Learning by Playing: Video Gaming in Education— A Cheat Sheet for Games for Health Designers

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CHILDREN PLAY GAMES to learn about the world around them. No longer limited to Red Rover and hopscotch, children have rapidly moved to the digital world to play games. Many of the fun, immersive, rewarding, and interactive elements of play remain even when a screen is inserted into the play space. *Learning by Playing: Video Gaming in Education* provides a snapshot of how videogames may enhance children's learning. The edited volume is a culmination of the "Academic Lessons from Video Game Learning: Screen2Screen" conference hosted in October 2010 by the book's editor, Dr. Fran Blumberg, at her home institution of Fordham University. Reading the book's author list indicates the interdisciplinary nature of the content, with 22 chapters from 52 experts in communication, computer science, developmental and cognitive psychology, game design, education, policy analysis, and statistics. Even a high school biology teacher weighs in.

Educational games with traditional academic outcomes were the focus of the conference and textbook, so the book is brimming with examples of games that improve literacy or math skills in a traditional classroom setting. Outcomes of interest include cognitive health, neural plasticity, executive functioning, motor skills, spatial imagery, visual processing, and auditory processing, as well as teaching science, technology, math, and literacy lessons that directly relate to school curriculum.

Game designers who are more interested in changing behavior than improving test scores, however, should not be dissuaded. Here I provide a "cheat sheet" guide for health game designers who wish to garner golden nuggets from *Learning by Playing* that can be adopted from the educational games research. First, I highlight select chapters that have direct relevance to those who want to change health behaviors via digital games. Second, I coalesce key "take home" messages from the entire book, drawing attention to particular sections that may pique a health game designer's interest.

Especially Relevant Chapters for Games for Health Designers

"Do video games provide motivation to learn?" (Chapter 6)

In my view, the most relevant chapter for games for health designers is authored by a team from Fordham University and Syracuse University, led by Dr. Akane Zusho. This chapter is devoted entirely to the theoretical explanations, coupled with empirical evidence, that explain what makes a videogame motivating. There are clear implications in this chapter for game designers hoping to change behaviors. Dr. Zusho and colleagues explore several theories, including self-determination theory, passion theory, and uses and gratification theory, to examine how digital games may satisfy the player's basic psychological needs and create an intrinsically motivating experience. Tapping into these intrinsic motivators is paramount when a game designer is hoping to promote continuous gameplay during exergaming for sustained physical activity, or when a game designer is providing repeated exposures to healthy food choices within a game to prompt healthier eating habits. The chapter largely focuses on the player's expectancies during gameplay, explaining that a player must find the game important, useful, interesting, and enjoyable and that there must be variety and novelty to entice continued gameplay. Allowing the player to create concrete and manageable goals, then providing clear feedback as the player progresses to the goals, is further motivating. Also, the authors comment on the social comparison within gameplay as a potential detriment to motivation, if the comparison leads to embarrassment or penalizes players because of poorer performance. On the flip side, positive interaction guided by a caring, involved teacher or mentor can create a positive experience.

"Game design perspectives: How should we design educational videogames?" (Chapters 10–13)

An entire section of the book is devoted to the design of games for learning, so these chapters are chock-full of practical guideposts for the design of well-crafted, evidence-based

games. As Dr. Celia Hodent of Epic Games begins this section, “Humans are the most playful creatures of the animal kingdom.” By tapping into the emotional engagement of gameplay through interesting storylines, pushing players beyond their zone of proximal development (a theory by Dr. Leo Vygotsky), and leveraging the social interaction inherent in gameplay, designers can build more relevant, immersive games. Dr. Hodent even provides a list of questions that game designers should ask before designing a game, in order to encourage players to enter the “flow” state (pp. 152–153).

A key message in this section is that game designers should partner with academics in order to use formative research and scientific theory as a guide. Chapter 12 explicates this game designer/researcher partnership with an actual example of research-led game development. This point is especially relevant considering game development is no longer limited to big industry—publishing mobile games, for instance, can be done at a very low cost and low skill level given that accessible and affordable developer kits are now available (Chapter 11).

