

# How Are Games Educational?

## Learning Theories Embodied in Games

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### **ABSTRACT**

Through the combined efforts of many dedicated researchers across the globe, the “message” of the value of games for learning is starting to be heard in formal education, but there remains considerable resistance. One way to help overcome this resistance and influence the acceptance and integration of games as educational technology is through the connection of existing game design with scholarly and widely accepted pedagogy. This paper outlines the theories of Robert Gagné, and Howard Gardner to demonstrate how good games, even purely commercial ones, already embody the fundamental elements of these learning and instructional theories. In this way, it can be shown that good games constitute sound educational pedagogy.

### **Keywords**

Games, Learning Theory, Multiple Intelligences, Gagné’s Nine Events, Pedagogy

### **INTRODUCTION**

Although the climate is changing, there remains resistance to the use of games in the classroom, especially to commercial, off-the-shelf (COTS) games. The potential value of computer and video games for learning seems high [1], but the body of in-class research on the use of games is still small – partly because studying learning through games in the classroom still meets with considerable resistance. Most teachers want evidence of the effectiveness of games as learning objects before adopting them in their classrooms. This is understandable. However, we will have difficulty building evidence of effectiveness without teachers who are willing to try games in their classes. One way to help convince more teachers to try games is through pedagogy; by connecting elements of existing games designs with accepted learning and instructional theories. The same approach can also be used to justify the acceptance of games as a sound instructional technology, and worthy of inclusion in teacher training programs.

This paper proposes to explain how existing game design already coincides with two of the most prominent learning theories to come out of the last generation: Gagné’s Conditions for Learning [2]; and Gardner’s Theory of Multiple Intelligences [3]. Whether or not these theories have found their way into mainstream school environments, it should at least be possible to assume that teachers certified to teach in most of North America, if not most of the developed world are at least familiar with Gagné’s and Gardner’s theories. Certainly, in the school districts

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surrounding the author's home institution both theorists are well known, and you'd be hard pressed to find a child in a K-6 classroom who was **not** able to tell you about the different "kinds of smart", and where their own personal strengths lie.

Through pedagogy, a convincing case can be made for the applicability of games for learning. Some, like game designer and CCO for Sony Online Entertainment, Ralph Koster, have even suggested that games are really *all about* learning [4]. While it is not the intent of this paper to make a case for the replacement of all instruction by games, it *is* the intent to demonstrate how effortlessly good games can be shown to fit into multiple widely-known and well-accepted instructional approaches. Existing game pedagogy is sound but often unrecognized: good games *already* possess the major components necessary to meet the needs for sound instruction as outlined by both Gagné and Gardner. Howard Gardner's Multiple Intelligences provides a somewhat more accessible classification based on social interactions and culture, while the late Robert Gagné's theory focuses on cognitive constructs. While there is a fair degree of overlap between Gagné's approach and Gardner's, there are still sufficient distinctions to warrant separate treatment.

## **GAGNÉ**

Gagné's theory stipulates that there are several different types or levels of learning, implying that each type also requires a different approach to instruction. Good games already do this. Game designers employ multiple approaches to both aid and challenge players. According to Gagné, "an instructional plan can generate both appropriate environmental stimuli and instructional interactions, and thereby bringing about change in the cognitive structures and operations of the learner" [5].

Each of Gagné's five categories of learning are well supported in most good games. Verbal information is provided both verbally and textually, and even games like Pokemon that are targeted at young children, still present information textually. Intellectual skills, such as the use of concepts and rules to solve problems [6], are the cornerstone of most strategy games. Cognitive strategies are how we win games: by finding novel solutions to problems, the acquisition of skills and knowledge, and practice and perseverance. While only a few games, like "Dance, Dance Revolution (DDR) currently support the development of gross motor skills, all games require the use of some sort of controller or keypad, thereby helping to develop fine motor skills. The fifth category, that of attitudes is central to role-playing games. For example, Black & White has not only embodied ethical and moral dilemmas into the gameplay, the consequences of the player's choices even effect the appearance of the player's onscreen character.

