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Christie Blazer, Supervisor

DIGITAL TEXTBOOKS

At a Glance

Across the U.S., an increasing number of school districts are switching from print textbooks to digital textbooks. This Information Capsule summarizes the advantages and disadvantages of digital textbooks. Research on the impact of digital textbooks on students' reading habits, reading speed, reading engagement, content retention, and academic achievement is reviewed. This report also contains a section detailing the costs associated with digital textbooks, such as electronic devices, digital content, infrastructure, and teacher training. A summary of issues that should be considered when transitioning to digital textbooks is included, based on the experiences of school districts that have adopted digital initiatives.

A more comprehensive literature review on digital textbooks is available at Research Services' website (http://drs.dadeschools.net). The literature review includes detailed information on the advantages and disadvantages of digital textbooks, research findings, costs associated with digital textbooks, and issues that school districts should consider when transitioning to digital textbooks. Examples of digital textbook programs being implemented across the U.S. are provided. A full listing of references is also included.

An increasing number of school districts across the U.S. are switching from print textbooks to digital textbooks. Digital textbooks are electronic versions of paper textbooks that can be read on a computer, netbook, cell phone, or e-reader (an electronic device designed primarily for reading digital textbooks, such as Amazon's Kindle or Barnes and Noble's Nook). Digital textbooks allow students to highlight passages, take notes, and change font sizes. Many contain built-in dictionaries and calendars and include bookmarking and search capabilities. Today's devices have evolved from platforms displaying simple digitized versions of print textbooks to tools that support highly interactive, multimedia experiences.

Research Services
Office of Assessment, Research, and Data Analysis
1450 NE Second Avenue, Suite 208, Miami, Florida 33132
(305) 995-7503 Fax (305) 995-7521

Advantages of Digital Textbooks

Researchers have concluded that digital textbooks have many advantages over print textbooks. A summary of benefits associated with digital textbooks is provided below.

- **Digital content is up-to-date.** Students have immediate access to current events and the latest scientific advances without having to wait years for the next updated edition of a paper textbook. Similarly, if a publisher needs to update content or correct mistakes in a digital textbook, it can electronically distribute new versions of the content instantaneously.

- **Multimedia features enhance the learning experience.** Electronic readers contain many interactive features that cannot be found in print textbooks. Multimedia features, such as hyperlinks, audio and video extensions, still and animated images, graphic simulations, virtual labs, interactive lessons, and education-based games, have been found to enhance the reading experience for many students.

- **Teachers can customize learning.** Digital textbooks allow teachers to personalize students' learning experiences by using different modules that suit students' particular learning style, language, or level of skill, while adhering to local education standards.

- **Digital content more effectively supports a variety of learning needs.** Researchers have concluded that the interactive features of digital textbooks provide support for students with different learning needs, such as visually impaired students, students who become easily distracted, and English language learners.

- **Digital textbooks better engage tech-savvy students.** Digital textbooks address the discrepancy between the types of literacy experiences students encounter at school (paper, pencil, and print textbooks) and those they use in their daily lives outside of school (Web 2.0).

- **Digital textbooks can be accessed anytime, anywhere.** Digital content is available anytime, anywhere, both online and offline. This unlimited access translates into less wasted instructional time due to forgotten or lost textbooks and assignments.

- **Students do not need to carry heavy backpacks.** Digital textbooks decrease the physical burden placed on students who use print textbooks. A single electronic device can store hundreds of textbooks and eliminates the need to transport heavy print textbooks back and forth from home to school. The average weight of an e-reader or tablet is between 0.75 to two pounds. Print textbooks, on the other hand, can weigh over five pounds each.

- **Digital textbooks are better for the environment.** Environmental benefits of digital textbooks include reduced deforestation, less pollution from printing and transporting books, and fewer costs related to paper textbook disposal and recycling.

Disadvantages of Digital Textbooks

Despite the many advantages associated with digital textbooks, researchers and educators point to some clear disadvantages, summarized below.

- **Digital textbooks are not conducive to in-depth reading.** Some researchers have concluded that digital textbooks are more suited to leisure reading and do not fully support academic reading. Furthermore, certain features of mobile devices, such as their small size and restrictive keyboard and mouse functions, make them more difficult to use for in-depth reading.