*“Electronic game changers for the obesity crisis”
(Chapter 15)*

My colleagues and I contributed a profile of the potential for games to combat childhood obesity. Along with Dr. Sandra Calvert of Georgetown University and Dr. Bradley Bond of University of San Diego, we use a social cognitive theory framework to describe how gaming may both be implicated in the obesity crisis and combat the obesity crisis by teaching healthy eating habits and encouraging physical activity. Online advergames are the focus of the healthy eating section, and we describe a study conducted at Georgetown University where children were conditioned to choose healthier snacks after their PacMan character was rewarded for eating virtual healthy snacks. Exergames are the medium discussed for the physical activity section, with a focus on the social aspects that may elicit higher involvement and therefore energy expenditure, as well as the potential for exergames to teach sports skills that may be transferred to authentic play (although both topics are underdeveloped in research).

“Perceptual and cognitive effects of action video game experience” (Chapter 3)

Dr. Shawn Green of the University of Wisconsin, Madison, contributed a chapter on the utility of digital games to promote cognitive health. Dr. Green is an excellent choice to provide this overview, given his and his colleague’s Dr. Daphne Bavelier’s extensive work documenting the cognitive outcomes of action (i.e., “first person shooter”) videogame play. Although focused on cognitive change not behavior change, Dr. Green’s overview of the literature provides foundational knowledge for games for health designers to understand the perceptually salient and attractive aspects of digital games. Digital games immerse players with sensory information that leads to physiological and cognitive arousal. For instance, temporal and spatial unpredictability and the demand for quick reaction time make games engaging and challenging. It is important that the author dissuades educational game designers from using a “chocolate covered broccoli” approach—in other words, using “practice-makes-perfect” repetitive structure when teaching educa-

tional content, which will lead to a rather boring game. Similarly, games for health designers should capitalize on the sensory stimuli and the rapid pace of gaming to keep players interested and on their toes.

“Relations between video gaming and children’s executive functions” (Chapter 4)

As a segway from Dr. Green’s synopsis, Dr. John Best of the University of British Columbia further explores the effects of videogaming on cognitive outcomes, and he actually devotes 3 pages to the potential for exergames to impact cognition. Relevant to behavior change, gaming may impact inhibitory control in positive or negative ways. For instance, children may overeat while playing sedentary videogames. Yet digital games require that a player overrides automatic impulses in order to make correct choices in a constantly changing digital environment. It remains to be seen whether improved inhibitory control within a gaming context transfers to better inhibition when faced with tasty but sugar-laden snack foods. Dr. Best also explicates the relationship between physical activity/fitness and the executive function demands of gaming. Specifically, he highlights the limited research indicating that the activity of exergame play appears to improve a player’s executive functioning skills, as well as cross-sectional data that show an association between children’s fitness and higher executive functioning. Similarly, Chapter 21 provides an extensive literature review of games that enhance information-processing skills, and a few health-oriented game systems (e.g., the Nintendo Wii) make the list. Yet still, changing behavior by improving executive function skills remains an untapped potential for games for health designers. Will improving a gameplayer’s planning, organizing, strategizing, spatial management, and attention subsequently transfer to healthier habits and impulse control outside of the game?

Key Themes for Game Designers Interested in Changing Behaviors

1. Serious games are (often) boring

It is difficult to create a serious game that excites a child or adolescent, particularly because the market is flooded with commercial products that are sophisticated and appealing but largely lack a serious games focus. Yet many elements of the commercially successful games can be incorporated into serious games and games for health—including fantasy, challenge, interactivity, agency/control, feedback, and immersion/flow. As noted in Chapter 5, aspects of digital games would make for an ideal learning environment, including lack of fear of failure, leveling up, acquiring mastery skills, and behavioral persistence that produces lengthy time on task. The formal features of gaming, which are the production techniques used to engage attention and encourage interactivity (Chapter 8), provide perceptual salience. Although most often auditory or visual, salient techniques may also be kinesthetic, such as in an exergame when the player’s body controls the on-screen activities. Chapter 19 provides hints to designers on how to craft a motivating game, such as by creating real-life simulations with a touch of fantasy, using leader boards to incentivize competition, and following the MUSIC model of academic motivation (make learners feel

eMpowered, make content Useful, make players Successful, ensure they are Interested, and promote Caring within the play environment). The “take home” message is, if a game is boring, it will not be played.

