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The Merging of Literacy and Technology in the 21st Century: A Bonus for Gifted Education

The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.
—Alvin Toffler

For most of the past century, literacy has been associated with being able to read the printed word. The meaning of literacy, however, is changing (Lankshear & Knobel, 2003). Not only are reading experts expanding their notion of literacy to include technology use (Leu, 2003), but it is included in literacy in other disciplines, as well (Burkhardt et al., 2003), and technology skills often cross disciplines.

> Indeed, business leaders, policymakers, and educators are in wide agreement that definitions of literacy must be widened to include skills with digital technology and that children will need the ability to use information technologies in order to function effectively as citizens and workers in the 21st century. (Ba, Tally, & Tsikalas, 2002, p. 4)

Technology literacy can be defined as "knowledge about what technology is, how it works, what purposes it can serve, and how it can be used efficiently and effectively to achieve specific goals" (Burkhardt et al., 2003, p. 15). In other words, it is the application of technology that makes one literate, and we are seeing an increased use of technology among young people. Teenagers in 2002 spent more time each day with digital media (3.5 hours) than they did watching television (3.1 hours). Interestingly, using the Internet does not lead to isolation. Children who use the Internet spend 37% less time watching television and 16% more time with friends and family (Burkhardt et al.).

A close examination of technology literacy goals reveals an interesting parallelism with the goals of gifted education. This association provides a ray of hope for gifted educators. Future education movements to promote student technology literacy will serve gifted children well since current technology literacy goals are very compatible with many gifted and talented students' learning preferences. The purpose of this column is to list literacy skills related to technology, describe educational activities that promote these skills, and discuss how those activities fit gifted and talented students.

Classroom Technology

Over the past three decades, technology use in classrooms has progressed through three distinct phases. Initially, educators merely used computers

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to automate print. Print automation in the early 1980s often included drill and practice or tutorial programs where students were expected to respond with a correct answer. Very little creativity or student innovation was required. During the 1990s a second phase of technology developed: Educators used technology to expand student learning opportunities. The computer shifted from a delivery instrument to a tool. Students were able to collect data from a variety of sources, analyze and organize it, and create impressive multimedia projects that communicated their understanding of the material. The current emphasis on learner-centered classrooms and the proliferation of the Internet has ushered in a third phase: data-driven virtual learning.

> Phase III is in an early stage of very rapid development and is now accumulating quality research that shows that technology use is most successful when used for strategic purposes in particular contextual settings and content areas. (Valdez et al., 2000, p. 16)

In a data-driven virtual learning environment, technology literacy is demonstrated by the application of a number of skills toward a given purpose. According to researchers at the North Central Regional Educational Laboratory, technologically literate students exhibit these competencies:

- demonstrate a sound conceptual understanding of the nature of technology systems and view themselves as proficient users of these systems;
- understand and model positive ethical use of technology in both social and personal contexts;
- use a variety of technology tools in effective ways to increase creative productivity;
- use communication tools to reach out to the world beyond the classroom and communicate ideas in powerful ways;
- use technology effectively to access, evaluate, process, and synthesize information from a variety of sources; and
- use technology to identify and solve complex problems in real-world contexts (Burkhardt et al., 2003, p. 22).

A quick perusal of these competencies reveals the overlap with the major goals of gifted education.

Integration and Complexity

Educators of the gifted strive to provide curricula with complexity and depth. This includes organizing, analyzing, synthesizing, and communicating large amounts of information. Technology can be effectively used for this process.

Technologically literate students need to be able to collect, integrate, and present content using a variety of different software applications. They should be able to download text and graphic images from the Internet, manipulate them in word processing and graphics programs (e.g., Adobe Photoshop CS [http://www.adobe.com/digitalimag/main.html]), and integrate the modified content into multimedia presentations (e.g., Flash MX 2004 [http://www.macromedia.com/software/flash/?promoid=home_prod_flash_082403], HyperStudio 4.0 [http://www.hyperstudio.com/], iPhoto 2 and iMovie 3 [http://www.apple.com/software/], PowerPoint 2003 [http://www. microsoft.com/office/PowerPoint/prodinfo/default.mspx], Windows Movie Maker 2 [http://www.microsoft.com/windowsxp/moviemaker/default.asp]). This process of using multimedia has been called *multimediating* (Bigum et al., 1997).

Two common learning characteristics of gifted students work well here: the ability to transfer learning from one situation to another and an understanding of complicated material through analytical reasoning ability (Renzulli et al., 1997). Student-created multimedia projects afford gifted and talented students an opportunity to explore their interests in depth while polishing a variety of

technology skills necessary for literacy in the 21st century. Such projects also increase student motivation in and understanding of the subject (Leu, in press; Siegle & Foster, 2001).

