Chapter 2
What Is (and Is Not) a Learning Game?

Abstract This chapter examines how learning games are defined theoretically and pedagogically. It explores the relationship between simulation and game through examples from commercial and academically produced digital tools. Concepts of virtual vs. real and media vs. method that continue to be central concerns in the field of learning technologies are also discussed.

Keywords Learning games • Definitions • Philosophy • Education • Media vs. method • Simulation • Real vs. virtual • Design • Development

Part of the goal of philosophy is to define the boundaries of a phenomenon or concept. With this in mind, a few years ago we wrote an article seeking to define what learning games, simulations, and virtual worlds are and how we can discriminate among these terms. At the outset, we stated a fundamental problem with the field of learning games:

> Within the broad fields of educational theory and research, there exist numerous definitions and understandings about what games and simulations are. This often results in miscommunication regarding such fundamental concepts such as (a) what they are, (b) what they can do, and (c.) how to employ them in an effective manner.
> (Warren, Jones, Dolliver, & Stein, 2012, p. 1)

This has not changed in the articles we have reviewed in the intervening years. There is a group of authors who define "game," but tend to do so by drawing from commercial gaming books written by folks like Salen and Zimmerman (2004) or Chris Crawford (2003). This is fine as a foundation and we have done so ourselves (Warren, Dondlinger, Barab, and Stein, 2009; Jones & Warren, 2008). Unfortunately, many authors simply state this commercial definition and go no further.

Authors in the first group also often fail to provide direct explanation of elements necessary to make a game more than simply entertaining. There is no description of how their development is expected to influence learning through particular media or psychological features. Without a detailed explanation of the treatment mechanisms that are peculiar to learning games or games in general, there is little credibility to an approach that simply adds game features without linking them to learning concepts.

A second group of authors, while dramatically fewer in number, referred to other academics' definitions that explained how they tied learning principles to game play

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and the psychological principles that explain how one is expected to learn from and with games. However, most of these authors do not attempt to synthesize new and improved definitions from those. In order to improve these, which we believe is central to the academic endeavor of philosophy (and keeping in mind that many designers at universities have doctorates in philosophy), we grow the field's understanding of games, adding to the knowledge base through research and theory work.

A third group offers no definition at all, vaguely claiming their design is a game or "gamified," with no explanation of what they believe a game is. There is also rarely description of how they designed it, again failing to tie learning principles to game mechanics. Instead, they simply say: this is the game treatment, here are the statistical outcomes, and they were significant based on data collected and our set p-value. There is no clear connection to particular game learning mechanics. The authors say, because the numbers showed positive results this one time, you and everyone you know should use games for learning and teaching. However, the numbers are often un-explicated and rely on the reader to interpret and their meaning is often unclear. As academics ourselves, such claims, tied to limited evidence and explanation and with little proper argumentation, are maddening.

2.1 What's in a Name? Defining Games

So, what is a game? To deal with this knotty question, one must first acknowledge that any of today's games are a multimedia platform, not a single medium of delivering the experience. The average game is made up of many forms of visual stimulus (i.e., still and moving video, still images, text) and audio (i.e., speech, music) of an astonishing quality that would make a 50-year-old John Williams green with jealousy even as he stacked his Star Wars money in his basement vault with a forklift. (We have no idea if this is true about the forklift and the money, but that would be awesome, and recording equipment back then was not spectacular and very expensive.) The interactive qualities that exist in the space between player and system change the experience each time a button, trigger, or stick is pressed or moved in ways that are sometimes unpredictable.

2.1.1 The Media vs. Method Issue

It is important to acknowledge that most games today, with a few exceptions, are not what researchers like Richard Clark (1983, 1994) studied back in the 1970s and 1980s in our field; that is, a single medium compared with another to test its effectiveness to improve learning. Rather, today's video games are a set of interrelated mediums, each with their own particular psychological impacts on human beings, either in segmented moments or as a whole experience. This differentiation of experience results from each user interacting differently with multiple media delivery affordances in the system (i.e., audio, video), possibly a narrative containing affective and language components, and each having fundamentally different immersions based on their past experiences with games, content, and cultural experience.

