This presentation is intended to fulfill two goals:

1. To show that many commercial games, the successful ones at least, *already* implement sound pedagogy when it comes to how they get players to learn the game and how they facilitate gameplay.

2. To encourage critical examination of successful video games, to learn how this has been done, so that we may use that information to build engaging educational games.

Notes:

Credits that appear on only one slide are listed with that slide's annotations. Others are listed at the end.

Slide 2: How I Got Here

- Learning how to design and create programs
- Teaching how to design and create programs
- Teaching how to create games (already designed)
- Thinking about how to design games
- Thinking about how to design and create educational games.

….. How to *teach* how to design and create educational games

Comments: I taught my first lab in 1979, and have been teaching freshman CS students how to program for 27 years, with varying degrees of success. One of the things I have learned after all that time is that we *still* don't really know how to teach programming. True, we can teach those who are interested and already inclined, but this is not the same as, say, basic literacy. There are those who hold that programming ability ought to be counted as a basic literacy in the 21st century, like reading and writing. If so, we still have a long way to go to learn how to help people learn programming. The point to be made in this particular context is that a significant and irrefutable aspect of designing and creating educational digital games is the design and creation of the program that is the game. I remain unconvinced that we will be able to teach people how to design educational games without also having them understand how to design digital games. Since we don't really know how to do that, our challenge is a large one.

Slide 3: Quote

"The invention of new methods that are adequate to the new ways in which problems are posed requires far more than a simple modification of previously accepted methods."
 Vygotsky (p.58)

Credits:

Vygotsky, L.S., et al., Mind in society: the development of higher psychological processes. 1977.

Slide 4: New Ways to Pose Problems

- Complex
- Ill-structured
- Interconnected
- Different perspectives
- Emergent
- Affective
- Value laden

Credits/Resources:

Elliott, A.M., Computational support for sketching and image sorting during the early phase of architectural design, in Architecture. 2002, University of California at Berkeley.
Rittel, H.W.J. and M.M. Webber, Dilemmas in General Theory of Planning. Policy Sciences, 1973. 4: p. pp155-169.

Slide 5: New Ways to View Learning

- Constructivism http://tip.psychology.org/bruner.html
- Constructionism http://www.artteacherconnection.com/pages/constructionism.htm

- Envactivism http://www.ucalgary.ca/~kposcent/EDER679/
  http://ace.acadiau.ca/~dreid/enactivism/EnactivismDef.html
- Activity Theory http://carbon.cudenver.edu/~mryder/itc_data/act_dff.html
- Situated Cognition http://tip.psychology.org/lave.html

Slide 7: Why are These Such Good Teachers?

When looking at how the different forms of modern media have been used for educative purposes and which particular instances have been chosen, one notion stands out – the majority of the most remarkable and effective "lessons" taught to us have been created by extraordinarily talented writers, directors, and producers together with their teams. They have, by and large, *not* been created by professional educators or instructional designers.

Far from trying to sell educators and instructional designers short, we should recognize the opportunities afforded us in studying these outstanding examples of "educational" objects, and try to learn why they have the impact they do.

By "studying the masters", we can progress towards understanding the essential elements of 'good' games and begin to discuss the implications this holds for the deliberate design of educational games.

Credits:

Romeo And Juliet [movie version] 1968, *Director:* Franco Zeffirelli UK / Italy *Cast:* Leonard Whiting, Olivia Hussey, John McEnery, Milo O'Shea, Pat Heywood, Robert Stephens, Michael York, Bruce Robinson…[image: http://www.moviewallpapers.net/]

To Kill a Mockingbird [book] 1959, Harper Lee [image: http://www.amazon.ca]

Of Mice and Men [book] 1937, John Steinbeck [image: http://www.amazon.ca]

Catcher in The Rye [book] 1945-46, J.D. Salinger[image: http://www.amazon.ca]

Don Quixote [book] 1605, Miguel de Cervantes Saavedra [image: http://www.wikipedia.org]

Amos and Andy [radio program] 1928-1953 [image: http://www.wikipedia.org]

West Wing [TV drama] 1999- [image: http://www.nbc.com/The_West_Wing/

Schindler's List [movie], 1993, Steven Spielberg [image: imdb.com]

Aesop's Fables [stories], ~600 BC [image: Arlene Graston]

A Christmas Carol [book] Charles Dickens. 1843 [image: imdb.com]

Slide 8: Are Games Good Teachers Too?

