Considerations for Realizing the Promise of Educational Gaming Technology

Nancy J. Nelson, Hank Fien, Christian T. Doabler, and Ben Clarke

TEACHING Exceptional Children, Vol. 48, No. 6, pp. 293–300. DOI: 10.1177/0040059916650639

Hope Elementary School recently purchased tablets for all of its students to facilitate the use of technology in the classroom. The principal at Hope Elementary understands that technology can be an efficient and effective way for teachers to access materials and differentiate instruction to support the achievement of all learners. However, some teachers are struggling to determine how to best use the tablets in the classroom. Ms. Williams is a special education teacher at Hope Elementary School. She is excited about the tablet initiative and has a number of ideas about ways she can effectively and meaningfully integrate technology into instruction. The principal at Hope Elementary has asked Ms. Williams to serve as an example for other teachers at the school to help alleviate their concerns about using technology in the classroom. The principal is confident if other teachers see the way Ms. Williams is taking advantage of the school-purchased tablets to differentiate and individualize instruction, they will be better able to differentiate their own instruction to prevent academic difficulty and improve student outcomes in math, literacy, and other content areas.

The principal at Hope Elementary is not alone in her vision for education technology, nor is she alone in her dilemma. Education technology, or "the application of technology to teaching and learning" (Edyburn, 2013, p. 9), is at the center of a number of national initiatives. To provide education in the 21st century, schools and districts are increasingly turning to technology for many services, including information access, data management, assessment, instruction, and intervention (ConnectEd Initiative; White House, 2013). In addition, it is clear that student fluency using technology is essential to their prospects for careers in the "digital age." The number of jobs available in science, technology, engineering, and mathematics (STEM) fields has outpaced non-STEM job growth 3:1 in the last decade, a trend that is expected to continue (Langdon, McKittrick, Beede, Khan, & Doms, 2011).

In the past 30 years, technology has played an important and evolving role in U.S. schools—from the introduction of the personal computer in the 1970s and '80s to laptops in the '90s, followed by LCD projectors and SMART Boards, learning management systems and student information systems, high-speed Internet and Wi-Fi, social media, tablets, and other mobile and assistive devices. Learning games and apps is one area of education technology where there has been exponential growth in the last decade. For example, in June 2008, the Apple App Store did not exist. In January 2012, less than 4 years later, Apple reported the availability of 20,000 educational apps being accessed on more than 1.5 million devices in schools around the world (Rao, 2012). Apple now has available in its App Store more than 80,000 educational apps (Apple, 2015), and it manages traffic approaching millions of downloads each day (Friedman, 2013). One can barely keep up with the pace at which new educational games and apps are being introduced and digested in the market. With so many choices available, how do schools and teachers decide what to use? How do they have confidence their choices will result in desired outcomes?

With so many choices available, how do schools and teachers decide what educational games and apps to use?

These are fair questions that plague many teachers, school administrators, and parents. Although there are

numerous education technology products available, there is a lack of information about the quality and effectiveness of these products. Arguably, two sources of information should influence teachers' decisions about whether to use a product, including the degree to which a product has been vetted by experts (e.g., content standards, evidence-based curriculum design features, engaging gaming features) and the evidence base demonstrating the effectiveness of those interventions (i.e., rigorously designed research studies).

However, many widely available educational games and apps have not been independently evaluated by experts according to important and established criteria. Moreover, the impact of these education technology products on student learning is largely unknown (Young et al., 2012). For instance, in a large-scale cluster-randomized controlled trial of 16 reading and math technology-based interventions designed to test the effects of teachers' use of technology for learning, students in the treatment group (i.e., those receiving educational games and apps) did not perform significantly better than control group students who did not have access to the educational games and apps (Dynarksi et al., 2007). Also, the few studies of technology-based interventions that have been rigorous enough to meet What Works Clearinghouse (WWC) standards have largely demonstrated inconsistent results, with just a handful of interventions resulting in positive or potentially positive effects on student learning (WWC, 2015). With these limitations in mind, it is essential that practitioners proceed cautiously to adopt and implement technology initiatives in schools.