These five categories of learning are embodied in Gagné's well-known "Nine Events of Instruction" [2, 7]. These events are purported to provide the necessary conditions for learning, and also for the appropriate selection of media. As will be explained, (good) games meet virtually all the criteria listed. As in all good instruction, the nine events need not be distinct, separately identifiable tasks as often elements of one "event" can be combined or intertwined with another. This also holds true for other well-accepted instructional technologies, such as goal-based learning [8] and story-telling [9, 10]. For example, gaining attention, explaining the objective and stimulating recall are often all combined as part of the initial "set-up", and creates the narrative used in all three forms.

## **Gagné's Nine Events Applied to Games:**

1. **Gaining attention (reception)** - In games this is referred to as “attract mode”; it is what one sees when a game appears to be playing by itself – it shows elements of the game play and is intended to entice players to play. This aspect is also addressed through the game’s introduction when one begins to play; it is often accompanied by prepared video clips, which are typically of high production quality. This is where the game is set-up.
2. **Informing learners of the objective (expectancy)** – This is typically part of the back-story and description of the victory condition (how one wins the game).
3. **Stimulating recall of prior learning (retrieval)** – Again, the back-story associated with the introduction to a game provides the frame of reference; sometimes sequels and new levels will refer back to things learned in previous levels/versions. Even when it is not explicitly noted in the game, virtually all game players are aware of the concept of levels, where each level requires players to build on knowledge and skills acquired in the previous level. Stimulation of recall can be both explicit, and implicit.
4. **Presenting the stimulus (selective perception)** – This aspect is controlled with-in the game and is designed to provide encouragement as well as challenge. A game that is insufficiently stimulating for the target audience will fail to hold their attention, receive a poor rating and eventually fail economically.
5. **Providing learning guidance (semantic encoding)** - Games must be self-contained; players do not use manuals, and players typically do not have a “facilitator” to help them learn how to play. Learning how to play is accomplished within the game itself. In effect, games act as the tutor – often employing sophisticated “just-in-time” approaches to providing help.
6. **Eliciting performance (responding)** – This is, of course, an essential component of interactivity – without this, there really *is* no game.
7. **Providing feedback (reinforcement)** – Feedback is provided in many ways, including scores; displays; queries; and verbal feedback. Again, this is one of the imperative elements of every game: without timely and appropriate feedback, the player has no way of knowing whether or not they are progressing towards their goal.
8. **Assessing performance (retrieval)** – Feedback and assessment are typically coupled within games. Games that do not have clearly identified goals tend not to be popular [11]. Assessment is an integral part of the game – game designers already know that when players receive insufficient feedback on progress they tend to lose interest in the game. Achievement need not be easy, but assessment must be clearly and logically tied to that achievement.
9. **Enhancing retention and transfer (generalization)** – On a small scale, moving through levels within a single game requires players to remember skills, knowledge and strategies learned in the previous level. On a larger scale, skills and strategies learned in one game are often applicable to other games and even entire genres.

## **GARDNER**

According to many, Gardner's Theory of Multiple Intelligences is one of the most significant developments in learning theories to come out of the last quarter of the 20<sup>th</sup> century. The foundation of this theory is that we all employ different strategies for learning, and that these strategies relate to internal strengths and capabilities that can be classified into eight categories, which Gardner called "intelligences" [12]. Gardner proposes eight primary forms of intelligence: (1) linguistic, (2) musical, (3) logical-mathematical, (4) spatial, (5) body-kinesthetic, (6) intrapersonal (e.g., insight, metacognition), (7) interpersonal (e.g., social skills), and (8) naturalistic (sensitivity to natural phenomena, and classification skills). The implication of this theory is that learning can become more effective if we focus on and develop instruction for these intelligences. Generally speaking, assessment should include more than one 'intelligence', as each is more than simply a content domain; it is also a learning modality. Cultural differences play a key role, as each culture tends to value and emphasize particular intelligences in favour of others.

### **Gardner's Seven Intelligences**

Connecting Gardner's ideas with the design of games is particularly effortless, as almost every one is evident in almost every successful game – in fact, it could be argued that one of the features of games that make them so engaging is that they address each one of these forms, providing game players with a particularly rich experience, where each player has an opportunity to take advantage of her own particular strengths.