- Games are so engaging precisely because they tap into some of the most effective approaches for learning. Successful games teach us to play in the manner we learn best.
- Play and Learning are Linked
- Piaget (1951) and Bruner (1962) have said that play is important for deep learning, so perhaps they might (have) agree(d) with the assertion that players are also learners.

Credits/Resources:

Bruner, J. S. (1962). **On knowing; essays for the left hand**. Cambridge: Belknap Press of Harvard University Press.
Piaget, J. (1951). **Play, dreams, and imitation in childhood**. New York: Norton.

Slide 9: How Do Games Teach? – Learning Theories

The next slides are just a few examples of how games can be shown to implement known learning theories and styles.

Gagné's Nine Events Applied to Games:

1. **Gaining Attention (Reception)** "attract mode" (what one sees when a game appears to be playing by itself) the set-up. Also, trailers.

2. **Informing Learners of the Objective (Expectancy)** back-story and description of the victory condition - trailer, advertising, and at start of the game. In sequels, basic premise usually is similar to the previous game. In licensed games, the back story is pre-determined. A game based on *Spiderman* should involve fighting crime, and the main character would look, and act in a particular way and have particular abilities as well as weaknesses.

3. **Stimulating Recall of Prior Learning (Retrieval)** back-story: sequels and new levels refer back to things learned, achieved, or discovered in previous levels/versions. At the start of a game, the opening sequence describes some thing that players are expected to know. Some games provide both subtle (a glow around an object) and not-so-subtle clues (a voice actually tells you).

4. **Presenting the Stimulus (Selective Perception)** If a player can not easily determine what she needs to do in a given situation, she will become frustrated and eventually give up. If I wander aimlessly about in *Pikmin*, I will eventually get a reminder of my ultimate goal, and a hint – where to look, something to do or examine.

5. **Providing Learning Guidance (Semantic Encoding)** Games must be self-contained; players do not use manuals. Learning how to play is accomplished within the game itself. In effect, games act as the tutor – use a multitude of sophisticated "just-in-time" approaches to providing help. Verbal or written hints, items that glow briefly as they come into view, NPC's that tell you something or offer help. Real world fan communities.

6. **Eliciting Performance (Responding)** This is, of course, an essential component of interactivity – without this, there really *is* no game. While the physical interface for most games is limited and tends to remain the same from game to game and console to console, *how* one actually plays the game can vary.

7. **Providing Feedback (Reinforcement)** – provided in many ways, including scores; displays (the head up display, or HUD being a common approach); queries; and verbal feedback. Characters within games typically have various attributes that the player can monitor throughout the game: strength, magic, health, etc.

8. **Assessing Performance (Retrieval)** – Achieving a favourable assessment is what the game is about. Even in a game like *Dance Dance Revolution* where there are no opponents to fight, no treasure to find, and no puzzle to solve, a running 'score' of how closely the players' moves approximate perfection is essential.

9. **Enhancing Retention and Transfer (Generalization)** –moving through levels within a single game requires players to remember skills, knowledge and strategies learned in the previous level and use them to overcome obstacles and solve problems in the next. On a larger scale, skills and strategies learned in one game are often applicable to sequels, other games and even entire genres.

Credits/Resources:

Gagné, R. M. (1985). *The conditions of learning and theory of instruction* **(4th ed.).** New York: Holt, Rinehart and Winston.

Reeves, Thomas C., *GAGNÉ'S NINE EVENTS TEMPLATE* Instructional Technology, College of Education, The University of Georgia

Slide 11: How Do Games Teach? – Learning Theories

Reigeluth's Elaboration Theory

Elaboration theory proposes seven major strategy components, and when they are applied to the design of good games we find:

1. **An Elaborative Sequence.** Good games follow a well-paced sequence progressing from simple (and easy) to complex (and hard). A Game explains its own context (theoretical), requirements to operate (procedural), and goals for play (conceptual).