2. Games should match player skills and interests

As Dr. John Sherry of Michigan State University states eloquently in Chapter 8, games will be motivating when designers have balanced the cognitive demands within an attractive, challenging environment that aligns with the player’s expectations and experiences. It is difficult to create gaming content that will match each individual player’s skills. If a game is too hard or too easy, the player may be disillusioned and unmotivated to play. Although the author focuses primarily on traditional learning outcomes, this observation may hold true for teaching sports skills, disease self-management, or other health lessons. Taking into account the skill level and developmental stage of the player is also essential to achieve what some call “pace matching”—that the pace of learning in the game is appropriately challenging for the player (Chapter 9). Achieving the right challenge will involve a gradual progression in the game toward goals (Chapter 5), as well as extensive opportunities for practice and feedback as the player improves (Chapter 9).

Games should also seek to fulfill a variety of players’ interests. Chapter 18 describes research indicating a variety of factors that may influence a player’s gaming experience. Players are embedded in an environment external to gameplay—impacted by individual attributes like gender, age, personality, and mood as well as situational attributes like relationships with other players, household or worksite rules restricting gameplay, or limited access to games because of financial resources. The concluding chapter of the book (Chapter 22) draws this point together well with the lens of Bronfenbrenner’s ecological systems theory, discussing how these individual factors will certainly influence a player’s gameplay experience and should not be ignored by designers or researchers.

3. “Let science inform design”

The best line of this book, in my mind, is “let science inform design,” written by Dr. Sherry (Chapter 8). Indeed, game designers would benefit from immersing themselves in the scientific evidence covered in *Learning by Playing*, the *Games for Health Journal*, and other academic sources, to move beyond using personal experience or intuition to design games. This tenet is echoed by Dr. James Bachhuber of the Center for Children and Technology (Chapter 12): that academics build games based on psychological or pedagogical theories, whereas designers often use their own “hunches” in game design.

A refreshing aspect of the book is it is steeped in theory—appropriate from an educational lens. Uses and gratification theory focuses on how people use media to satisfy their needs (Chapter 8). For instance, a gameplayer may approach a game for escapism, to relax, to form a social relationship

with another player, or merely to pass the time. Understanding the various reasons that players are drawn to games can help designers to use a variety of engaging experiences that address each individual’s needs. Dr. Douglas Gentile of Iowa State University and his colleagues (Chapter 9) further describe learning theories from psychology, including habituation, classical conditioning, operant conditioning, and observational learning, that designers can use to elicit behavior change, at least while the player is actually playing the game. Other theories explored in the book that are certainly relevant for games for health designers include social cognitive theory, social determination theory, and interest theory—all used to tap into what motivates a player to want to play and how gameplay affects a player’s outcomes related to learning or behavior change.

4. Can we really transfer skills from the game to the real world?

Nearly every chapter touches on the potential for digital games to encourage transfer of skills from the game to the real world. Dr. Gentile in Chapter 9 provides a particularly cogent description of the unconvincing evidence that transfer is possible—and in fact is quite rarely achieved. If a specific behavior change is desired, then the game should target these specific skills for deliberate practice in order to expect transfer outside of the game, and even then there is little literature indicating that specific skills learned in the game will transfer to behavior external to gaming (Chapter 7). Chapter 2 provides multiple tables to illustrate a taxonomy for transfer skills, which may be useful for designers to consider how the game elements may lead to the ultimate behavior goal. Chapter 13 by Dr. Debra Lieberman and colleagues at the University of California, Santa Barbara, provides an extensive discussion of different dimensions of transfer, as well as specific elements of videogames that can teach transfer, can motivate and build self-confidence in the player, and can teach self-monitoring through continuous assessment and feedback (pp. 192–195). Designing games that carry over across multiple media platforms may provide further opportunities for transfer, particularly through coherent narrative and convergent media that reinforce the health message or desired behavior (Chapter 14).

In summary, as Dr. Gentile states in Chapter 9, “Games are natural teachers, and gamers are natural learners” (p. 139). Now it is up to the game designers, with support from researchers, to design games that can teach healthy habits that a player will actually incorporate into daily life.

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