Obstacles to Effective Use of Education Technology

There are several likely reasons that the implementation of education technology has not resulted in desired outcomes in recent years. With regard to educational games and apps, crucial instructional design elements that have proven efficacious for struggling learners when employed in print-based products (e.g., the unambiguous, clear models; guided practice; and academic feedback that constitute explicit instruction) may have been sacrificed during technology development (Fien, Nelson, Doabler, & Clarke, 2015; Klopfer, Osterweil, & Salen, 2009). For example, many recent technology products have focused narrowly on providing students with opportunities to independently practice skills (e.g., solving math facts, identifying letter sounds), without providing the academic feedback and modeling students need to prevent and correct misconceptions during learning activities. Explicit instruction designed to gradually release control from the "teacher" (i.e., the technology-based program) to the student is essential for building mastery, especially for students with learning disabilities or others at risk for school failure (Kame'enui & Simmons, 1999; Rupley, Blair, & Nichols, 2009). In contrast, other technology-based instructional programs incorporate principles of evidence-based, explicit instruction focused on important content but may overlook the importance of engaging students in learning activities by failing to immerse students in the learning experience.

Many widely available educational games and apps have not been independently evaluated by experts.

A third possible reason education technology has not reached its potential in schools and classrooms is the lack of articulated purpose for using the technology in the first place. In a recent survey of more than 1,000 teachers, simply providing teachers with such technology tools did not ensure that teachers would use them effectively (Grunwald Associates, 2010). Grunwald Associates (2010) found that teacher perceptions about the utility and relevance of education technology could influence its effectiveness in classrooms. For years, experts have espoused the potential utility of technology to enhance teachers' practice and student learning but only if technology is used appropriately (Bransford, Brown, & Cocking, 2000)—in other words, to serve an intended purpose.

Another reason educational technology may not result in desired outcomes is the lack of alignment and integration of adopted technology with regular classroom practice. At present, educational games and apps are not developed to necessarily align with other instruction taking place in schools. The lack of alignment with core instruction is problematic because educational games and apps are generally intended to supplement the general curriculum. Without explicit connections between the core program and supplementary interventions, struggling learners, who are frequent recipients of supplementary instruction (e.g., Tier 2 or Tier 3 inventions), may struggle to understand how learning during intervention applies to the general education curriculum (Baker, Fien, & Baker, 2010), introducing confusion in the learning process.

A related issue is the frequent disconnect between education technology and curriculum, generally. The need to integrate technology with regular classroom practice has been acknowledged by federal agencies seeking to support, if not promote, the positive impacts of education technology on outcomes for students with disabilities. For instance, the Office of Special Education Programs (OSEP) has created an entire grant program focused on the development and dissemination of tools and products, including training, that promote effective implementation of education technology in school settings (OSEP, 2014). This OSEP grant program and other initiatives like it that focus on seamlessly integrating technology with the curriculum are intended to help schools realize the promise of education technology for improving student outcomes.

Potential Benefits of Education Technology

Despite a lack of evidence derived from rigorous research, the promise of educational technology to improve educational practice in the 21st century is widely accepted. The National Educational Technology Plan (NETP) called for leveraging technology to "provide engaging and powerful learning experiences, content, and resources and assessments that measure student achievement in meaningful ways" (Atkins et al., 2010, p. v). Technology is an integral part of our everyday lives—school and the workplace not excepted. According to Atkins and colleagues (2010), in the 21st century, "technology-based learning and assessment systems will be pivotal in improving student learning and generating data that can be used to continuously improve the education system at all levels" (p. v). Well-designed educational games and apps—those that integrate the "fun" and engaging features of commercially available games with evidence-based principles of instructional and technological design—are ostensibly equipped to respond to the NETP call to strategically integrate innovative technology approaches in schools.

