A Solution-Finding Report

Title*: Play-based technology platforms*
Date: August 19, 2013

This solution-finding report provides information requested by the Northeast Comprehensive Center for resources related to "play-based technology platforms that assess student learning while they play games and read books," with a special emphasis on the efficacy of these platforms.

Solution-finding Reports are intended to provide a quick response to the request for information; they are not intended to be a definitive literature survey or synthesis of the topic.

The Center on Innovations in Learning (CIL) wishes to thank the Center on Enhancing Early Learning Outcomes (CEELO) for its assistance with this report.

Appel, A. E., & O'Gara, C. (2001). Technology and young children: A review of literature. *TechKnowLogia*, *3*(5): 35–36

http://ict.aed.org/infocenter/pdfs/technologyandyoung.pdf

This article reviews current literature on developmental issues and the use of technology in learning environments for 4-, 5-, and 6-year-old preschool children. It examines how current practices address developmentally appropriate learning, and reviews guidance on how best to use computers with young children.

Barron, B., Cayton-Hodges, G., Bofferding, L., Copple, C., Darling-Hammond, L., & Levine, M. (2011). *Take a giant step: A blueprint for teaching children in a digital age*. New York: The Joan Ganz Cooney Center at Sesame Workshop.

http://www.joanganzcooneycenter.org/wp-content/uploads/2012/01/jgcc_takeagiantstep1.pdf

In January 2010, the Cooney Center and the Stanford Educational Leadership Institute convened a Digital Age Teacher Preparation Council to look at current practices for teaching young children and to design a professional development action plan for integrating the effective use of technology in preschool and the primary grades. This report describes the Council's action plan to enhance teacher education and a higher quality, 21st century approach to the learning and healthy development of children in preschool and the primary grades. The report sets forth several goals for the nation to meet by 2020, including advancing technology integration and infrastructure; a more robust professional training program for early education professionals; the expanded use of public media as cost-effective assets for teachers; and the establishment of a Digital Teacher Corps.

Bell, A. (2008). *Game rubric: Assessing student learning in virtual simulations and serious games*. Menomonie, WI: University of Wisconsin–Stout.

http://www2.uwstout.edu/content/profdev/rubrics/gamerubric.html

This rubric may be used for self-assessment and peer feedback.

Chiong, C., & C. Shuler. (2010). *Learning: Is there an app for that? Investigations of young children's usage and learning with mobile devices and apps*. New York: The Joan Ganz Cooney Center at Sesame Workshop.

http://pbskids.org/read/files/cooney_learning_apps.pdf

According to this report's executive summary, "This report focuses on how new forms of digital media are influencing very young children and their families in the United States and how we can deploy smart mobile devices and applications — apps, for short — in particular, to help advance their learning. It does so in three parts: Part One discusses new trends in smart mobile devices, specifically the pass-back effect, which is when an adult passes his or her own device to a child. Part Two presents the results of three new studies that were undertaken to explore the feasibility and effectiveness of using apps to promote learning among preschool- and early-elementary-aged children. Though designed to complement one another, each study approached mobile learning from a different angle. Finally, Part Three discusses the implications these findings have for industry, education, and research."

Common Sense Media. (2008). *Media + child and adolescent health: A systematic review*. San Francisco: Author.

http://ipsdweb.ipsd.org/uploads/IPPC/CSM%20Media%20Health%20Report.pdf

According to this report's overview, "Several systematic reviews have investigated the relationship between media and violent behavior, but there has not been a comprehensive evaluation of the many studies examining other ways that media impact children's health. Common Sense Media and the Department of Clinical Bioethics at the National Institutes of Health arranged this review to evaluate all of the best research on the impact of media exposure (both the amount consumed and the content) on children's health and development."

Common Sense Media. (2011). *Zero to eight: Children's media use in America*. San Francisco: Author.

http://www.commonsensemedia.org/sites/default/files/research/zerotoeightfinal2011.pdf

According to this report's introduction, "The purpose of this study is to provide publicly accessible, reliable data about media use among children ages 0 to 8, to help inform the efforts of all of those who are working to improve children's lives."

Delacruz, G. C. (2011). *Games as formative assessment environments: Examining the impact of explanations of scoring and incentives on math learning, game performance, and help seeking*. Los Angeles: The National Center for Research on Evaluation, Standards, and Student Testing.

http://www.cse.ucla.edu/products/reports/R796.pdf

This report examines how different levels of detail about a game's scoring rules affect math learning and performance. Implications of the results identify attributes for learning games in mathematics.

