What Is Game-Based Learning? Past, Present, and Future

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This article aims at clarifying and conceptualizing game-based learning (GBL) in order to pinpoint directions for practices and research. The authors maintain that GBL should be conceptualized toward the transformation of a textbook-learning culture. The authors emphasize the importance of a paradigm shift in learning and a reorientation in conceptualizing GBL. To support this argument, the authors present four types of games for learning and three GBL models. The taxonomy provides a channel for thinking about the past, the present, and the future of GBL. The authors hope that it also serves as a convenient and useful thinking tool for teachers, school leaders, policy-makers, and researchers.

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Learning with Games: Then and Now

If you considered using digital games to help your students learn in 2003, perhaps most people would have thought of you as a maverick and unconventional, though it was not entirely inconceivable. It was the year pioneer education game researcher James Paul Gee published *What Video Games Have to Teach Us About Learning and Literacy* (Gee, 2003), a seminal book cited more than six thousand times in twelve years. At the same time, the term "digital native," coined by renowned game researcher Marc Prensky, was still peculiar to the public. Google in the meantime had just emerged from the battle of the search engines to offer innovative and speedy approaches to access information and contents. One year later, Web 2.0 began to increase its impact on the Internet. Facebook and other social media also launched. The year 2003 was not just a monumental year for game-based learning (it will be referred to as GBL from here on); it was a milestone year for social media and the information age.

Today, a decade after Gee's influential work on the design of games for learning, if you consider using digital games in your classrooms, chances are that people would not be surprised by your decision. Instead, they look for clarification, as if they have also come across a similar idea.

At Canberra Primary School in Singapore, noted for being an early adopter for using games to teach, the Principal and Head of Department in Science will ask more questions regarding your instructional objectives, lesson plan, pedagogy, logistical support requirements, and learning outcome assessments. What subject is this game about? What activities have you considered to go with the game? How do you evaluate students' learning? In the States, some teachers may even share their experience using games in the classrooms with you.

A recent survey published by the Games and Learning Publishing Council suggests that 55% of nearly 700 teachers have students play games at least weekly (Takeuchi & Vaala, 2014). The amazement and amusement that come with using games for learning in formal learning settings are virtually gone, replaced with requests for clarifications about concrete action plans, cost, scalability, and sustainability.

Indeed, clarifications on GBL are vital, as we look for directions to move forward. Though we now have more than a decade of fervent research on, and practice in, conceptualizing and using games as a teaching and learning approach, it is often obscure when researchers or teachers say that they are taking up a GBL approach to improve learning. What are their views on learning? What are their views on GBL?

About This Article

In this article, we maintain that GBL should be conceptualized toward the transformation of a textbook-learning culture. Games as an interactive medium afford the design of two essential learning components for higher-order thinking and social skills—authentic problem-solving contexts and guided participation (Brown, Collins, & Duguid, 1989). We articulate *four types of games for learning and three models of GBL*. Based on the classification, we pinpoint the future design direction.

Four Types of Games for Learning

Games have been promoted and used to help people learn for at least four major reasons—*motivation, drill and practice, content mastery,* and *21st century competencies*. For the convenience of discussion, we will refer to them as motivation games, drill and practice games, content mastery games, and 21st CC games.

Motivation Games

Motivation games refer to games that engage students in the behavior of learning desirable content or information. The *fun* element associated with games is a major point of interest when researchers and practitioners introduce games to schools. Indeed, MIT researcher Malone (1981) provided a sound argument for doing so, maintaining that players/learners are motivated by *challenge, fantasy,* and *curiosity* in games. But fun is not the only reason for using games. Some researchers and teachers use games in the classroom because students, being digital natives and growing up with interactive media, are simply far less interested in texts and graphics that they cannot interact with. Empirical studies suggest that games can foster higher intrinsic motivations in the game-based environment (e.g., Tüzün, Yılmaz-Soylu, Karakuş, İnal, & Kızılkaya, 2009) and motivate students to learn via competition (e.g., Burguillo, 2010). However, it is often equivocal if students are really learning when they feel motivated in a GBL setting. Enhanced motivation can be the result of having more freedom to chat with others or being able to deviate from routine tasks.

Drill and Practice Games

Drill and practice games refer to games that foster the acquisition and familiarization of ready-made content. Before using drill and practice games, teachers taught content, information, or concepts using other instructional materials, such as textbooks. Therefore, drill and practice games are more like gamified assessment books in digital or non-digital format. They are often used to engage students in repetitive practices. These games, such as math games that boost skills and speed for addition and subtraction, are well accepted in classrooms because of their close alignment with mainstream curriculum and instruction. Though popular among teachers interested in GBL, they usually are not designed for learning new concepts and have little to do with higher-order thinking skills.