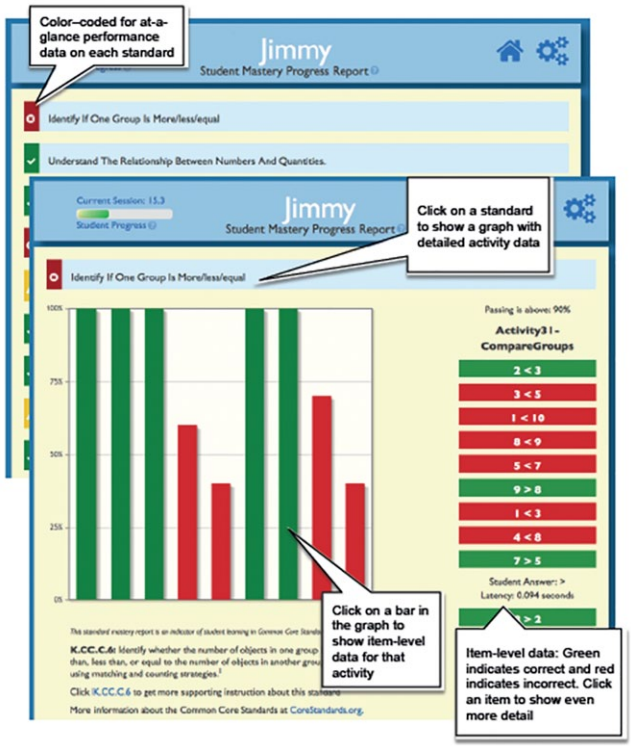
According to the Joan Ganz Cooney Center at Sesame Workshop, "digital games offer a promising and untapped opportunity to leverage children's enthusiasm and to help transform learning in America" (Thai, Lowenstein, Ching, & Rejeski, 2009, p. 6). Educational games and apps have the potential to motivate and engage students who have experienced academic difficulty and may be beginning to disengage from school by situating learning experiences in a narrative arc, using characters to teach concepts, employing student-created avatars that interact with other players, allowing opportunities for independent exploration, and incorporating game-based rewards to sustain student effort (Fien, Doabler, Nelson, Kosty, & Clarke, in press; Klopfer et al., 2009; Young et al., 2012).

Moreover, educational technology can increase instructional intensity by allowing for a higher rate of instructional interactions (i.e., interactions that occur between teachers and students which are designed to support academic success) than can be accommodated during traditional instruction (Fien et al., 2015). Compared to technology-based games that provide practice opportunities to students one-to-one, teachers who instruct sometimes dozens of students in the same class simply do not have the time or ability to provide the same frequency of modeling, practice opportunities, and feedback to individual learners. The frequent input and output required to progress in educational games provides an opportunity rife for meaningful, content-relevant interaction that can accelerate student learning and mastery of targeted concepts and skills through extended practice, feedback, and review.

Educational games and apps also have the capacity to differentiate instruction to support individualization within the classroom. Differentiated instruction involves responding to varied needs of learners in a classroom in order to create the best learning experience possible and maximize student success (Tomlinson, 2000). When developing technology products, gameplay pathways can be designed to differentiate instruction so that students are automatically routed to different activities according to their success or choices in previous activities, which is valuable for special education teachers who manage instruction for students with varied needs. In practice, designing educational technology to differentiate instruction means that students who need more instruction or practice to access and master a target skill receive it, whereas those students who are ready to move on to new content do so—all through a fully automated gaming system.

Finally, educational technology tools, including games and apps, can support teachers in making real-time, data-based decisions that can

Figure 1. Example data dashboard



contribute to the effectiveness of instruction and interventions (Doabler, Nelson, Fien, Clarke, & McCammon, 2014; Edyburn, 2013). Simple data dashboards that depict student gameplay data according to established criteria (e.g., the Common Core State Standards [CCSS]; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) can guide teachers to reteach concepts in classroom lessons the same day. Figure 1 presents an example of a data dashboard for an individual student (Jimmy), depicting student gameplay data according to activities aligned with the CCSS for Mathematics (CCSS-M). In the background, a list of standards Jimmy is learning is color coded according to his performance. In the foreground, a counting and cardinality standard Jimmy appears to be struggling to master during gameplay (K.CC.C.6) is depicted, including the items Jimmy answered correctly and incorrectly. The teacher can look at data such as these to better determine the next steps for working with Jimmy to support his mastery of important content objectives.

Effectively Implementing Technology in the Classroom

If technology is to be an integral part of instruction in the present and future, schools and teachers need strategies that will allow for responsible uptake and use of educational games and apps in a way that is designed to support their implementation toward valued outcomes for students. The NETP urges the education system to "be clear about the outcomes we seek; collaborate to redesign structures and processes for effectiveness, efficiency, and flexibility, continually monitor and measure our performance; and hold ourselves accountable for progress and results every step of the way" (Atkins et al., 2010, p. v). Consistent with the NETP, there are a number of strategies teachers can use to counteract the obstacles and more effectively implement educational games and apps in the classroom to support students with or at risk for learning disabilities. These strategies can be structured in three broad areas: (a) strategies to promote planning for use of education technology, (b) strategies to manage implementation, and (c) strategies to support data-based decision making using education technology (see Table 1).