- **Multimedia features may interfere with students' reading comprehension.** Research suggests that some students find digital textbooks' interactive features distracting. Tablets such as the iPad and Kindle Fire offer links to videos, games, websites, and music, as well as frequent email alerts.

- **Standards for the quality and accuracy of digital content have not been established.** Some researchers believe that the content contained in digital textbooks is inferior to that of print content. Traditionally, changes to paper-based textbooks are carefully vetted by government bodies, but digital textbooks are not subjected to this process.

- **Content is not easily transferrable among different types of devices.** A large portion of digital content is formatted for a specific type of e-reader and can only be accessed on that one type of device. The result is that schools often purchase digital content but are then unable to transfer it from one type of device to another (for example, from an Amazon Kindle to an Apple iPad).

- **Digital textbooks break easily and are costly to fix.** Many opponents of digital textbooks question their durability. Broken digital textbooks require repair by experienced technicians, which can be costly and time-consuming and put a strain on school districts' IT departments. In contrast, paper textbooks can usually be repaired with basic supplies such as tape or glue.

- **Prolonged use of digital textbooks may increase the risk of several health problems.** Some researchers have voiced concerns about the side effects of long-term usage of digital devices on students' health. Frequent use of handheld devices, including tablets and e-readers, has been found to contribute to Computer Vision Syndrome and has been linked to a higher incidence of musculoskeletal disorders associated with repetitive strain on muscles. In addition, education leaders have become concerned that students are becoming too dependent on technology. The American Academy of Pediatrics reported that between 8% and 12% of U.S. children show signs of Internet addiction.

Research on the Educational Effects of Digital Textbooks

Since the introduction of digital textbooks into the classroom is relatively recent, researchers are just beginning to investigate their various effects. Research findings from early studies conducted on digital textbooks are summarized below.

- Studies comparing the amount of reading students do on digital vs. paper textbooks have produced mixed findings.

- Researchers have found that digital textbook users read 20-30% more slowly than users of print textbooks.

- A number of studies have confirmed that students find digital textbooks more engaging than print textbooks.

- Several studies have reported that students using digital textbooks recall fewer details than students who read the print version of the same text. These studies have found that students using digital versions of unfamiliar materials have to read the same text several times before they gain the same level of recall as print readers.

- Studies suggest that digital textbooks have a positive impact on students' reading comprehension and particularly on elementary students' emergent literacy skills.

- The impact of digital content on students' algebra achievement was found to vary, depending on the conditions under which it was used.

- Some researchers have hypothesized that the distracting nature of digital textbooks' interactive features may be responsible for slower reading speed and reduced content retention.

Costs Associated with Digital Textbooks

There is heated debate over whether digital textbooks actually save school districts money. In order to realize long-term financial benefits, school districts must first invest in many resources, including electronic devices, digital content, supporting equipment, network infrastructure, maintenance and repair costs, upgrade and replacement costs, IT support, and teacher training. Some experts estimate that it will cost large school districts over $1 billion to transition to digital textbooks.

A brief review of some of the costs associated with digital textbooks is provided below.

- **Electronic devices.** School districts must consider the cost of purchasing or leasing an electronic device, such as a Kindle or iPad, for every student.

- **Content.** Introduction of digital textbooks in the classroom requires that school districts acquire digital content. There are three general sources for digital content and most districts mix and match among them: digital content purchased from educational publishers, free open educational resources, and locally created content.

- **Infrastructure.** Most school districts are struggling to find the money to build or update the infrastructure needed to support digital textbooks, including wireless networks that have the capacity to support the bandwidth when thousands of students access it at the same time.

- **Maintenance and repair.** Electronic devices require periodic upgrades and maintenance. There are always costs for broken, misplaced, and defective devices as well.

- **Teacher training.** Transitioning to digital textbooks requires teachers to be trained on how to use the technology and how to incorporate the digital content into their classroom practice.

Suggestions for School Districts that are Introducing Digital Textbooks

A summary of issues that should be considered when transitioning to digital textbooks follows, based on the experiences of school districts that have introduced digital initiatives.

- **Start small.** Experts recommend limited launches so that district administration is able to obtain constructive feedback before introducing a full digital textbook initiative. Some districts initially provide digital textbooks in only one subject area or grade level.