Din, F. S., & Calao, J. (2001). *The effects of playing educational video games on kindergarten achievement*. *Child Study Journal*, *31*(2), 95–102.

http://clem.mscd.edu/~sandersc/3310%20ed%20video%20article.pdf

This study investigated whether kindergarten students playing Sony PlayStation educational video games learned better than peers who did not play such games. Results from data analyses via ANCOVA indicated that the experimental group gained significantly more than the control group in spelling and decoding areas, though no difference was found in the math area.

Edutopia. (2013). *Video games for learning: Resource roundup*. San Rafael, CA: The George Lucas Educational Foundation.

http://www.edutopia.org/video-games-classroom-learning-resources

This webpage is Edutopia's collection of articles, videos, and resources on using video games and simulations in the classroom, including a section on Using Games for Learning and Assessment.

Epper, R. M., DerryBerry, A., & Jackson, S. (2012). *Game-based learning: Developing an institutional strategy*. Louisville, CO: Educause.

http://net.educause.edu/ir/library/pdf/ERB1208.pdf

This report says true adoption and institutional implementation of videogames in U.S. education is still at an early experimental stage. It identifies six trends that will drive the adoption of game-based learning: student expectations, integration of games and simulation, data analytics, badges for learning, mobile devices, and increasing prevalence of social media.

Gee, J. P. (2009). Deep learning properties of good digital games – How far can they go? In U. Ritterfeld, M. Cody, & P. Vorderer (Eds.), *Serious games: Mechanisms and effects* (pp. 67–82). New York: Routledge.

http://www.jamespaulgee.com/sites/default/files/pub/Ritterfeld_C005.pdf

This book chapter states, "Digital games are, at their heart, problem solving spaces that use continual learning and provide pathways to mastery through entertainment and pleasure….There are lots of features of good entertainment games that make them good for learning."

Hong, J., Tsai, C., Ho, Y., Hwang, M., & Wu, C. (2013). A comparative study of the learning effectiveness of a blended and embodied interactive video game for kindergarten students. *Interactive Learning Environments*, *21*(1), 39–53.

http://www.tandfonline.com/doi/pdf/10.1080/10494820.2010.542760

For their study, the authors developed an embodied interactive video game (EIVG) that is both educational and entertaining, with the hope of using such a system to compare blended and pure digital learning with respect to differences in learning effectiveness. In addition to conducting experiments wherein the children learned using the EIVG, they also involved teachers as part of the study to allow observation of the emotional aspects of the children.

Institute of Play (2013). *GlassLab*. New York: Author.

http://glasslabgames.org/

According to this website, GlassLab [Games Learning and Assessment Lab] is "[t]ransforming learning and formative assessment through digital games….GlassLab brings together leaders in commercial games and experts in learning and assessment to leverage digital games as powerful, data-rich learning and formative assessment environments. The Lab represents a groundbreaking collaboration between Institute of Play, the Entertainment Software Association [ESA], Electronic Arts [EA], Educational Testing Service [ETS], Pearson's Center for Digital Data, Analytics & Adaptive Learning and others. With best-in-class talent and intellectual property from EA; trusted expertise in evidence-based assessment from ETS and Pearson; the ESA's distributed network of thought leaders and public advocates; and Institute of Play's expertise as a leading innovator in 21st century learning design, GlassLab is creating a new model for commercial game studios and learning organizations to come together to do great work. A project of Institute of Play, GlassLab is made possible through the generous support of The Bill and Melinda Gates Foundation and The John D. and Catherine T. MacArthur Foundation."

Keesee, G. (2011, January). *Educational games*. San Mateo, CA: PBworks.

http://teachinglearningresources.pbworks.com/w/page/35130965/Educational%20Games

According to the introduction of this webpage, "Games and games-based learning have been a part of education for decades. However, with new technological advances, digital games have recently emerged as a new teaching tool. Neuroscience has proven that 'Games are tailor made to fit the very different tasks animals and humans will face.'"

Klopfer, E., Osterweil, S, Groff, J., & Haas, J. (2009). *Using the technology of today, in the classroom today: The instructional power of digital games, social networking simulations & how teachers can leverage them*. Cambridge, MA: The Education Arcade.

http://education.mit.edu/papers/GamesSimsSocNets_EdArcade.pdf

This paper advocates "for an evolution in educational practices and approaches to instruction, which not only align with the processes and operations of the world outside of school, but also leverage the emerging power and potential of these new processes and technologies. Attending to this end of the technology-teaching relationship has the additional benefit of helping to shape emerging technologies that is most effective for cognition and instruction."