Content Mastery Games

Content mastery games refer to games that facilitate the mastery of information, facts, concepts, or canonical knowledge. Content mastery games are usually informed by research about human cognition and instructional design. They employ simulations, representations, and gaming features to facilitate the mastery of complex ideas and skills. For example, *Supercharged*, an electromagnetism simulation game (Squire, Barnett, Grant, & Higginbotham, 2004) helps students develop intuitive understandings of abstract physics phenomena. Like drill and practice games, content mastery games are closely aligned with the mainstream curriculum and instruction models, so they already have a place in schools. Unlike drill and practice games, they address challenging issues in learning, such as misconception. Content mastery games can be the building blocks of a GBL paradigm, as they build the foundation for learning.

21st Century Competency Games (21st CC Games)

21st CC games refer to games that foster higher-order thinking and social skills, such as problem-solving, inquiry, argumentation, systems thinking, and collaboration. To foster these skills, 21st CC games situate players in authentic contexts with genuine problems. Coupled with guided participation from games, teachers, or capable peers, players construct personally meaningful ideas about these abstract skills. Unlike content mastery games, 21st CC games are informed by cognitive science and context-laden learning theories, such as situated learning, cognitive apprenticeship, and knowledge building. For example, based on situated argumentation design constructs, Jan (2009) designed *Saving Lake Wingra*, a ten-day argumentation curriculum with a mobile augmented reality game. Although 21st CC games embody very different views on learning, they are particularly challenging to take up in mainstream schools (Jan, Tan, & Chen, 2015). Even if they are readily available as curricular packets for schools, teachers might not have the expertise to use them.

Table 1 is a brief synthesis of the above classification.

Three Models of GBL and Implications for Learning

Much like the different types of games for learning, the perspectives on what count as *GBL* are equally

Table 1. A taxonomy of GBL based on learning objectives.

Games for Learning	Major Design Constructs	Characteristics
Motivation games	Motivation theories, content theories, etc.	The fun element attracts researchers and practitioners to use them, but it is often equivocal if students are really learning when they feel motivated in a GBL setting.
Drill and practice games	Behaviorism	Their alignment with traditional schooling practices makes them a popular choice for practitioners, but they don't really teach important concepts.
Content mastery games	Behaviorism, Cognitive Science, Instructional Design	They can be textbook killers, as they are more appealing and can be more effective ways to learn 20th century literacies.
21st CC games	Cognitive Science, Sociocultural Learning Theories	They hold the potential to transform the mainstream learning, and it is the very reason they are misaligned with mainstream learning.

diverse. In the following, we synthesize three ways GBL is conceptualized. We will discuss their implications for learning in mainstream schools.

GBL as a Learning Approach Driven by Game Technologies

The first view conceives GBL as a learning approach driven by game technologies. It asks how digital and non-digital games, such as commercial off-the-shelf video games or card games designed by educators, can help young people learn. This view often assumes that learning occurs predominantly *as the result of* and *within* game play. Therefore, ideal learning experience takes place when players can play a game at their own pace and learning style. Through self-directed game play, players develop understandings of abstract concepts or systems thinking without intervention from teachers. Such games are not ideal for mainstream schools, as they interrupt regular school activities. At the same time, players will not be able to control their pace of play and playing style. As a result, the game as a medium might be the same, but the *play* is profoundly altered by the prevailing schooling culture.

GBL as a Learning Approach Driven by Both Game Technologies and Corresponding Pedagogies

The second view perceives GBL as a learning approach driven by both game technologies and pedagogy. Learning does not take place only within a game, but also through guidance from teachers, interaction with peers, and other sources. Therefore, it is indispensable to conceive the game and the pedagogy as inseparable entities for the second GBL. The view of GBL as both a technological and pedagogical innovation seems like an ideal model for schools, as most learning activities in schools involve teacher guidance and the use of technologies. The reality, conversely, often suggests otherwise.

Schools often bring a game to the classroom without well-articulated pedagogy and the capacity to design appropriate activities. Teachers are often asked to come up with the pedagogy and activities, but many are not up to the challenges, because they are mostly not trained to do so. A common issue is that teachers use a game for what it is not designed for. For games that should be played by the students alone, teachers often intervene by teaching students how to play successfully. For 21st CC games that are designed as interactive systems *with little content knowledge, they bring extra information from textbooks to the table* in order to cover content. The results are that both teaching content and fostering 21st CC are compromised.

