studies that can be generalized to overcome the achievement gaps caused

by socioeconomic factors. Specifically, the review will attempt to answer the following questions: 1) How can technology be used to bridge the early gap in exposure to print for students from low socioeconomic backgrounds? 2) How can technology be used to provide instructional opportunities for students where both parents work outside the home or work second- or third-shift? 3) How can technology offer additional independent reinforcement for low-performing students in schools that cannot afford to lower teacher-student ratios?

In "An Internet-Delivered, Individually Differentiated Reading Program: Effects on Students' Literacy Achievement and Technology Skills" (Tracey & Young, 2005), the authors examine an Internet-based reading program in which students read passages and complete follow-up activities. The authors note the lack of high-quality research in the field regarding technology-enhanced learning. Their study attempts to uncover the effects of such a learning system on students' reading and technology skills. Most of the measures in the study focus more specifically on gains in reading skills, with the exception of one survey, skewing the findings somewhat toward reading.

The text passages were based on current events in the areas of technology, science, trends, sports and other national or world events. The follow-up activities varied among comprehension and vocabulary questions and written responses.

The study consisted of 219 5th grade student participants. The 11 classrooms from which the students came were grouped into one of three experimental categories: differentiated, undifferentiated and control. The program included a tracking function that was able to provide students with an appropriately leveled text. Therefore, the differentiated group (four classrooms, n=84) read passages that were leveled according to their reading ability. The undifferentiated

group (three classrooms, n=51) also used the program; however, they were presented with passages that were consistent with grade-level text, not text specific to their individual reading ability. These two groups used the program according to its intended use of two 40-minute computer lab sessions per week. Finally, the control group (four classrooms, n=84) did not use the program at all. The study was conducted over the course of almost an entire school year, October to June.

The students' growth was assessed using three data sources: the Scholastic Reading Inventory (SRI), TerraNova and the SouthEast and Islands Regional Technology in Education Consortium Student Survey (SEIR*TEC). The first two of these measures are valid and norm-referenced language skills assessments. The last measure is a tool used to assess students' familiarity and frequency of use on a variety of technological applications.

The researchers found a statistically significant impact on reading (as assessed through the SRI) and language gains (as assessed through TerraNova) for the differentiated group over the control group. On the SRI, students in the differentiated group gained 53.38 points while control group students gained just 5.26 points. The undifferentiated group gained 27.84 points, a statistically insignificant difference from either the differentiated or control groups. On the SEIR*TEC survey, students in the differentiated group reported significantly greater increases in experience using a variety of technological applications.

Overall, it can be said that the study revealed significant gains by the differentiated group in both reading skills and use of technology. However, students in the undifferentiated group failed to outperform those in the control group on *any* measure, indicating that the cause of the gains was most likely due to the leveling of passages rather than use of the technology itself.

Although the sample size was >200, all students were found in the same geographical area and most were white and middle-class, making the findings less easily to generalize. Furthermore, the study failed to mention whether control group classrooms were observed as to their use of leveled books in print, as this is a fairly common pedagogical practice. Since this would help to answer the question of causality among leveling of text or use of technology, it seems to be an important oversight. In the future, researchers may wish to conduct studies specifically comparing the impact or benefits of technology-enhanced leveled reading versus leveled print.

Teachers may sometimes feel limited in their use of technology in the classroom by district policies. In "Improving Student Writing Through E-mail Mentoring" (Burns, 2006), the author attempts to describe how the use of e-mail as a distance mentoring tool, though often prohibited by schools and districts due to concerns about safety, can impact students' writing in quality, quantity and engagement. The impetus for this study came from the researcher's own frustrations as an educator with the quality of student work and their lack of engagement with their writing.

This study can be considered teacher action research as it was conducted with a single class by one teacher researcher. The sample size is extremely small and consists of a writing class of English Language Learners. Both of these factors may limit the ability of educators to generalize the study findings.

Participants are described as having certain writing challenges in common: structure and syntax, variety and quality of vocabulary, lack of engagement with writing content and process and lack of reflection and analysis upon completion of writing projects. Burns wanted to find

effective ways to overcome these barriers, so she created an e-mail mentoring program through which her students would write functional correspondence (business letters) to professionals in their future career fields. The study was to include four e-mail exchanges between mentor and student: report on career choice and letter of introduction, resume and cover letter, feedback from mentor on student web portfolio and follow-up thank-you letter from mentee.