Planning Strategies

To counteract the obstacles associated with planning to use education technology tools, there are several strategies teachers can undertake prior to implementation to support appropriate use of technology.

To support appropriate use of technology (Bransford et al., 2000), teachers should first understand clearly what they are hoping to accomplish by using an education technology tool. For example, if the goal of using the tool is to deliver an intervention to improve early literacy skills, the teacher might review reading curriculum-based measurement (CBM) data and other student data as appropriate to determine a more specific area of need (e.g., phonics, fluency, comprehension). The teacher might also examine the curriculum in use, standards, and individualized educational program (IEP) goals the student is expected to meet in preparation for identifying an educational technology tool.

After a purpose has been established, the teacher aims to identify educational technology tools that are designed to present targeted content in an engaging way, using evidence-based features of instructional and technological design that support struggling learners (i.e., products that incorporate explicit instruction as well as a motivating and engaging platform). If products are not available that target intended content or they are not engaging for students, teachers should consider whether time might be better spent using more traditional instructional methods.

Do research to determine the level of evidence available, if any, for the education technology. The WWC and the National Center on Intensive Intervention (NCII) review rigorous research evaluating the effectiveness of educational programs on student achievement and summarize results for practitioners. Other primary sources (e.g., journal articles) may also be

Table 1. Strategies to Support the Implementation of Education Technology in Schools

Type of strategy	Strategy	Resources
Planning	**1. Determine a purpose:** Identify the goal of using the education technology tool; in other words, what you need the tool to be able to accomplish.	Standards, curriculum, schoolwide intervention plans, IEP goals, student performance data
	2. Identify products: Identify and review available resources that document expert opinion and features of the technology tool.	Product website, Common Sense Media and other Internet reviews
	3. Do research: Review available evidence for use of the education technology tool to improve student achievement.	National Center on Intensive Intervention, What Works Clearinghouse
	4. Select a product: Obtain access to the education technology tool. Review available manuals and product-provided information and training materials.	Product manuals, scope and sequence, standards alignment documents, PD and training sessions
	5. Test the product: Test the education technology tool prior to implementation in an authentic setting.	Product manual, product technical support, school or district IT support
	6. Preview the product: Examine education technology tool content prior to user access and take notes as needed.	Education technology tool and other materials required for use
Implementation	**7. Prepare to use:** Identify organizational structures for management of materials.	Storage space, schedules
	8. Teach users: Directly teach users how the education technology tool works and materials management structures.	Lesson plan, educational technology tool, and other materials required for use
	9. Connect to instruction: Make connections to the education technology tool in other contexts (ongoing).	Preview lesson plans, other curriculum, and data sources
Data-based decision making	**10. Review progress:** Examine data gathered using the education technology tool (ongoing).	Item-level data, summarized data, data reports, instructional recommendations
	11. Assess outcomes: Use data sources to assess the effectiveness of the education technology tool to support the intended purpose and make adjustments to implementation (ongoing).	Education technology tool data, other data sources and trends

Note. IEP = individualized education program; IT = information technology; PD = professional development.

accessed to support a decision about the effectiveness of an educational technology tool. It is important for teachers to be aware of the strengths and weaknesses of potential programs in order to use them effectively to supplement instruction.

After reviewing the available evidence, expert opinion, and product information, teachers should select a product and obtain access to the product, including product manuals, standards alignment documents, and any other available product information. Then, prior to implementation, teachers can test the product in the setting in which they will implement the product to support usability and troubleshoot connectivity issues (e.g., firewalls, Internet connectivity, user name and password setup). It is also important to preview the product prior to implementation so that the teacher can work with students who may experience challenges during use to navigate technology or content.