GBL as a Pedagogical Approach Informed by Game Design Concepts

The third view regards GBL as more of a pedagogical/learning innovation informed by game design principles. This view employs game mechanics and game design thinking to design learning environments, turning the learning setting into a game. Role-playing, challenges, competition, and reward systems are some of the common game features employed to "gamify" learning contexts, such as online learning communities.

The view of GBL as a pedagogical innovation appears to be a more plausible approach when costs, logistics, and scalability are considered. Indeed, when James Paul Gee published *What Video Games Have to Teach Us About Learning and Literacy,* his foci was on how the *design principles* from many good games may inform learning. Drawing from cognitive science and sociocultural learning theories, these good learning design principles are equally inspirational for commercial games and learning experience in schools. Though it is still underexplored, there is rich potential

Table 2. Three GBL models and their relationship with learning and schooling.

GBL Models	Relationship with Learning	Relationship with Schooling
GBL as a learning approach driven by game technologies.	Learning takes place as the result of game play.	More suitable for self-directed learning.
GBL as a learning approach driven by both game technologies and corresponding pedagogies.	Learning takes place as the result of game play and associated activities.	Most popular GBL model in schools, but there is a need to advance teachers' design expertise.
GBL as a pedagogical approach informed by game design concepts.	Learning takes place in gamified learning activities.	A promising GBL model for schools but there is a need to advance teachers' design expertise.

to employ theory-informed game design principles to make classrooms good games (e.g., Jan, 2009; Jan, Chee, & Tan, 2010) that foster content mastery and 21st century competencies.

Table 2 briefly summarizes the above.

Transforming a Textbook-Learning Culture with Games

Textbook-Learning Culture

The mainstream education systems have been designed to maximize efficiency of basic content mastery—a much needed 20th century literacy for an industrial society. Teachers' professional development, compartmentalization of subject content, curricular plan, configuration of classroom, didactic teaching approach, and summative assessments all have been designed, calibrated, and streamlined to achieve this goal. The textbook was an indispensable technology and the foundation of a content mastery learning paradigm. A textbook-based learning model is deeply intertwined with how teachers learn to teach and what students learn to learn. It enculturates key stakeholders— students, parents, teachers, school leaders, and policy-makers—to believe that content mastery equates to learning. The more information students acquire, the more they have learned. Through the enduring textbook-based learning practices, a textbook-learning culture is reproduced and reinforced to become a dominant lens for learning, even in the early 21st century. Through this epistemological and cultural lens, the public defines the norms for education, teaching, learning, assessment, schooling, and the use of innovative technologies such as games.

The Transformative Power of Disruptive Technologies

The education and schooling model that the public is accustomed to may not be taken for granted any longer. The scarcity of content knowledge and information, a major education issue in the 20th century, is rarely an issue today due to the information revolution. In the age of Web 2.0 and 3.0, high-quality content is now freely available on YouTube, MOOCs, blogs, Wikipedia, etc. Learners of different ages, learning styles, and educational backgrounds have plenty of choices to access the content that suits their learning goals. Many can even become content area experts without formal education. This was hardly imaginable just two decades ago.

Besides its accessibility and affordability, content knowledge and information become out of date fairly quickly, eroding the education landscape built upon a prolonged content-mastery model. In this flat new world, one's ability is not defined by what he or she knows. Instead, emphasis is placed on the ability to construct new knowledge, solve problems, collaborate with others, organize activities, and manage communities (Jan & Tan, 2013). These skills were less critical in an industrial society, so they are seldom taken seriously in the textbook learning culture.

GBL emerges from the recognition that content-mastery is insufficient, though still important, for a flat new world full of changes and innovations (Shaffer, Halverson, Squire, & Gee, 2005). It does not mean that GBL cannot be or should not be used for learning content, if there is a good fit. It does not negate the fact that games are fun and can be used to motivate learners to play and learn. However, using games simply for motivation, drill and practice, and basic content mastery underestimates what GBL can be and do for education.

Designing 21st CC Games

Situating GBL in the quest for 21st century competencies provides a fitting and meaningful direction to promote GBL in and out of schools. The challenge is: how do we design good GBL, and how do we conceptualize the *new* learning?

Instead of providing *contents* for learning, games may be designed to provide rich and meaningful contexts deemed essential for higher-order thinking and social skills to develop (Squire, 2006). To develop 21st century competencies, there is a need to shift the focus of teaching from giving direct instruction with ready-made contents to designing authentic problem-solving contexts and providing guided participation (Brown, Collins & Duguid, 1989; Rogoff, 1990; Thomas & Brown, 2011).