- **Secure increased flexibility in textbook adoption policies from state lawmakers.** States' textbook adoption cycles are geared to purchasing one textbook a year and then keeping that book in schools for 5-10 years. Experts recommend that state laws be expanded to include digital content in the definition of textbooks and broaden the types of content available for use in schools.

- **Select high-quality content.** District staff should ensure that the digital content selected is accurate, bias-free, aligns to standards, and adheres to state and local laws. Experts suggest that school districts move away from the "one book per content area per grade level per student" model and select the highest quality content from a variety of sources. Digital content can be acquired in smaller pieces (i.e., chapters or lessons) and those pieces can be assembled and used throughout the K-12 curriculum.

- **Address licensing and re-use rights.** In spite of the virtual nature of digital content, it is subject to the same licensing and copyright constraints as print textbooks. Before digital content is downloaded, staff should determine if there is a limit on how many devices the content can be downloaded onto, if the licensing agreement has an expiration date, and if the content is purchased or leased. Copyright issues, such as laws that prevent non-authors from modifying existing content, must also be addressed prior to downloading digital content.

- **Decide whether the district will provide students with electronic devices or implement a Bring Your Own Device (BYOD) model.** Most schools transitioning to digital textbooks provide a standardized device for all students. Advantages to using district-provided devices include control over device capabilities, functions, and security settings; guaranteed compatibility with content and programs; and assurance that all students, regardless of income

level, have access to the same device. The main disadvantage of district-provided devices is the cost of purchasing or leasing a device for every student.

A number of school districts have successfully implemented BYOD programs. Advantages of the BYOD model include significantly reduced district costs; the opportunity for families to select the device that best suits their needs; and ownership benefits (i.e., students who have an ownership interest take better care of their devices). The biggest disadvantage associated with the BYOD model is that low-income families may not be able to purchase devices. Schools must be prepared to give or loan devices and pay for network plans when families cannot afford them. Other disadvantages of the BYOD model include incompatibility (i.e., having a variety of devices that are incompatible with the school's chosen operating platform, content, and even connectivity systems) and loss of control over how students use the devices, including what programs they install.

- **Determine schools' infrastructure needs.** School districts need to plan for a network and infrastructure sufficient to enable simultaneous use of devices by students, faculty, and staff for instruction, assessment, and school operations. Not all schools need the same infrastructure and schools may want certain classrooms and facilities to have more bandwidth than others.

- **Ensure that all students have equitable access to digital textbooks and home Internet connectivity.** Digital textbook initiatives have the potential to negatively impact students from low-income backgrounds. Less affluent districts and schools are less likely to be able to afford digital textbooks than higher-income districts and schools. In addition, lack of Internet connectivity at home leaves low-income students even further behind. Although school districts may find funds to provide every student with an electronic device, most cannot afford to absorb the cost of home Internet connectivity.

- **Provide teachers with professional development.** Studies have found that districts often do not invest in the teacher training programs needed to ensure the success of digital textbook initiatives. Teachers must be trained on how to use electronic devices and integrate digital content into their lessons, and they must be provided with time to work with colleagues to restructure lesson plans and teaching materials.

Examples of Digital Textbook Initiatives in the U.S.

Many districts and states, including Florida, have begun transitioning from paper textbooks to digital content. According to the State Education Technology Directors

Association, 22 states have implemented digital textbook initiatives, launched open educational resource initiatives, and/or introduced measures that increase the flexibility of the textbook adoption process. Examples of digital textbook programs being implemented across the U.S. and brief descriptions of each initiative are included in a Research Services literature review on digital textbooks, available at http://drs.dadeschools.net.

Summary

An increasing number of school districts across the U.S. are switching from print textbooks to digital textbooks. The advantages and disadvantages associated with digital textbooks were reviewed in this paper. Findings from research conducted on the impact of digital textbooks on students' reading habits, reading speed, reading engagement, content retention, and academic achievement were summarized. A brief description of the costs associated with digital textbooks was also provided. Finally, a summary of issues that should be considered when transitioning to digital textbooks was included in this report, based on the experiences of school districts that have adopted digital initiatives.

Many states, including Florida, have begun transitioning from paper textbooks to digital content. Examples of digital textbook efforts being implemented across the U.S. and brief descriptions of each initiative are included in Research Services' more comprehensive literature review on digital textbooks, available at http://drs.dadeschools.net.