The study revealed a greater proliferation of student writing. During the course of the project, the students became so engaged in their correspondence that the scope of the study increased to include reflective writing which they exchanged with their mentor at a much greater rate than the originally anticipated four exchanges. They composed these reflective writings to their mentors even when the exchange would not be graded, indicating that their motivation and engagement with writing had also increased. Another indication mentioned by the author to show an increase in engagement was the marked improvement in sentence structure and mechanics. Students asked one another to proofread e-mails and were open to correcting grammar and mechanics mistakes noted by their mentors. Finally, the study also revealed an impact on the quality of students' writing. The students were using a greater variety of vocabulary, as assessed by statistical functions of Excel allowing the author to measure uses of parts of speech and the variety of students' word choice. Overall, the author was able to observe positive impacts on student writing in quantity, quality and engagement through use of e-mail mentoring. However, readers should be cautioned as to the lack of scientific method here as well as the small sample size.

Another study analyzing the effects of distance mentoring or tutelage is "Back to the Future: The Practicality of Using Microsoft NetMeeting for Effective Distance Tutoring" (Legutko, 2007). This research was conducted as a pilot study and, like Burns' research,

consisted of a small number of participants. However, Legutko angled his research to address the specific needs of students in poorer urban and rural districts needing academic assistance who may not have access to tutors or to a great deal of technological applications. Therefore, his study may be more relevant to a wider variety of situations despite its limited scope.

Legutko began his research to provide a mentoring service to students in need of academic assistance but whose schools could not afford tutors. Since these students might also be coming from lower socioeconomic backgrounds, the study was beneficial in that it eliminated the need for travel as the students were able to receive the intervention at their school.

The author hired four education majors and recruited four elementary students as participants in the program. Microsoft NetMeeting was selected as the technology of choice since it could be utilized by both the tutors and the students at little or no cost. However, the author's explanation of his choice of software over readily available and free internet-based programs such as Yahoo Messenger fails in its logic. He states that Microsoft NetMeeting was a part of Windows operating systems, but later notes that it is no longer included in the newest version (Vista) nor is it available as a public download. After connectivity between campus computers at the university and school computers was established, the author found that the application would be limited by the fact that all 20 computers at the school shared one Internet Protocol address. Therefore, tutoring sessions could only be conducted once a week over the course of 6 to 10 weeks. This seems to limit even the possibility of finding significant impacts with such a small amount of time spent teaching or tutoring.

The following components of NetMeeting were used in the study: chat, audio and interactive whiteboard. The web conferencing function was not used. Although the author states

that it was deemed unnecessary, he also goes on to say that telephone access was necessary to confirm presence of the student and tutor. This does not seem to make sense since the student and tutor could be more readily identified through a video component. This would also have allowed tutors to monitor students' attention to task and academic integrity.

A second reason given for the need of a telephone at the computer console was that the involved parties would need to communicate on the morning of the tutoring session to confirm that school was indeed in session. However, it seems that Legutko might have planned better by utilizing another one of Microsoft's operating system software, Microsoft Calendar.

Legutko states that all tutors seemed to have success, but he fails to thoroughly quantify or qualify this success. Reflections by university tutors are included in the research results. Some include specific statements of student growth and progress, but some appear irrelevant or vague: "it makes things a little more fun" or "I also have a very good time talking". The study finds that the tutoring had a positive benefit for the students based on the tutor's reflections and on several informal classroom assessments of spelling and reading comprehension. However, this research would be improved by more exact measures of growth and a greater degree of uniformity across the study in time spent and topics covered by the tutors. The author also might have learned more about the effects of the program by using a more detailed descriptive tool with his team of university students instead of open reflection. Educators wishing to use a similar distance tutoring program will probably want to investigate an internet-based tool such as Yahoo Messenger or Google Talk since these are publicly available downloads and free of cost.