Implementation Strategies

There are several additional strategies teachers can use in schools and classrooms to counteract obstacles associated with implementation, beginning with preparing for use. Implementing education technology requires preparation on the part of a teacher. The teacher needs to identify when tools will be used, plan for time that will be needed to manage devices during sessions, and establish guidelines for users. Similarly, when implementing a new education technology tool, it is important to teach users how to use the tool, rather than assuming users will have the skills to navigate the interface independently. Although many educational games and apps are designed to be intuitive for students, even young children, students are likely to need explicit support (i.e., modeling and guided practice) prior to independent use. There are also typically semifragile materials associated with education technology. Thus, to support efficient and effective use of these materials, users need to know the rules of use, including examples and non-examples of how to use the tools, where materials are stored, and how and when they can be accessed.

There are several strategies teachers can use to integrate technology with other classroom instruction. These include direct opportunities to connect to education technology content or experiences during traditional instruction (e.g., reviewing or completing activities in educational games and apps as a whole class or in small groups) and indirect opportunities to connect to educational content or experiences (e.g., referring to characters and themes, concepts, or problem sets students may have encountered in an educational game or app).

Data-Based Decision-Making Strategies

Teachers can also use data-based decision-making strategies in schools and classrooms to counteract obstacles associated with education technology. Teachers can review progress data (e.g., data dashboards) that track student performance and learning. These data can be highly useful for making instructional adjustments and other low-stakes decisions. They may also be useful for communicating progress to other teachers and parents alongside other data sources. At established intervals, teachers implementing education technology should also consider how the introduction of the product has contributed (or not) to student learning. If student performance data (e.g., results of CBMs) do not indicate students are making progress using the tool, teachers may want to consider alternative approaches to instruction.

Ms. Williams realizes the evidence supporting the use of educational games and apps to improve student achievement is thin while at the same time she recognizes that technology is an important part of education in the 21st century. She has observed many of the obstacles to effective implementation yet believes if educational games and apps are carefully and strategically implemented, they can improve student learning.

Like other teachers at Hope Elementary School, Ms. Williams uses an established online database to summarize her students' screening and progress monitoring data and discern which students may require additional support to meet IEP goals and develop proficiency in core content areas. This fall, after reviewing her students' mathematics data, she identified several first-grade students on her caseload that could benefit from increased support. To supplement her mathematics instruction, Ms. Williams reviews available information about mathematics interventions on the NCII website and determines that NumberShire, a technology-based gaming intervention, best matches her students' academic needs and the resources available in her school building.

Based on her review of the NumberShire website, NumberShire teacher guide, and description of NumberShire in the Apple App Store, Ms. Williams concludes she likes NumberShire because she and her students can easily access it through the data system using a desktop computer or the new tablets the school has purchased. She can give students access to NumberShire using a flexible schedule and a variety of delivery formats (e.g., whole class, small group, one-to-one). In addition, there is strong alignment between NumberShire and the Whole Number Foundations Level 1 intervention program that she is already using in her classroom. Ms. Williams also likes that NumberShire provides her students with explicit instruction in whole-number concepts, which are essential to developing early numeracy skills and part of the CCSS-M that she and other teachers are charged with preparing students to meet. She appreciates how NumberShire provides struggling learners with frequent opportunities to learn about whole-number concepts that involve explicit modeling, guided practice, independent practice, and academic feedback and that these interactions present math content in fun and meaningful ways. Most important, through her review of the information on the NCII website, Ms. Williams has also identified promising evidence for the effect of the NumberShire intervention on student math learning through available research studies.

Prior to using NumberShire in her classroom, Ms. Williams tests a demo of the intervention and buys an individual license to confirm the product will work using the school's tablets and the Wi-Fi connection in her classroom. In testing the materials, Ms. Williams determines all students will need headphones to play NumberShire during class time and that she will need to establish a workstation for storing headphones and tablets when they are not in use. In order to support her students in efficiently transitioning between traditional instructional activities and NumberShire and to make sure students understand how to care for mobile devices, Ms. Williams teaches her students a few tablet-use routines before they begin the intervention (e.g., use two hands when carrying the tablet, always sit down when using the tablet, keep it dry and free from food or drink, turn off the screen when the teacher is

talking or tablet time is over, put devices away in their dock when finished using).