This does not make Clark's findings less relevant. Instead, it points to a failure of much of the research in this area to recognize that the confounding factors come from intentional freely made player choices, forming what appear to be seemingly random experiences that impact learning outcomes of each player. Each time one interacts with a game, they learn new strategies and tactics from the experience. As a result of this change from learning, they are not the same and the next game play should also be dissimilar, but familiar. This is because our lived experiences leading to that new moment are different, meaning our knowledge and skills have changed, our moods changed based on what happened that day or immediately before we sit down to play. Therefore, our choices will often be different, making the next game experience for each individual different.

2.2 How We Define a Learning Game and Why

With all this said, we still have not proffered our own definition, but we will. It is important for the reader to understand why our definition is what it is and from where we derive it. Part of the goal of an academic endeavor is not to just make definitions up on our own, but, rather, to understand from where they evolved over time, how and why they evolved, and how they lead us to where we are now. It is tempting to just say something is what we want it to be, because that is easier, but it lacks any sort of validity or ties to an externally agreed upon reality. It also makes it nearly impossible to compare, for example, several constructs called "games" when their underlying structures may be so fundamentally different that it amounts to comparing apples, to oranges, or as mentioned earlier, hand grenades. We may also miss out on the commonalities we agree upon about what a game is that allow us to improve our design treatments over time. So, we start with our naïve attempts to synthesize a definition of learning games from both commercial and academic sources into something coherent. For us and our educational focus, we believe one must start with the concept of simulation.

2.3 What and Why Simulation?

Before we can meaningfully talk about educational games, another concept has to be elucidated as *learning* games rely upon principles to allow for transfer between the play activities and real-world tasks. We believe that any learning game must include a reasonable representation of the reality of anything we want students to be able to do out in the real world or they offer no ability to accurately move practice to real activity. That is where the concept of simulation becomes important.

The idea of simulation can today be traced at least to biblical Ur, the Indian Vedas, and other early civilizations seeking to understand their reality, how to communicate it to others, and come to shared concepts of truth (Cubitt, 2001). Socrates and Plato considered ideas of *eidolon* or simulacrum, where the reality stems from the pure world of ideas, but that humans can only know an imperfect copy of any object (Plato & Lee, 1955). From this starting point, we agree upon which is most accurate as a group, what Habermas (1984) might call intersubjective agreement among social peers. In our field, while many other definitions preceded it, modern conceptions of simulation may be traced to the simplicity of that offered by Pearce (1997) who described it as: "(a) simulation is a model of a system (p. 14)." While this was not specifically for educational simulations, its simplicity is admirable and it reveals a core idea helpful to learning: any simulation is not a model of a *single* process or event; rather, it includes *all* system interactions if it is to be educationally useful, and the more it corresponds to the real, the better.

This is a heads up to the reader: both authors grew up in the 1970s and 1980s when early learning games became available on the Apple II and IBM 80286, so we will use them as examples throughout. This is for a few reasons including that we are familiar with them and they shaped us into the people we are today. Further, they were simple enough to explain the basic principles of learning from games that are often covered up by the bells, whistles, and complexity of today's games. It is important to start with base principles, rather than jump ahead to today's games, so that any of us can build our own successful, which we have argued elsewhere (Warren, Jones, & Trombley, 2011).

Therefore, going back to earlier pieces since we already talked about Pong and Space Wars elsewhere, *Lemonade Stand* by Bob Jamison is a good example to employ here. A business simulation that was primarily played by children was a game with the Apple II+, it was one of the first Scott played at around the age of six when his dad came home with their new computer at Christmas 1980. His mother, the Montessori teacher, was concerned games like *Choplifter* would rot his and his father's brains; however, a simulation of a childhood lemonade stand would simply replicate the experience of running a small business. The elements were simple and reflected core small business principles regarding cost-benefit ratios, supply vs. demand, profit-loss, and a few other variables that a business owner must consider. The user bases decisions on the daily weather report, determining how many glasses to make, the cost of each glass, and how much advertising to do that day. The program would then simulate the variables to determine the end profits based on user inputs and provide a report. Certain variables such as thunderstorms could wipe out all profits and create a loss, similar to what might happen with a real lemonade stand. That stand itself may be seen to represent other small businesses, but with less complexity to teach basic business principles. Again, as Pierce proposed, it simulated system interactions that one would normally expect to find in a traditional lemonade stand in a suburban neighborhood. However, it did so in a simplified fashion, in part because of the difficulty of programming a large number of variables to represent more complexity. It was also likely in part because its target audience sought basic principles rather than something on the order of today's *Civilization* series with its millions of variables.