The next two pieces of literature have a much greater scope in both the number of participants and the technology utilized. In "The Effects of Technology on Reading Performance

in the Middle-School Grades: A Meta-Analysis with Recommendations for Policy" (Pearson, Ferdig, Blomeyer, & Moran, 2005), the authors synthesize 20 studies to analyze effects. The authors selected only studies that were experimental in nature, focused specifically on middle grades (6-8) reading and used technology to directly teach content and skills.

The outcomes of the media as well as the definition of media studied here was much broader than any other articles in this review. Other studies define technology as a specific software program or use of the internet for communication or inquiry. In this study, however, the authors regarded technology as almost any and all digital media: images, video and audio clips, hypertext, hypermedia, Web pages, learning environments and presentations.

The researchers were attempting to discern the impact of such technology tools on five areas: strategy use, metacognition, reading motivation, reading engagement and reading comprehension. However, the results of the analysis revealed that the available research was so lacking that only one of the five areas could be adequately studied. Of the 20 studies chosen for the meta-analysis, almost all emphasized comprehension and meaning. This reflects a similar trend in the literature overall; most studies focus on cognitive processes rather than engagement or motivation. The authors also observed that it became impossible to separate strategy use from metacognition, since most strategy use is essentially a metacognitive process. While the researchers did indeed find that the use of technology in middle grades reading instruction has a positive impact on student learning, there were also several surprising outcomes to their analysis.

The researchers found a statistically different effect size between a general, undifferentiated population of students and students possessing learning disabilities or struggling readers. The effect size for the general population was 0.52, significantly greater than the effect

size of 0.32 for the struggling readers and those with learning disabilities. While unexpected, this could be due to the fact that the technological applications studied did not address the specific needs of the at-risk population, which may have included engagement, motivation or attention factors.

A second unexpected finding of the study was that longer duration of use of a program did not necessarily produce better results. Third, and possibly most surprising, the authors found that smaller sample sizes actually produced larger effect sizes. Both of these factors may be explained by the loss of control and instructional precision that might come from a larger-scale study of longer duration.

Finally, the specificity of both the technology tools and the measurement tools was statistically important. Tools designed by the research team resulted in greater effects as well as more reliable measurements of those effects.

One of the largest studies of the effectiveness of technology in the classroom was the result of a mandate of the No Child Left Behind Act. "Effectiveness of Reading and Mathematics Software Products: Findings from the First Student Cohort" (Means, Murphy, Penuel, Javitz, Emery, & Sussex, 2007) was a collaboration between the authors and the U.S. Department of Education to select technology applications; recruit districts, schools and teachers; test students; and analyze results. For the purposes of this paper, the review will focus only on the reading software analyzed in the study.

Nine technology products were selected for use in the study based on voluntary submissions and presentations by the publishers. The reading software included Destination Reading (Riverdeep), Waterford Early Reading Program (Pearson Digital Learning), Headsprout

(Headsprout), Plato Focus (Plato), the Academy of Reading (Autoskill), Leapfrog (Leaptrack), Read 180 (Scholastic) and Knowledge Box (Pearson Digital Learning). All the programs except for Knowledge Box followed a model of tutorial-practice-assessment in delivering instruction to students.

The developers of the software presented information to the research team and had to include at least some evidence of effectiveness. Not mentioned here was whether the researchers actually used the software or simply listened to a pitch by the developers or publishers of the product. In an attempt to replicate real classroom use, the design of the study allowed teachers to stop using the products at any time. However, this actually created an unreal situation since teachers typically don't have the power to make decisions about instructional media or curriculum. These decisions are usually made at the district level and enforced at the local level by building administrators, except in the case of some locally empowered schools. The products addressed elementary and secondary reading and math and were used in first, fourth, sixth and ninth grade classrooms.

The participants included 33 districts, 132 schools and 439 teachers; the districts were selected based on the fact that they were not already using technology similar to the products chosen for the study. In addition, the design team attempted to focus attention on low-income schools. This leads one to question the usefulness of findings since low-income schools or districts may not be able to afford the same products outside of a federally funded research study. All participation by software vendors and school districts was entirely voluntary, which can sometimes skew results in experimental studies.