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

http://education.mit.edu/papers/MovingLearningGamesForward_EdArcade.pdf

This paper makes a case for learning games grounded in principles of good fun and good learning, gleans lessons from the rapidly growing commercial games market, analyzes the downfall of "edutainment" in the 1990s and establishes how the current movement differs, and establishes principles and best practices for moving the field forward in a positive direction. It states, "Simulations often include their own internal assessment measures (data) that can be used to assess student understanding of both micro and macro elements….[G]ames can be used as environments for assessing student learning of curricular content or state standards. For example, students might play Quest Atlantis to show their understanding of certain science concepts or they might play a MiLK game that centers on answering questions around certain academic content."

MacArthur Foundation. (2012). *Documenting and assessing learning in informal and media-rich environments: A report to the MacArthur Foundation*. Chicago: Author.

http://lchc.ucsd.edu/MacArthur-Learning-Report_2012-12.pdf

The aim of this project was to provide a review of relevant research on documenting and assessing learning in informal educational activities and to provide a set of related recommendations. It identifies a number of promising directions for the future of documentation and assessment of informal learning activities, including computer-assisted learning games that unobtrusively document progress.

Michael, D., & Chen, S. (2005). *Proof of learning: Assessment in serious games*. *Gamasutra*, 19: 35–54.

http://www.gamasutra.com/view/feature/2433/proof_of_learning_assessment_in_.php

This article states in part, "Serious games, like every other tool of education, must be able to show that the necessary learning has occurred. Specifically, games that teach also need to be games that test. Fortunately, serious games can build on both the long history of traditional assessment methods and the interactive nature of video games to provide testing and proof of learning."

National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College. (2012). *Technology and interactive media as tools in early childhood programs serving children from birth through age 8*. Washington, DC & Latrobe, PA: Authors.

http://www.naeyc.org/files/naeyc/file/positions/PS_technology_WEB2.pdf

According to this statement, this "is intended primarily to provide guidance to those working in early childhood education programs serving children from birth through age 8. Although not developed as a guide for families in the selection and use of technology and interactive media in their homes, the information here may be helpful to inform such decisions." The statement holds, in part, "Developmentally appropriate practices must guide decisions about whether and when to integrate technology and interactive media into early childhood programs….Professional judgment is required to determine if and when a specific use of technology or media is age appropriate, individually appropriate, and culturally and linguistically appropriate….When used appropriately, technology and media can enhance children's cognitive and social abilities….Technology tools can help educators make and strengthen home–school connections." The statement ends with six recommendations.

Oregon State University. (2009). *Self-regulation game predicts kindergarten achievement*. *ScienceDaily*, June 9, 2009.

http://www.sciencedaily.com/releases/2009/06/090608162547.htm

According to this article, early childhood development researchers have discovered that a simple, five-minute self-regulation game not only can predict end-of-year achievement in math, literacy and vocabulary, but also was associated with the equivalent of several months of additional learning in kindergarten.

Prensky, M. (2001). *Fun, play and games: What makes games engaging*. In M. Prensky, *Digital game-based learning* (pp. 105–144). New York: McGraw-Hill.

http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Game-Based%20Learning-Ch5.pdf

This book chapter has sections on Fun: The great motivator, Play: The universal teacher, and Games: Adding the structure. It analyzes the different types of computer games.

Rapaport, R. (2008). *Serious gaming: Computer games become potent student motivators and evaluators*. San Rafael, CA: The George Lucas Educational Foundation.

http://www.edutopia.org/whats-next-2008-games-assessment

This article states, “Educational researchers are working with game manufacturers to create a new brand of "serious games" that have the potential to capture and stream the kind of important assessment data that educators can use comprehensively, from tracking individual student achievement to determining national educational trends.”

Raymer, R. (2011). *Gamification: Using game mechanics to enhance eLearning*. *eLearning Magazine*, 9(3). New York: Association for Computing Machinery, Inc.

http://elearnmag.acm.org/featured.cfm?aid=2031772

This article has sections on What is Engagement?, Setting Goals and Objectives, Provide Frequent Feedback, and Measure Progress.

