METATUNING

Game Design-based Learning for a Generative STEM Education

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Today’s Goals

Metatuning aims to create and mobilize discovery learning through game design activities that educate students through STEM concepts in a generative manner, where the knowledge-construction activities are valuable to the students and their social spaces.

• Why Metatuning?
• Metatuning as Framework
• Tes’ Case Study
• Q and A
Reimagining Game-based Learning

Critical Pedagogy:
Digital Literacy
Critical Literacy

Digital Rhetoric:
Procedural Rhetoric
Media and Memory

Game Design Research:
Participatory Design
Constitutive Design
African American youth between the ages of 8 and 18 play games 30 minutes more per day than white youth, while Hispanics play an average of 10 minutes more (Kaiser Foundation 2010)
### TABLE 27: Time Spent Playing Video Games, 8- to 18-Year-Olds

Among 8- to 18-year-olds, average amount of time spent playing video games on each platform in a typical day.

<table>
<thead>
<tr>
<th>Platform</th>
<th>White</th>
<th>Black</th>
<th>Hispanic</th>
<th>Asian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Console player</td>
<td>:32&lt;sup&gt;a&lt;/sup&gt;</td>
<td>:32&lt;sup&gt;a&lt;/sup&gt;</td>
<td>:45&lt;sup&gt;b&lt;/sup&gt;</td>
<td>:38&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cell phone</td>
<td>:09&lt;sup&gt;a&lt;/sup&gt;</td>
<td>:29&lt;sup&gt;b&lt;/sup&gt;</td>
<td>:24&lt;sup&gt;b&lt;/sup&gt;</td>
<td>:28&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>Handheld player</td>
<td>:15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>:24&lt;sup&gt;b&lt;/sup&gt;</td>
<td>:27&lt;sup&gt;b&lt;/sup&gt;</td>
<td>:32&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total video games</td>
<td>:56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1:25&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1:35&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1:37&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

(Center on Media and Human Development School of Communication Northwestern University 2011)
Is Diversity in Game Dev Important?
...and YES!

80%

10%
More incongruities

Figure 1-1
Average NAEP mathematics scores of students in grades 4 and 8: Selected years, 1990–2009

Average score

Grade 8
Grade 4

Figure 1-3
Ninth-graders proficient in various algebra skill areas, by race/ethnicity: 2009

Percent

Increasing difficulty

All ninth-graders | White | Black | Hispanic | Asian

Algebraic expressions | Multiplicative and proportional thinking | Algebraic equivalent | Systems of equations | Linear functions

Notes: Skill areas are arranged in a hierarchy such that proficiency in a given area assumes proficiency in all lower areas. “All ninth-graders” bars also include students in other racial/ethnic categories that are not shown separately.


Science and Engineering Indicators 2012
Longterm Inquiry

1. How can we get the games industry (driven by profit) and the needs of low-income and underrepresented youth (driven by principles of social equities) to thrive together?

2. How can we develop a *generative justice* framework to facilitate this hopeful synergism?
Generative Justice

- The universal right to generate unalienated value and directly participate in its benefits
- The rights of value generators to create their own conditions of production
- And the rights of communities of value generation to nurture self-sustaining paths for its circulation. (Eglash 2016)

Sources: Upper left, an Arduino printed circuit board mass-produced in China by Gold Phoenix; Upper right, a circular LilyPad Arduino from artisanal production in the US by SparkFun; Lower left, a LilyPad electronic textile handmade by Becky Stern.
From Tuning to *Meta-tuning*

Intertwining of the Social, Material, Conceptual

The Mangle of Practice is a “goal-oriented and goal-revising dialectic of resistance and accommodation [hence trial-and-error,] where the overall practice encompasses the dialectic.” (Andrew Pickering, 1995)

*Artist Charis Tsevis*
Game Design-Based Learning

- Iteration
- Systems based Thinking
- Collaboration
- Intercultural Thinking
Finding the Sweet Spot:
Underrepresented Youth As Game Designers!