In her previous experience with educational technology, Ms. Williams observed a divide between technology-based activities and daily teaching. Because the NumberShire intervention is linked to a data system, she can view and print student reports that integrate real-time formative assessment data and diagnostic information generated during NumberShire gameplay. She uses the data reports to guide her instruction and to communicate to parents and teachers about student progress. In preparation for an upcoming IEP meeting, Ms. Williams reviews Jimmy's progress in NumberShire and notices he is continuing to struggle in a couple of areas—one of which involves comparing numbers (see Figure 1). Through the NumberShire data system, Ms. Williams is able to print a report she can share with Jimmy's parents that identifies the specific skills he has mastered and where he is still having trouble. In addition, on the basis of Jimmy's progress, Ms. Williams receives instructional recommendations and routines she and other teachers can use to provide Jimmy with additional instruction and practice to ensure he is successful in meeting IEP goals and objectives.

Conclusion

In the absence of compelling evidence for the use of educational games and apps to support student achievement, schools and teachers need to be cautious in their implementation of new initiatives. In recent years, the influence of a booming gaming industry has vastly increased the interest level of educational games and apps for students (Thai et al., 2009; Young et al., 2012) at the same time that a number of federal initiatives have invested in the development and rigorous testing of education technology tools (e.g., Institute of Education Sciences special and general education technology competitions). In addition, there has been an uptick in the kinds of technology-based data tools and systems that are available to meet increased demand for data use and evidence in schools (Hess & Little, 2015). Education technology offers a number of potential benefits that can support student achievement, including its promise for engaging and motivating struggling learners and its utility for differentiating and increasing the intensity of instruction and intervention. However, the availability of education technology does not guarantee these benefits. To realize the potential benefits of education technology in schools and classrooms, it is important that teachers are informed about technology products and take careful steps to integrate education technology with classroom instruction. By being strategic, teachers can more effectively implement education technology to support students with or at risk for learning disabilities.

References

Apple. (2015). *iPad in education: App Store. Whatever the lesson, make apps part of the plan*. Retrieved from http://www.apple.com/education/ipad/apps-books-and-more/

Atkins, D. E., Bennett, J., Brown, J. S., Chopra, A., Dede, C., Fishman, B., . . . Williams, B. (2010). *Transforming American education: Learning powered by technology*. Washington, DC: U.S. Department of Education, Office of Educational Technology. Retrieved from http://www.ed.gov/sites/default/files/netp2010.pdf

Baker, S. K., Fien, H., & Baker, D. L. (2010). Robust reading instruction in the early grades: Conceptual and practical issues in the integration and evaluation of tier 1 and tier 2 instructional supports. *Focus on Exceptional Children*, *42*(9), 1–20.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Doabler, C. T., Nelson, N. J., Fien, H., Clarke, B., & McCammon, S. (2014). *The development and validation of the NumberShire coaching and implementation tutor: Supporting schools to scale up evidence based education technology and improve data based decision-making*. Proposal submitted to the Office of Special Education Programs, Stepping Up Technology Implementation Competition.

Dynarski, M., Agodini, R., Heaviside, S., Novak, T., Carey, N., Campuzano, L., . . . Sussex, W. (2007). *Effectiveness of reading and mathematics software products: Findings from the first student cohort* (Report to Congress No. NCEE 2007-4005). Washington, DC: U.S. Department of Education, Institute of Education Sciences. Retrieved from http://files.eric.ed.gov/fulltext/ED496015.pdf

Edyburn, D. L. (2013). Critical issues in advancing the special education technology evidence base. *Exceptional Children*, *80*, 7–24.

Fien, H., Doabler, C. T., Nelson, N. J., Kosty, D. B., & Clarke, B. (in press). An examination of the promise of the NumberShire Level 1 gaming intervention to improve student math outcomes. *Journal of Research on Educational Effectiveness*.

Fien, H., Nelson, N. J., Doabler, C. T., & Clarke, B. (2015). *A multi-site randomized controlled trial to assess the efficacy of the NumberShire Level 1 gaming intervention for improving math outcomes for students with or at risk for math learning disabilities*. Proposal submitted to the Institute of Education Sciences.