2. **Learning Prerequisite Sequences.** Tutorial mode - involves some simplifications as well as suggestions. Boss-battles, death-spirals. Story-mode.

3. **Summary.** Almost all games provide some form of "stats" (HUD – score, health, strength, maps, assets, etc.)

4. **Synthesis** Levels of play - building on knowledge gained from the previous one. Often players are defeated many times before finishing a game. Each time they try again, they do so having gained some knowledge or understanding that they will apply correctly this time in order to progress a little further.

5. **Analogies**. Players very quickly learn to look for approaches or tactics that are similar to some other game they have played, and will try to apply these in any new context that looks like it might favour this approach.

6. **Cognitive Strategies**. Progressions, repertoires, etc. exist by the very design of games and is one of their great achievements: the ability to force the player to use strategies invented by the designers in order to achieve their goals. A significant part of the challenge, enjoyment, and attraction of games is the desire to uncover the requisite strategies that allow the player to reach the 'victory condition' in a game.

7. **Learner Control**. Player (learner) control is an obvious requirement of all games: without this it stops being categorized as a game.

Credits/Resources:

Reigeluth, C. M., Merrill, M. D., Wilson, B. G., & Spiller, R. T. (1980). *The elaboration theory of instruction: A model for sequencing and synthesizing instruction.* *Instructional Science, 9*(3), 195-219.

Indiana University's *Instructional Design Theories* Home Page http://www.indiana.edu/~idtheory/home.html

Kearsley, Greg, *Explorations in Learning & Instruction: The Theory Into Practice Database* http://tip.psychology.org/reigelut.html

Slide 13: How Do Games Teach? – Learning Styles

Keirsey (based on Myers-Briggs)

Artisans value freedom and spontaneity. They tend to be impulsive, playful and creative.
Guardians value belonging to a group or community. They tend to be traditional, responsible and conservative.
Idealists value personal growth, authenticity, and integrity. They tend to try and encourage these traits in others. This group includes people they define as "teachers".
Rationals value competence and intelligence. They strive for knowledge, predictability, and control.

Kolb's Learning Style & Characteristic Description

Converger:
· Practical application of ideas
· Focus on hypo-deductive reasoning on specific problems
· Unemotional
· Narrow interests

Diverger:
· Imaginative ability
· Generates ideas and sees things from different perspectives
· Interested in people
· Broad cultural interests

Assimilator:
· Can create theoretical models
· Excels in inductive reasoning
· Abstract concepts rather than people.

Accommodator:
· Doing
· Risk taker
· Can react to immediate circumstances
· Solves problems intuitively

Credits/Resources:

Keirsey, D., & Bates, M. M. (1984). **Please understand me: Character & temperament types** (5th ed.). Del Mar, CA: Distributed by Prometheus Nemesis Book Co.

Kolb, D. A., & Fry, R. (1975). **Toward an applied theory of experiential learning.** In C. Cooper (Ed.), Theories of group process. London: John Wiley.

Myers, I. B., & McCaulley, M. H. (1985). **Manual: A guide to the development and use of the myers-briggs type indicator**. Palo Alto, CA: Consulting Psychologists Press.

Slide 15: How Do Games Teach? – Learning Styles

Felder's Index of Learning Styles

Index of Learning Styles	
Active (doing) *Medal of Honor, Star Wars, Super Mario Kart*	Reflective (thinking) *Black & White, Syberia, Myst*
Sensing (facts, processes) *Civ III, SIMs, Age of Empires*	Intuitive (concepts, relationships) *Pikmin, Katamary Damacy, Harvest Moon*
Visual (seeing, picturing) *Super Mario Kart, Super MonkeyBall*	Verbal (hearing, reading, saying) *Elecrtoplankton, Karaoke Revolution*
Sequential (step-wise) *Roller Coaster Tycoon, Myst*	Global (leaps, random) *Psychonauts, Grim Fandango*

Credits/Resources:

Felder, R. M., & Silverman, L. K. (1988). **Learning and teaching styles in engineering education**. Engineering Education, 78(7), 674-681.