Quick Processing

While intelligence tests often include bonus points for fast processing, educators during the past quarter century have downplayed the importance of speed in learning. In the 21st century, speed counts in important ways. With the advent of the Internet, speed matters (Leu, 2003). The vast amount of information that is available on the Internet and the myriad of links that can be followed mandate that users must be able to review and process information quickly to make decisions regarding what hyperlinks are worth following. This includes inferring correctly what is behind a hyperlink (critical thinking skills such as this will be discussed later in this column). One of the characteristics sometimes associated with gifted and talented students is their ability to process large amounts of information quickly. This is a valuable skill for the Internet. There is no knowledge speed limit on the Internet, and gifted students can swiftly cruise it as they apply knowledge triage.

Critical Thinking

Educators of the gifted and talented have long been proponents of creative and critical thinking. The latter has now gained literacy status for most fields. Not only is there a myriad of information for students to process, but much of what students encounter has limited value or can be inaccurate or biased. Hate pages continue to flourish on the Internet. Therefore, critical reading and thinking skills are even more crucial on the Internet.

First, from an early age, students must be trained to development a healthy skepticism about information. They should be taught not only to evaluate the information content, but also the source. What clues exist to infer who created the information? What stance does the author take and how does this stance shape the information presented? Does the author have anything to gain by presenting this information? Are there other possible viewpoints or explanations? Do other resources support this information? In this world of knowledge without quality control, a critical examination of the reliability and validity of information is essential.

Second, critical thinking for literacy also involves knowing where to look. This includes what links seem most promising from within text, as well as selecting keywords for topic searches. Literate students use search engines to effectively locate information. Google. (http://www.google.com) is the *Reader's Guide to Periodical Literature* for today's youth. Students need experience selecting search terms and combining them for effective search results.

A third critical thinking component is the necessity of information. Being literate includes knowing when additional information is needed and also knowing what information is not necessary. Information overload can be just as crippling as information paucity.

"Just-in-time information" is becoming an area of interest to educators. The concept is borrowed from manufacturing, where a product is not manufactured until it is sold. Some research indicates that skills that are repeatedly used should be practiced before doing a task, while skills that are uniquely applied should be practiced (and, in some cases, introduced) during that task (Kester, Kirschner, van Merriënboer, & Bäumer, n.d.). The top level of Bloom's Cognitive Domain Taxonomy (Bloom, Engelhard, Furst, Hill, & Krathwohl, 1956) is evaluating the usefulness of information. This higher order skill becomes paramount when determining which proficiencies are "just in time" and which should be explicitly taught. In some cases, learning *how* to learn and learning how to transfer skills from one application to another may be more important than learning a specific technology skill.

Creative Productivity

Renzulli and Reis (1997) have been strong advocates for providing gifted and talented students with opportunities for creative productivity. While the multimediating discussed earlier is one example of using technology for creative productivity, technology can be used by students in a variety of ways. The widespread availability of technology has lowered the barriers that formerly kept young people from using the authentic methodologies of professionals. Students can be productive draftsmen, composers, and graphic artists by approaching problems and using software in a similar manner as career professionals. Thanks to a new "level playing field" provided by the Internet, today a fourth-grade student living almost anywhere in the country has Web publishing powers that rival that of the *New York Times*.

Australian researchers (Bigum et al., 1997) found that, when young people work in groups and engage in significant activity involving technology, they remain with the working group for as long as the creative project lasts. Afterwards, they will often regroup around other initiatives as media becomes available. Any teacher who is assigning group work can appreciate how rare these qualities are. This observation suggests that students can develop collaborative and cooperative skills while increasing their technology prowess.

Conclusion

The skills that educators of gifted and talented students have been advocating for the past half-century are now on the forefront of the literacy movement. We must embrace these skills through technology. The Internet needs to be the primary focus as we consider technology integration within our classrooms. Simply using technology in the classroom does not ensure that students are acquiring new literacies. We must help young people to use the vast resources of the Internet to solve problems and achieve specific goals efficiently and effectively. GCT

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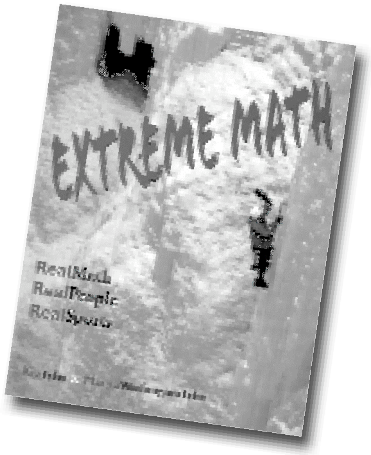

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