Friedman, L. (2013). The App Store turns five: A look back and forward. *Macworld*. Retrieved from http://www.macworld.com/article/2043841/the-app-store-turns-five-a-look-back-and-forward.html

Grunwald Associates. (2010). *Educators, technology and 21st century skills: Dispelling five myths. A study on the connection between K–12 technology use and 21st century skills*. Bethesda, MD: Author. Retrieved from http://www.grunwald.com/pdfs/Educators_Technology_21stCentury-Skills_GRUNWALD-WALDEN_Report.pdf

Hess, F. M., & Little, B. (2015). *"Moneyball" for education: Using data, evidence, and evaluation to improve federal education policy*. Washington, DC: American Enterprise Institute, Results for America. Retrieved from https://www.aei.org/wp-content/uploads/2015/03/Moneyball-for-education.pdf

Kame'enui, E. J., & Simmons, D. C. (1999). Beyond effective practices to schools as host environments: Building and sustaining a school-wide intervention model in beginning reading for all children. *Australasian Journal of Special Education*, *23*, 100–127. doi:10.1080/1030011990230204

Klopfer, E., Osterweil, S., & Salen, K. (2009). *Moving learning games forward*. Cambridge, MA: Education Arcade.

Langdon, D., McKittrick, G., Beede, D., Khan, B., & Doms, M. (2011). *STEM: Good jobs now and for the future* (ESA Issue Brief No. 03-11). Washington, DC: U.S. Department of Commerce, Economics and Statistics Administration. Retrieved from http://www.esa.doc.gov/sites/default/files/stemfinalyjuly14_1.pdf

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core State Standards for mathematics*. Washington, DC: Author. Retrieved from http://www.corestandards.org/

Office of Special Education Programs. (2014). *Special education-technical assistance and dissemination to improve services and results for children with disabilities* (CFDA No. 84.326). Washington, DC: U.S. Department of Education.

Rao, L. (2012). Apple: 20,000 education iPad apps developed; 1.5 million devices in use at schools. *TechCrunch*. Retrieved from http://techcrunch.com/2012/01/19/apple-20000-education-ipad-apps-developed-1-5-million-devices-in-use-at-schools/

Rupley, W. H., Blair, T. R., & Nichols, W. D. (2009). Effective reading instruction for struggling readers: The role of direct/explicit teaching. *Reading & Writing Quarterly*, *25*, 125–138. doi:10.1080/10573560802683523

Thai, A., Lowenstein, D., Ching, D., & Rejeski, D. (2009). *Game changer: Investing in digital play to advance children's learning and health*. New York, NY: Joan Ganz Cooney Center at Sesame Workshop.

Tomlinson, C. A. (2000). *Differentiation of instruction in the elementary grades* (ED 443572). Champaign, IL: ERIC Clearinghouse on Elementary and Early Childhood Education.

What Works Clearinghouse. (2015, March 13). *Designing quasi-experiments: Meeting what works clearinghouse standards without random assignment*. What Works Clearinghouse webinar conducted at the U.S. Department of Education, Washington, DC. Retrieved from http://ies.ed.gov/ncee/wwc/multimedia/qedwebinar/wwc_webinar_qed_030315.html

White House. (2013, June 6). *ConnectED Initiative* [Press release]. Retrieved from https://www.whitehouse.gov/photos-and-video/video/2013/06/06/president-obama-speaks-technology-schools

Young, M. F., Slota, S., Cutter, A. B., Jalette, G., Mullin, G., Lai, B., . . . Yukhymenko, M. (2012). Our princess is in another castle: A review of trends in serious gaming for education. *Review of Educational Research*, *82*, 61–89. doi:10.3102/0034654312436980

Nancy J. Nelson, *Research Assistant Professor, Center on Teaching and Learning,* **Hank Fien,** *Associate Professor, School Psychology Program, and Director, Center on Teaching and Learning, University of Oregon, Eugene;* **Christian T. Doabler,** *Assistant Professor, Department of Special Education, University of Texas at Austin;* **Ben Clarke,** *Associate Professor, School Psychology Program, University of Oregon, Eugene. The authors of this manuscript are also authors of NumberShire and may receive royalties from its sale.*

Address correspondence regarding this article to Nancy J. Nelson, University of Oregon, Eugene, OR 97403 (e-mail: nnelson3@uoregon.edu).

TEACHING Exceptional Children, *Vol. 48, No. 6, pp. 293–300.*