To expand and contrast these ideas to some of the views of others that we do not necessarily disagree with nor have enough data to agree with, we look to Becker and Parker (2009). They gave an example of a solitaire card game played in the real world. When done with physical cards, the authors stated that this is qualitatively different from handling digital cards with a mouse or trackpad, even if the virtual and real represent the same idea. The authors discriminated the analog version from the digital by noting what is different about the two is the psychomotor skills used to develop the outcomes. For these authors, in the physical game, one is turning over cards and placing them, while digitally, one clicks on cards to turn them over and uses the mouse to drag them in place, making the experience itself, and therefore (likely) the neural pathways trained different. However, other theorists assert something different altogether as seen in the next section.

2.3.1 Jean Baudrillard: The Virtual Is Real

It is therefore important to consider the views of both Pierce and Becker and Parker in the context of Baudrillard's (1994) concepts. These help explain something we need to understand about human cognition that bridges psychology and philosophy if we are to make valid claims that humans can learn from simulations of human activities. For Baudrillard, a representation such as a picture of an airplane and the real thing are equivalent in a practical sense in terms of how we use it. Our brains interpret the symbol of the phone in our hand and the image of it on-screen as having the same qualities and useful for achieving the same ends as the real thing it represents, and so we treat that information in the same fashion in terms of making choices about how to use it or whether or not to buy an airline ticket that is represented by the airplane symbol. For example, using the Internet, many consumers will determine whether to buy the new Samsung flagship phone based on looking at an online representation. Some buyers will read the specifications about power and camera quality and see an approximation of color choices rather than actually holding a real device in their hand at the store first and using it (Smith, 2012). We create a still model or dynamic simulation in our mind of sufficient quality to allow us to make useful decision, creating a cognitive model some call the *perceptual real*. This *perceptual real* is an idea we rely on today as principles to explain why one can learn from a model that is not exactly the same as the thing itself, because it is good enough to allow us to act upon with the information the simulation of symbolic representation provides.

Becker and Parker's (2009) work contrasts with Baudrillard's ideas, which have been illustrated in *The Matrix* trilogy of films. Baudrillard's concept was that, cognitively and philosophically, both the real object and the representation of it are the same; thus, they are of equivalent value (Baudrillard, 1994). Signs, whether as words or abstract objects, are valuable because they can refer to real things. Thus, a given signifier, as we use in the form of emoticons today, using ☺, easily refers to a given thing such as a person smiling, even if that thing does not exist here presently, according to our senses (Bernstein, 1983). Baudrillard's rule of the code therefore explains that these signifiers can refer to real objects that might not materially exist, and we cognitively perceive and process the virtual and real as the same.

An example he gave is that money in a bank often exists digitally but not physically, but we all agree it exists. It is represented to us through a digital account from our bank on our computer screen using their website. The bank cannot physically hold the amount of money represented by these signs on paper at every bank branch to ensure it can be withdrawn, as it would be impractical and possibly dangerous. Instead, the digital set of 1 s and 0 s in a computer database symbolizes $5,888,973,449.01 in the virtual bank vault. Despite the fact that the money is not physical, people understand that they still possess this money, which is why modern banking can function, especially when much of it is lent out in the form of loans for businesses and individuals in order to generate interest profits for the bank. Why does this work? Baudrillard's structural law of value of equivalence explains that:

> (R)eferential value is annihilated, giving the structural play of value the upper hand. The structural dimension becomes autonomous by excluding the referential dimension, and is instituted upon the death of reference. The systems of reference for production, signification, the affect, substance, and history, all this equivalence to a 'real' content, loading the sign with the burden of 'utility,' with gravity – its form of representative equivalence – all this is over with…simulation, in the sense that, from now on, signs are exchanged against each other rather than against the real.
>
> (Baudrillard, 1994, pp. 6–7)

Thus, the real object and its reference or sign are no longer perceived as different, making their perceived and usable value equivalent: I can transfer $1000 virtual dollars to your account from mine and use it as if it were real money in my hand. If this idea is accepted in the context of learning from simulations, then if it accurately models reality, a simulated reality is perceptually as useful for education as the equivalent activity in the real world. This concept is important because it nullifies the argument from some theorists in the field that both classroom settings and for the game to teach accurately the student learning activities must be *exactly the same* as the work they will be expected to do in the future to allow for transfer to other settings. For example, Gredler (2004) stated, "simulations *must* simulate the real world, or they are not actually simulations." Baek (2009) stated that:

> the factor of fidelity is an overarching issue that affects all aspects of a simulation…[f)idelity refers to how closely a simulation imitates reality…(it) affects learning (by) its users). (p. 33)

Becker and Parker (2009) explained that this may be the core of conflict "between the way different (educational) groups use and perceive these terms (simulation/game)" (p. 5). This becomes important to consider as we move later from simulation to game.