Sajwani, S. (2013). *Assessment matters: Game-based learning to foster student engagement*. New York: The Joan Ganz Cooney Center.

http://www.joanganzcooneycenter.org/2013/06/11/assessment-matters-game-based-learning-to-foster-student-engagement/

According to this article, “Education, worldwide, is changing. There is a growing number of people who are looking at unique ways to keep students more engaged and increase their learning potential….One such way of increasing student engagement is through personal learning models, particularly through game-based learning and assessments. Scholars around the country are looking at ways that video games can be used in the classroom to facilitate learning as well as assess what students have learned.”

Shute, V., Ventura, M., Kim, Y. J., & Wang, L. (2011). *Assessing learning in video games*. Sydney: UNSW Press.

http://myweb.fsu.edu/vshute/pdf/SHUTE_ch10.pdf

The authors write, “In this chapter, we describe how well-designed video games can be used as vehicles to assess and support learning across a variety of knowledge and skills. We also present a framework for designing such embedded assessments into video games, and illustrate the approach with examples from a physics game. We conclude with our thoughts on future research in this area.”

Squire, K., & Ramirez, D. (2013). *Video games take learning to new heights*. Brooklyn, NY: Amplify.

http://www.amplify.com/viewpoints/video-games-and-learning

This article has five sections: Why Video Games?, Assessment and Data-Driven Teaching, Games as Preparation for Future Learning, Games in the Curriculum, and A Brave New World.

Steinkuehler, C. (2011). *The mismeasure of boys: Reading and online videogames*. Wisconsin Center for Education Research Working Paper No. 2011-3. Madison, WI: University of Wisconsin–Madison School of Education.

http://www.wcer.wisc.edu/publications/workingPapers/Working_Paper_No_2011_03.pdf

This is a report on a series of four investigations, the goal of which was to: (a) identify the digital texts that are used as a regular part of gameplay, (b) evaluate the nature and quality of such texts for reading, (c) compare adolescents' reading performance on such texts to their performance on school-related texts, and (d) assess these adolescents' performance on game text when they are allowed to choose the topic of the text.

The Concord Consortium. *Molecular Workbench*. Concord, MA: Author.

http://mw.concord.org/modeler/

On this website is Molecular Workbench software, which the site describes as: a modeling tool for designing and conducting computational experiments across science; providing an authoring system for instructional designers to create and publish model and simulation-based curriculum materials; delivering an interactive learning environment that supports science inquiry; and free and open-source. It says, "It allows teachers to create new activities and/or modify existing ones. It supports embedded assessments in learning activities."

University of Victoria. *Hot potatoes*. Victoria, British Columbia, Canada: Author.

http://hotpot.uvic.ca/

According to this site's homepage, "The Hot Potatoes suite includes six applications, enabling you to create interactive multiple-choice, short-answer, jumbled-sentence, crossword, matching/ordering and gap-fill exercises for the World Wide Web. Hot Potatoes is freeware, and you may use it for any purpose or project you like."

Vigil, R. L. (2000). *Getting the most out of online training: Integrating the missing ingredients*. *TechKnowLogia*, 2(4), 14–19.

http://www.techknowlogia.org/TKL_active_pages2/CurrentArticles/main.asp?FileType=PDF&ArticleID=143

Imagine a highly interactive, synchronous, internet-managed learning experience between distant locations over vast national and international networks, providing learners with an ability to obtain simultaneous distance learning services from their geographically dispersed organizations, schools and other colleagues. This article describes how a well-designed, integrated system can provide effective e-Learning solutions.

Willis, J. (2011). *A neurologist makes the case for the video game model as a learning tool*. San Rafael, CA: The George Lucas Educational Foundation.

http://www.edutopia.org/blog/video-games-learning-student-engagement-judy-willis

According to this article, "The popularity of video games is not the enemy of education, but rather a model for best teaching strategies. Games insert players at their achievable challenge level and reward player effort and practice with acknowledgement of incremental goal progress, not just final product. The fuel for this process is the pleasure experience related to the release of dopamine."

Wong, W. L., Shen, C., Nocera, L., Carriazo, E., Tang, F., Bugga, S., Narayanan, H., Wang, H., & Ritterfeld, U. (2007). Serious video game effectiveness. *ACM International Conference Proceeding Series: Proceedings of the International Conference on Advances in Computer Entertainment Technology*, *203*, 49–55.

http://www.acsu.buffalo.edu/~hwang23/Research/ConferencePapers/ACE07wongFinal.pdf

In this paper, the authors describe a comparative study that thoroughly investigates the effects of interactivity and media richness on science learning among college students. They also discuss important results and implications yielded from comparisons among four conditions in their experiment (game, replay, hypertext, and text).