Designing Games that Resonate with Learners and Learning

ERIC KLOPFER
PROFESSOR/DIRECTOR
MIT SCHELLER TEACHER EDUCATION PROGRAM
THE EDUCATION ARCADE
MIT Teacher Education Program?

Leads to Massachusetts Licensure, but is not a major or minor, simply additional courses (including student teaching)

Consists of 5+ courses (including student teaching)
The Abdul Latif Jameel World Education Lab will spark a global renaissance in education for all learners. Leveraging MIT’s resources, we will convene a global community of collaborators for sustainable, high-impact transformation in education through research, policy, pedagogy, and practice.
PreK-12 @ MIT

Changing the World through Learning
Changing the World of Learning
Technology-supported Innovative Pedagogy for Schools in India

- A collaboration between the Tata Institute for Social Sciences, MIT, and 4 Indian states
- Curriculum and technology tools for science, math, English, digital literacy, and values education
- Constructionist, collaborative pedagogy that connects learners, ideas, and the world
- Teacher professional development for innovative pedagogy and technology use
- Research on learning, adoption, and implementation at scale
Preparing Tomorrow’s Teachers

- Competency Based Education
- STEM Teachers
- Hybrid Learning + Field Experience
- Prepared or Classrooms of Today
- Ready to Create Classrooms of Tomorrow
The Education Arcade Goals

Enable Playful and Meaningful Learning Experiences Using the Affordances of New Technologies

- Designing/creating experiences
- Implementing and scaling experiences
- Developing capacity for more experiences
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Design Based Research
Design Based Research

Analysis of practical problems → Development of potential solutions → Iteratively Test and Redesign in Practice → Reflect to distill design principles

Refine

Reeves 2006
Overview

- The Evolution of Digital Learning
- Creative Play and Invention
- Learning? Games?
- Resonant Games
- Making Games and Simulations
Evolution in Schools
Evolution of Learning
Media Consumption Devices

Kindle Fire from amazon.com and Samsung Chromebook (wired.com)
Media Consumers
Millenial (21st Century) Skills

• Ways of thinking - Creativity, critical thinking, problem-solving, decision-making and learning

• Ways of working - Communication and collaboration

• Tools for working - Information and communications technology (ICT) and information literacy

• Skills for living in the world - Citizenship, life and career, and personal and social responsibility

  • ATC21S
Turn Passive Media Consumers
Into Active Digital Participants
Creative Thinking Today?
Creative Thinking
Creative Play
Creative Play
Creative Invention
Learning? Games?

How many volts do I need for my laser canon to kill 3 x 6 opponents?
The Legacy of Math Blaster

Edutainment

–Where play is the reward for learning
The Legacy of Math Blaster

Edutainment

– Gets kids to eat broccoli
– But doesn’t promote healthy eating
– What happens when the chocolate goes away?
The Legacy of Math Blaster

—Instead learning should be **playful**
The Joy of Gaming?
The Joy of Gaming = Hard Fun

Bottom Images -
http://www.mrtoledano.com
Zone of Proximal Development

- Can/Will Do
- Can’t Do/Won’t Do
- Can Do/Will Do
- With Help

Vygotsky
A game helps structure an experience, and ideally includes **open-ended play** and **structure and support** for learning.
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Structured, goal-oriented, feedback-driven can be fun.

In games we willingly submit to arbitrary rules and structures in pursuit of mastery, but only if we can continue to be playful.
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Science is About Play

I prefer to believe that there is some cognitive value to the playful element in science. Playing with ideas is, after all, what science is about. It can be solitary amusement or it can be a collective game… Such a playful, childlike attitude can be extremely fruitful. Let us not be too embarrassed to acknowledge that play is often what motivates us.

–Pierre Laszlo – American Scientists 2004
Gaminess

What features are important to structure games?

– Interesting **decisions** (Sid Meier)

– **Consequences** to decisions (+/- value)

– Clearly defined **goals** (rules/constraints)

– Visible measurable **feedback** (quantifiable outcome)

– Underlying **model/system** (coherent system of rules)

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*Little Gaminess*

Movies
Dolls
Books

**Scavenger Hunt**
*The Sims*

**Lots of Gaminess**

WoW
Risk
Resonant Games

- **Design for the whole learner**
  - Resonant design must begin with seeing the whole learner.

- **Design for communities**
  - Resonant design factors the sociality of learning and the sociality of play into our projects.

- **Design for Knowledge, Skills and Practices**
  - Resonant design takes the connection between learners and knowledge, skills, and practices very seriously.

- **Design for society**
  - Resonant design honors the fact that knowledge and skills and the players we are trying to enchant and educate are all part of society, as are the relationships between players.
Resonant Design
for the Whole Learner

- Resonant design must begin with seeing the whole learner.
Resonant Design
for the Whole Learner

Photos, L to R:
Smithsonian Forensic Anthropologists Kari Bruwelheide & Doug Owsley (AnthroNotes Volume 28 No. 1 Spring 2007)
Volcanologist Liz Cottrell
Vanished player at North Carolina Museum of Natural Sciences (Photographer: Liz Baird)
Resonant Design
for the Whole Learner
Resonant Design
for Communities

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Resonant Design for Communities

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<table>
<thead>
<tr>
<th></th>
<th>Genetics</th>
<th>DNA</th>
<th>Evolution</th>
<th>Ecology</th>
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<tbody>
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<td>.0647</td>
<td>-.223</td>
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<tr>
<td>Level</td>
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for Knowledge, Skills and Practices

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Felt like game assisted?

Game was fun or frustrating?

<table>
<thead>
<tr>
<th>Game Version</th>
<th>Fun</th>
<th>Frustrating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Explain + Recall</td>
<td>7.57</td>
<td>5.07</td>
</tr>
<tr>
<td>2 - Explain</td>
<td>7</td>
<td>4.2</td>
</tr>
<tr>
<td>3 - Fun Narrative</td>
<td>6.5</td>
<td>6.07</td>
</tr>
<tr>
<td>4 - No Narrative</td>
<td>5.79</td>
<td>6.29</td>
</tr>
</tbody>
</table>
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Define displacement correctly?

![Graph showing data for different groups.](image-url)
Collaborative Learning Experiences in Virtual Reality (CLEVR)

Knowledge, Skills and Practices
The Cell

Typical Textbook Depiction
(so easy yaaay!)

Actual Cell
(Aaahh!)

Image credit: MIT Game Lab
Building the First Full-Game Prototype

Organelle Design

True Density

Relative Scale
CLEVR design principles

Authentic representation
Use scientific techniques (GFP)
Real world narrative
Engaging and fun game
Limit nausea
Workable in classrooms
True density

Cells are jam packed full of stuff
CLEVR: Movement and Exploration
Resonant Design for Society

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Resonant Design for Society
Physical and Biological Systems
Resonant Design
for Society - Action Reflection Cycle
Design and 21st Century Skills

Resnick et. al
Designing Games

My Games

It doesn't look like you've created any games!

Create a game

Featured Projects

Bouncy Owl

Hungry Monster

UFODefense
StarLogo Nova

You can create and use a custom traits for any breed. Custom traits are things like health, lives and energy that StarLogo Nova doesn’t include automatically but that you might use in your project.

One way to implement chance is to generate a random number between 1 and 100 and use that value to represent percentage. This code will only create a Turtle 5% of the time because approximately 95% of the time the random number between 1 and 100 will be greater than 5 so the CREATE block will not run.

While this code will create 10 enemies with approximately 10 percent being red and the rest white.

As you design your game or simulation, look for places where chance could make your game more fun to play. Chance makes players want to keep coming back, because each time they play the game is a little different.
THANKS
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