2.3.2 Example of Teaching with an Inquiry Simulation Experience

This begs the question as to what it is we are trying to teach through a simulation: the practice or the concepts? For example, Quest Atlantis' *Taiga* world (Barab et al., 2009) simulated water quality experiments done in a national park to test for pH levels and turbidity, immersing students in an authentic context where such tests would be needed to solve a larger problem tied to pollution and shared use of resources. Students clicked on a rack of test tubes to take water samples, which went into their virtual backpack as indicated by a visual sign telling them they were present. Students then virtually traveled to a sampling site where they clicked with their mouse on the water to take the sample, causing a visual change to the test tubes in the backpacks. While we do not believe from the interviews and Scott's experience in the computer lab and classrooms that any child believed they were really taking water samples, they recognized it as learning the process of sampling and recognized where they would take samples in the real world and why. The testing gave result outputs similar to the aforementioned *Lemonade Stand* in the form of information that was useful for making decisions based on data stemming from the concepts. However, the goal was not to teach the practice of real-world data gathering. Rather, it was to help students understand broader scientific inquiry processes, their importance, the core concepts tied to water pollution and complex variables leading to it, as well as proper decision-making processes.

For students, the symbols on the screen represented simplified versions of these concepts and processes because they were in fourth grade; cognitively and developmentally that is what they needed. In US middle and high schools, actual pH testing with strips and water samples will be taught, which is useful as students move toward the professional world of work. The goal with this simulated experience was about inquiry processes, which an educational simulation must make clear to avoid criticism that it lacks the accuracy of say, a professional flight simulator. What was represented in Taiga was accurate enough to teach the broad concepts and therefore did not need the level of modeling reality that a Delta Airlines simulator requires, in part because the stakes are low. The chances that an elementary school child will be allowed to make decisions about land use in a national forest populated by loggers, tribal fishermen, and adventure sports enthusiasts are remote at best. Therefore, learning experience and context do not need to exactly transfer to settings perfectly, because humans' brains understand the general equivalence of real for the referential, as Baudrillard suggested. This is important for simulations and games that rely on simulated contexts if we are to believe learning activities in virtual spaces can transfer to work contexts.

However, this begs the question: if a construct does not accurately mirror reality, is it still a simulation or something else entirely? Becker and Parker (2009) quoted the US Department of Defense who stated that:

> It is important to distinguish between what the simulation is and what it is intended to represent (the simuland), and what it is actually able to represent…because many simulations do not intend to represent situations found in the *current* (italics added) reality.
>
> (DMSO quoted in Becker & Parker, 2009, p. 6)

Becker and Parker further noted that "(t)hus, fidelity is in fact a measure of the faithfulness of a simulation to the models it seeks to implement."

From analyzing a number of definitions, we developed a synthesized conception of what an educational simulation is, as well as the differences present among academic definitions in the field, which are presented in Table 2.1.

However, in the final consideration, simulation is only one component of most learning games, which we will explain in the following sections. While an important

Table 2.1 Commonalities and differences in definitions of educational simulation[a]

Common elements of educational simulations

Simulations should model a reality in order for learning to occur and have transfer to non-simulated contexts	Interaction must be present and allow for exploration of models for learning to occur
Analog and digital simulations are fundamentally different constructs and must be treated as such in educational environments	Simulated models must include the rules that reflect a specific reality being taught
Tasks must be authentic in order for learning to occur	Simulations must authentically imitate or the model the system that instructor/designer seeks to have the learner internalize/learn
Environment must be authentic in order for learning to occur	Feedback from the simulation must be present in order for learning to occur
Simulations must model an authentic system, process, or activity for learning to occur	

[a]From Warren et al., 2012

one, the degree to which the fidelity of the represented model of reality must match the intended depiction can differ in important regards in a game. While a simulation of reality is important, there is more to understand about what constitutes a game.