A Metatuning plane

Social justice goals

Student starts with SJ emphasis

Homeostasis: narrowing to predetermined outcomes

Homeorhesis: broadening for exploration of outcomes

Technical exigency goals
My Goal…

Create a generative game-based Ed for complex-dynamic (perceived as homogenous but heterogeneous) underrepresented groups where...

- Social and cultural value circulated
- Transformative knowledge
Uniquely Metatuned Sites

Seeing and Coding the World:

- Subjects: 5 Females/1 Male
- Location: RPI
- Technology: Academic
- Goals: Dr. Betty Shabazz
TABLE 1

**Question #16** "Game design can teach about how systems work"

![Bar chart showing pre-survey and post-survey responses]

TABLE 2

**Systems based thinking definitional questions from**

![Bar chart showing n<1, n<5, n<7 responses]

![Bar chart showing pre-survey and post-survey responses]
A Metatuning plane

Social justice goals

Homeostasis: narrowing to predetermined outcomes

Homeorhesis: broadening for exploration of outcomes

Technical exigency goals

I

II

III

IV

(Cooke, 2016)
Game Overview Sheet:

Hana D.: [handwritten notes]

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Game Philosophy

The WISH FACTOR: Why create this game? Why would someone want to play it? Why is your audience? Someone would want to play this game to know how to... are they healthy, children, etc. The game looks about how to care and have sympathy for others.

This game will respect

My target audience

Children

Rules

What you can and cannot do.

Goal

Short term and long term goals: The player needs to understand the story and survive all the characters.

Components

Sprites, Actors, AI, music, etc. Objects that are a part of the game.

Core Mechanics

Actions that help you navigate and get through the game.

Lobby story

Receptionist in lobby:

- Poor person
- Black person
- Spanish person
- Rich person

Rich person cuts in line. Level 1 - poor person.
Metatuning Quadrant I: Social Values and Identity
Metatuning Quadrant I and IV: Level Design & Social Justice

Lobby story
receptionist in lobby
poor person first

- poor person
- black person
- spanich person
- rich person

rich person cuts in front
level 1 - poor person

Doctor's Office

- Doctor's Office
- 'ENTER HERE' button

- Doctor's Office
- patient lying on bed
- doctor and nurse in room
Metatuning Quadrant IV: Procedural Literacy
Metatuning Quadrant IV: Procedural Literacy (Animation)
Main Implications of Metatuning

Tes’ personal (aspirations) and social (empathy) values—hence, the “sweet spots” of discovery learning—adaptively moved through iterative design processes, yielding a social-justice themed game about the injustices of health care. Metatuning Tes’ tuning processes (documentation writing, game deconstruction activities, researching, debugging).
Metatuning Social Justice Through (Cultural) Systems Based Thinking:

Tes: Justice, ummm...equality, that's about it.

ME: Yea, that's good. So tell me how social values or issues inspire your game design for your game?

Tes: Well...I... uhh... put what I wanted to do when I grow up into a game...cuz I wanna be a Dr.

ME: Right...what were some values you put into your game when we switched to your Construct 2?

Tes: Equality.

ME: Alright. OK. And was it difficult to translate values like “equality” into your game?

Tes: Umm no like when you thought about it a little, then it becomes easier?

ME: And did it in a good way or bad way help change your creative direction in how you wanted to create your game?

Tes: In a good way.

ME: OK. How so?

LN 24 Tes: Hmmm... It made me think about like the real world...about like... ummm, how people really react in society.
Thank You

Questions and Answers?
Metatuning Game Design Writing Genres

Game Design Document
MDA Flow Chart
Peer Assessment
Programmed Game
Playtesting Analysis
Paper Prototype
Blog
Game Pitch to Client
Future Research of Transdisciplinary Research and Pedagogy

P-12
Higher Ed
Community