Fedler, R.M., and Soloway, B., University of North Carolina, **INDEX OF LEARNING STYLES (ILS)**
  http://www.ncsu.edu/felder-public/ILSpage.html

Slide 17: How Do Games Teach? – Learning Styles

Gregorc System of Learning

Gregorc's Learning Styles		
Concrete-Sequential	Linear and sequential.	*Super MonkeyBall, Pikmin*
Concrete-Random	Concrete and intuitive Thrives on problem- solving.	*Syberia, Myst*
Abstract-Sequential	Abstract and analytical Thrives on a mentally challenging but ordered learning environment.	*Myst, Syberia*
Abstract-Random	Emotional and imaginative, Prefers an active, interesting, and informal learning environment.	*Katamari Damacy, Electroplankton*

Credits/Resources:

Gregorc, A. F. (1985). *Inside styles: Beyond the basics: Questions and answers on style.* Maynard, Mass.: Gabriel Systems.

Dennis W. Mills, Ph.D. (2002) *Applying What We Know Student Learning Styles*
   http://www.csrnet.org/csrnet/articles/student-learning-styles.html

Slide 20: Next Steps

• Is there a balance in games today?
• Are games preferentially "training" to certain styles?
• Are certain types/genres of games preferred by certain styles of learners?
• Do gamers have similar styles?
• How might we leverage this for education?

Credits/Resources:

Merrill, M. D. (2002). *First principles of instruction*. Educational technology research and development: ETR & D, 50 Part 3, 43-60.
   http://cito.byuh.edu/merrill/text/papers/ReigeluthCarrFirstPrinciples.pdf
   http://www.indiana.edu/~tedfrick/aect2002/firstprinciplesbymerrill.pdf

Further Resources:

1. Becker, Katrin, *Games and Learning Styles* Presented at the Special Session on Computer Games for Learning and Teaching, at The IASTED International Conference on Education and Technology ~ICET 2005~ July 4-6, 2005 Calgary, Alberta, Canada
2. Becker, Katrin, *How Are Games Educational? Learning Theories Embodied in Games* DiGRA 2005 2nd International Conference, "Changing Views: Worlds in Play" Vancouver, B.C. June 16-20, 2005
3. Becker, Katrin, *Pedagogy in Commercial Video Games,* Book Chapter, to appear in Games and Simulations in Online Learning: Research and Development Frameworks, in press at Idea Group Inc http://www.idea-group.com/ edited by David Gibson, 2005
4. Brown, J. S., Denning, S., Groh, K., & Prusak, L. (2001). *Storytelling: Passport to the 21st century.* Retrieved June 30 2004, 2004, from http://www.creatingthe21stcentury.org/Intro0-table.html
5. ESA. (2005). *Essential facts about the computer and video game industry: 2005 sales, demographics, and usage.* Retrieved Sept 25 2005, 2005, from http://www.theesa.com/files/2005EssentialFacts.pdf
6. Frasca, G. (2001). *Ludology meets narratology: Similitude and differences between (video)games and narrative.* Retrieved 31/10/2004, 2004, from http://www.ludology.org/articles/ludology.htm
7. Gamespot.com http://www.gamespot.com
8. Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences.* New York: Basic Books.
9. Gee, J. P. (2003). *What video games have to teach us about learning and literacy* (**1st ed.).** New York: Palgrave Macmillan.
10. Juul, Jesper, *Half-Real: A Dictionary of Video Game Theory.* http://www.half-real.net/dictionary . (Accessed December 3, 2005.)
11. Koster, R. (2004). *Theory of fun for game design* (1 edition (September 17, 2004) ed.): O'Reilly & Associates.
12. Mobygames.com http://www.mobygames.com
13. Wikipedia, http://www.wikipedia.com