2.4 So What the Heck Is a Game?

While simulations have been studied as tools for understanding the physical world in philosophy and education for thousands of years (Cubitt, 2001), games are relatively new generally, especially in the field of education. These have been used educationally for a little less than a half-century and have only come to greater interest and use in the last 15 years as educational tools. They became more of a focal point in academia since the publication of Jenkins, Squire, and Tan's (2003) article "*Entering the Education Arcade*" in the early-middle 2000s. Some believe computer games are simply a subset of simulations; however, others propose that each is their own construct, with different functions and outcomes. While specific features may overlap, they remain distinct entities. We tend to believe the act of simulation (i.e., simulating gathering water samples) is different from the entity of a simulation (a complex flight simulator), which tends to be a difference of depth rather than kind. Therefore, one may borrow the act of simulating actions as part of another learning experience in order to enrich it or to improve transfer, without the new entity becoming itself a full simulation product. Any educational experience can have components of simulation to differing degrees of fidelity, depending on what is being taught. Content, task activity, and degree of potential harm that may come to players/learners/others as a consequence of failure to properly simulate dictate how closely the simulated experience must mirror reality. Because games are intended to be played and replayed, many believe they should be fun. However, simulated reality can differ from absolute reality, even offering fantasy narratives without harming learning and still simulating what we intend learners to understand.

2.4.1 How Has "Game" Been Used Generally in Entertainment and How Are They Defined?

Early gaming activities in the middle ages mirrored physical feats of combat as part of simulated battles prior to war. Other early games included rules and win scenarios that were simple feats of skill competing in running, throwing, and other abilities often tied to hunting and other human survival skills. Since then, other games have been used to pass time and focus on cognitive skills of strategy including backgammon, marbles, chess, checkers, and card games (Salen & Zimmerman, 2004). Since the 1970s, digital games have flooded arcades, living rooms, classrooms, and now tablets and smartphones. We tend to know games when we see them and most people in the developed world have played them; however, many academic articles in computer science and education fail to define them in any meaningful way, if at all.

Our own definitions from the last decade often draw from industry, as they fit well with our experience. For example, Crawford (2003) and Salen and Zimmerman (2004) explained games should have (a) a *rule-based interactive system*, (b) a *quantifiable outcome characteristic*, (c) and *artificial conflict and play characteristics* and may also include (d) a *modeling reality characteristic*. However, this was not enough for defining an educational game. Therefore, Table 2.2 provides a synthesized definition based on agreements we identified a few years ago through an analysis of hundreds of definitions given in the last 50 years (Warren et al., 2012).

With this and the previous definition of simulation, there are some fundamental overlaps and differences between the entity of an educational game and a learning simulation that should be understood, presented in Table 2.3.

With these ideas in mind and understanding something about learning games, we need to have some idea why learning from games might occur from a media perspective relevant to our field. In the next chapter, we explain a bit about why games are expected to impact learning from three of the main perspectives about how people learn that people subscribe to in our field.

Table 2.2 Commonalities and differences in definitions of educational game[a]

Commonalities	Conflicts
Play	Disagreement ompetition between players necessary to game or only conflict to motivate learning?
Rules governing play should be apparent to the learner	Disagreement: Lack of evidence on whether games must be enjoyable or whether the enjoyment impacts learning?
Rules governing the game must be present that mirror a reality for learning to occur	Disagreement: Must games allow creativity for learning to take place?
Artificial and cognitive onflict used to drive motivation, play, and cognition	Disagreement: Must games be situated or narrative-based to connect learners to with content?
Win/loss scenarios must be present driving learners to avoid negative educational or play outcomes	Disagreement: Must games model an objective reality for learning to occur?
Interactivity between player and game	Disagreement: Level of fidelity between any real world and a fantasy world required to allow learning
Feedback should come from the game system for learning to occur	Disagreement: Which pedagogical approaches work best with game treatments?

[a]From Warren et al., 2012

Table 2.3 Criteria in common between educational simulation and game definitions[a]

Similarities between games/sims	Core differences
a. Clearly evident rules governing both the must be present for learning to occur	1. Simulations must authentically model the system the designer seeks to have learned
b. Authentic tasks for learning to occur	2. Game systems do not have to model a set reality for learning
c. Environments should have reasonable fidelity and authenticity for learners to connect with content	3. In games, win/loss scenarios must be present to drive learning
d. Interaction should allow exploration of models for learning to happen	4. Simulations do not require fantasy play to drive learning
e. Feedback from systemor teacher for learning to occur	5. Games often use artificial conflict to drive learning activities

[a]From Warren et al., 2012

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