The research had a very specific focus: to determine whether students showed gains in reading or math test scores after teachers used specific software products in instruction. Readers and educators must be cautioned against generalizing the study findings to the overall effectiveness of technology in the classroom. The team based their follow-up analysis of student achievement on a commonly used standardized test. The study does not explain whether the chosen technology, with the exception of one reading program, was specifically tied to the district's curriculum. If it was, an achievement test such as the SAT-9 which was used to assess first grade students may not be the most effective measurement tool. It has been observed in other studies that more specific measurement tools can garner more reliable results and increase effect sizes (Pearson et al, 2005).

The study found that 94%-98% of teachers in the selected schools participated in training on how to use the software products. Most teachers had a high level of confidence in their ability to use the products after the training, which decreased somewhat once they had actually tried the products in the classroom with students. There were few technical difficulties with the software; those that did occur were generally minor and easily resolved with or without help from the software developer. Furthermore, the use of these software products resulted in a 20% greater likelihood that teachers acted as facilitators for individual practice rather than lecturing while students listened or answered teacher-directed questions. This is a great and highly relevant finding since it is well-known that students retain almost all of what they actually do and almost none of what they simply hear. Unfortunately, possibly because of the large sample size distorting instructional precision or non-specific measurement tools (Pearson et al, 2005), the study was unable to show test scores that were significantly higher in classrooms using the selected technology products.

In conclusion, this review has several important implications. Technology can be used to bridge the early gap in exposure to print for students from low socioeconomic backgrounds. Internet-based reading programs are available. Students can access electronic books, interactive stories and leveled reading passages (Tracey & Young, 2005) or full texts through publicly available archives. If students lack hardware or internet access in the home, these resources can be accessed in the school building although use may be limited by space and time (Legutko, 2007). In addition, some districts may have access to reading software through federally funded programs or studies which often target specific skills and age groups (Means et al, 2007).

In addition, technology can be used to provide instructional opportunities for students where both parents work outside the home or work second- or third-shift. Microsoft NetMeeting is a tool included in older Microsoft operating systems that has web conferencing, audio, interactive whiteboard and chat capabilities (Legutko, 2007). Tutors and mentors can use this or another similar program such as a web-based instant messenger or e-mail to communicate with and instruct students whose parents may be unavailable for homework help in the afternoons or evenings (Burns, 2006).

Finally, technology can offer additional independent reinforcement for low-performing students in schools that cannot afford to lower teacher-student ratios. The studies show that students spent a greater portion of their day engaged in independent practice with teachers as facilitators and monitors when technology is integrated (Means et al, 2007). With the student leading his own independent practice and the technological tool providing support or feedback, technology can act as another teacher in the room when districts cannot afford to hire more teachers or paraprofessionals. In addition, mentors and tutors can be incorporated at little or no cost through web conferencing or chat tools (Burns, 2006).

Although a great deal of technology exists for use in the classroom as an instructional or administrative tool, there has been very little research conducted on its effectiveness outside the arena of reading comprehension. This review of literature justifies a call for increased study on the topic, not only on specific software products, but on more specific and diverse outcomes such as reading motivation, engagement and metacognition. In the meantime, there are many benefits that can be enjoyed by both educators and students – greater and more affordable access to leveled texts, more time spent on independent practice, increased access to tutors and mentors and variable effects on technological savvy and reading engagement.

Bibliography

Burns, M. (2006). Improving student writing through e-mail mentoring. *Learning & Leading with Technology* , 38-43.

Legutko, R. S. (2007). *Back to the future: The practicality of using Microsoft NetMeeting for effective distance tutoring.* Vancouver: Association for the Advancement of Computing in Education ED-MEDIA World Conference on Educational Multimedia, Hypermedia & Telecommunications.

Means, B., Murphy, R., Penuel, W., Javitz, H., Emery, D., & Sussex, W. (2007). *Effectiveness of reading & mathematics software products: Findings from the first student cohort.* Jessup: National Center for Education Evaluation and Regional Assistance.

Pearson, P. D., Ferdig, R. E., Blomeyer, J. R., & Moran, J. (2005, 11 01). The effects of technology on reading performance in the middle-school grades: A meta-analysis with recommendations for policy. *Learning Point Associates / North Central Regional Educational Laboratory* , pp. 1-57.

Tracey, D. H., & Young, J. W. (2005). *An internet-delivered, individually differentiated reading program: Effects on students' literacy achievement and technology skills.* Miami: National Reading Conference.