**1) Linguistic:** Linguistic intelligence coincides nicely with Gagné's Verbal Information category, and thus what was said there also applies here. Games often include written and spoken elements – for game play, as well as for direction and help. [13]

**2) Musical:** Virtually all games include sound to enhance play – there are sound-effects, both diegetic and non-diegetic, as well as music to set the mood or provide feedback about game states. In some cases musical scores for games are as sophisticated as they are for film. Sounds are used as feedback and reinforcement as well as for effect and enjoyment.

**3) Logical-mathematical:** Strategy is one of the key elements in play – the extent to which this intelligence is exercised depends heavily on the genre and specific game played. Puzzle games rely heavily on logical and mathematical intelligences to win. The management type games, like Zoo Tycoon also involve reliance on and further development of this intelligence, for it is virtually impossible to manage the zoo well without an ability to plan and manipulate a fairly complex set of resources. Simpler games, such as Pikmin, still requires counting and arithmetic. Moving an object often requires a minimum number of Pikmin, and even very young players quickly learn to do simple calculations in order to get the optimal number of Pikmin into position to complete a task.

**4) Spatial:** Games are of course highly visual, providing a rich and colourful 2- or 3-dimensional environment, which is always at least partially under the player's control in terms of what is visible. It is quite common, for example, to be shown multiple simultaneous first- and third-person views – which not only tap into one's spatial intelligence, but at the same time actively help players learn to use these views in their gameplay.

**5) Kinesthetic:** Although games can not yet place their players physically in the game, most games do require players to ‘place themselves’ virtually in the game in one way or another and all involve movement and action which, at the very least, is realized through physical movements of the players hands (watching players quickly confirms that there is indeed more going on than just hand motions). There are, of course, numerous games that are specifically designed to involve mild to heavy physical activity, such as Dance Dance Revolution, and, to a lesser extent, games like Donkey Konga. In spite of the fact that these games are marketed on their “Kinesthetic Intelligence” attraction, they still provide musical, visual, and linguistic stimulation, as well as requirements for logical thinking and strategizing.

**6) Intrapersonal:** Strategy is one of the key elements in play – once again this is a key element in games: they force players to discover and practice what one can do, what one wants to do, how one reacts to things, which things to avoid, and which things to gravitate toward. Many games present scenarios that involve ethical dilemmas, and have moral (or immoral) themes.

**7) Interpersonal:** Many of the most popular games include multi-player modes, many online games massively so. Even single player games typically include multiple NPC’s (non-playable characters) and often require varying degrees of both competition and cooperation in order to win.

**8) Naturalistic:** Games with naturalistic themes are common – whether they include purely realistic flora and fauna, purely fantastical ones or some combination of the two. Clearly, games like Zoo Tycoon call upon one’s natural intelligence in order to be able to identify various animals’ requirements for housing and care. Beyond that, any game that creates a world with geography and a variety of inhabitants require classification, as well as naturalistic skills and understandings. Once again, even a game like Pikmin includes several distinct kinds (species?) of Pikmin, each with its own strengths and weaknesses.

Although not all games embody every kind of intelligence, most embody most of them, and it is always possible to find a specific game that favours one or another.

## **GARDNER’S SEVEN LEVERS OF CHANGE**

An appropriate place to conclude this paper is with Gardner, who describes seven levers of change in his recent book on the art and science of changing minds [14]. This paper argues that all seven levers must be fully utilized in order to effect real change in the attitudes of educational institutions towards the use of games for learning. The establishment of a clear connection between best practices in game design and current learning theories is one more strategy that can be adopted to support the use of games as valuable tools for learning. Arguing that games are pedagogically sound instructional technology addresses at least some of Gardner’s levers, namely: reasoning, resonance, representational redescription, and resistances. This connection needs to be made explicit, both for the benefit of teachers currently in the classroom, and for the benefit of the academics who ultimately create the programs and curricula that are used to train the next generations of teachers.

1. **Rational Reasoning:** Logically outline the pros and cons of the use of games for learning.
2. **Research:** Present data and relevant cases to support the argument.

3. **Resonance:** Create connections between desirable facets of education and those elements already embodied in games.
4. **Representational Redescription:** Make your point in many different ways.
5. **Resources and Rewards:** Use rewards as incentives to convince someone to adopt your view; make it easy to agree.
6. **Real World Events:** Use events from society at large to make your point.
7. **Resistances:** Understand the factors that cause people to reject your view. Such insights can make it easier for you to change their minds.

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