Games situate players in designed problem space;

players are learners who must develop the intended problem-solving skills to tackle the challenges (e.g., Squire & Jan, 2007). For example, a *Rain Forest Mystery* game may pose a challenge (such as demystifying the disappearance of an insect in a rain forest) and demands that players, role-playing as a team of entomologists, collect and interpret data, identify relevant evidence, and jointly develop hypotheses in order to solve the mystery. This designed context can be modeled based on authentic rain forest studies so that the context, activities, and challenges can be authentic. The *Rain Forest Mystery* game, which can be designed based on any of the three GBL models proposed earlier, constructs an authentic inquiry process through which players develop not only explicit and tacit knowledge about an ecosystem (the rain forest), but also the identity, discourse, and collaborative problem-solving skills of scientists at the same time (e.g., Jan, Chee & Tan, 2010).

In a textbook-learning culture, students would have learned about the rain forest in the following fashion: Ready-made science content about the rain forest is concisely delivered in a textbook. The inquiry process through which the ready-made science is constructed is purposefully left out, as there might be irreconcilable views about the rain forest. Therefore, science is codified and mystified in the textbook and in the ways science is presented in the classroom (Kelly & Crawford, 1997; Lemke, 1990). Collaborative problem solving among students would have been seen as cheating instead of learning, because learning is believed to be an individual cognitive process. It demonstrates an extremely efficient factory model of learning. It takes far less time to cover the content than using an inquiry method. Students are promised to have "acquired" more knowledge than those engaging in and enacting in a scientific inquiry process via the *Rain Forest Mystery* game.

On a traditional multiple-choice exam that tests memory skills, students learning from textbooks and direct instruction can perhaps outperform those learning with the *Rain Forest Mystery*. The difference is, the *Rain Forest Mystery* game helps players develop collaborative problem-solving skills, while talking and demystifying science. Which of the above students would you hire or work with? Who are equipped with better tools to participate in a democratic society? Who are more likely to lead an ever-changing world?

Teachers as Designers

In articulating a learning paradigm shift from content mastery to 21st century competencies with GBL, we cannot afford to bypass teachers, assuming that games alone can take care of the learning business. What are the new roles for teachers? When we view a game like the *Rain Forest Mystery* as 'designed authentic problem-solving contexts' where players develop higher-order thinking skills, social skills, and identities as problem-solvers, what do teachers do?

In a textbook-learning culture, teachers usually play the role of content experts who deliver the content knowledge. In a learning-through-designed-context model, teachers guide students to develop higher-order thinking and social skills through practices and processes, such as inquiry. Therefore, there is a need for teachers to understand how learners develop higher-order thinking skills and soft skills in a designed context.

In the case of *Rain Forest Mystery*, teachers are de facto designing learners' experience by designing an authentic problem-solving context with a rain forest. Teachers are more like *game designers* than content experts. In other words, teachers will have to learn to think like learning-context designers. This is an area that requires much more substantial research—understanding what teachers need to know to become a classroom game designer and how we may help teachers to develop such expertise via teacher education and on-the-job professional development.

Quest for a Learning Paradigm Shift

In framing GBL as a 21st century learning approach, we emphasize the importance of a paradigm shift in learning and a reorientation in conceptualizing GBL. To support this argument, we have presented four types of games for learning and three GBL models. The taxonomy provides a channel for thinking about the past, the present, and the future of GBL. We hope that it also serves as a convenient and useful thinking tool for teachers, school leaders, policy-makers, and researchers.

As the shift of learning paradigm must occur within the current incompatible paradigm, we have already witnessed growing pedagogical, technological, logistical, social, and cultural contradictions (e.g., Zuiker & Jan, 2012). The contradictions are most noticeable when good games (such as 21st CC games) storm the classrooms. Perhaps this is why GBL is often taken up for motivation, and drill and practice. They don't rock the boat; but the boat may not be traveling in the right direction. □

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Game Remains: A Platform Design Grounded in Indigenous Knowledge Systems for Dialogue and Composition Play

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This article reviews the design and implementation of a game as an instrument for dialogue, both as a social tool and a shared interface for music performance. Beyond describing the design of *Game Remains,* the article shares the details of an impact story of how an installation in Guelph's Musagetes Boarding House Arts in Canada has supported community action and transformation efforts.

Introduction

In this article, we offer an alternative way of framing STEM that is rooted in indigenous knowledge systems (IKS). In mainstream learning environments, inquiry is mostly concerned with the individual's needs, development, and acquisition of knowledge. This focus on individuals often ignores the aspects of inquiry that are embedded within the communal aspirations, norms, and goals within which the inquiry takes place. This is not to

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