Using ‘Gamified’ PBL To Improve Student Learning Behaviors

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Immokalee Community School & the Redlands Christian Migrant Association (RCMA)
Overview - My Inquiry
My scholars developed an “urbanized” and sustainable farming world. Using MinecraftEdu, the students are able to use blocks in order to build and conceptualize scientific models.

https://goo.gl/trUqFn
Literature Review: Exploring The Application, Attitudes and Integration of Video Games In Middle School
Literature Review: Using Game Worlds in Cyberspace for Communicating Educational Content
Literature Review: Gamification in Education: A Systematic Mapping Study
Blended Learning Environment

https://goo.gl/WCCmyZ
Background Knowledge

6th Grade

Freepik
Project Based Learning

- Collaboration
- Communication
- Critical thinking
- *Develop solutions to real-world problems*
Step #1: Transform the Learning Space

BIG QUESTION: How can “urbanized” farms reduce the effect of human and natural impacts and improve environmental sustainability?

Adapted from: http://www.edutopia.org/blog/big-things-transformational-teachers-do-todd-finley & flaticon.com
Step #2: Organize students into learning groups

Cooperative Learning with Kagan

http://www.kaganonline.com/free_articles/research_and_rationale/311/Cooperative-Learning-Structures-Can-Increase-Student-Achievement & Freepik
Student Habits of Mind

• Perseverance/Persistence
• Taking Educated Risks
• Imaginative Thinking
Step #3: Make Learning Segments Manageable

<table>
<thead>
<tr>
<th>6 - Earth Structures</th>
<th>Earth's Interior Layers</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 - Earth Structures</td>
<td>Weathering / Erosion / Deposition</td>
</tr>
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<td>Landforms</td>
</tr>
<tr>
<td>6 - Earth Structures</td>
<td>Human Impact on Earth</td>
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</table>
Designed processes to plant, water and sustain crops. Learning about Earth’s Interior Layers
Students worked to develop different farming plot designs and irrigation system designs.
• Next, students were able to explore weathering, erosion and deposition.
• Students designed systems to protect their crops from natural causes that could weather, erode and deposit seeds in different locations than intended.
Students then learned about landforms. Students were able to understand how landforms and mass wasting events can protect and/or destroy farms.
Finally, we explored how human impacts upon the earth can affect urbanization and water quality. Students were able to explore the processes that engineers use for their careers. Students were enveloped into a design process that tasked them to ask, imagine, build, evaluate and share their design processes.
Next, students explored how to harvest, clean and transport crops in the virtual world. They imagined ways farmers cleaned their crops and how they might have developed clean water resources.
Purpose

Most ‘gamification’ concepts **FAIL** to improve student learning behaviors due to poor alignment with ‘gamification’ objectives.

Adapted from
Research Questions

1. How do virtual worlds like MinecraftEdu act as zones where students can explore, design and problem solve?
2. How do gamification concepts improve student learning behaviors and align with gamification objectives?
Gamification Mechanics

Dynamics (Student Learning Behaviors)
MDE Business Framework

Adapted from Robson, K., Plangger, K., Kietzmann, J., McCarthy, I., & Pitt, L. (n.d.). Is it all a game? Understanding the principles of gamification. Kelly School of Business University of Indiana.
Basics of Game Mechanics

• ‘Gamification’ mechanics are known to student before play and remain constant.
• They do not change from player-to-player
• Examples: Game controls, blocks & functions, inventories, MinecraftEdu world boundaries
• As educators, we cannot expect students to demonstrate understanding of classroom content proficiently through virtual worlds if they do not FIRST understand the mechanics of play.

Adapted from Robson, K., Plangger, K., Kietzmann, J., McCarthy, I., & Pitt, L. (n.d.). Is it all a game? Understanding the principles of gamification. Kelly School of Business University of Indiana.
## Game Mechanics-Self Assessment

<table>
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<tr>
<th>Level</th>
<th>Description</th>
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<td>Novice (1)</td>
<td>Students seek to understand the game and are motivated to learn how the Minecraft game works before play.</td>
</tr>
<tr>
<td>Apprentice (2)</td>
<td>Students are comfortable with basic gameplay controls and students are knowledgeable about the Minecraft game. Since students are comfortable with the game, it is easier for the student to accomplish their task.</td>
</tr>
<tr>
<td>Practitioner (3)</td>
<td>Students expect a challenge in the virtual world. Students enjoy learning more about the Minecraft game like blocks, levers and plates. The more the student knows about the Minecraft game, the easier it is for them to accomplish tasks.</td>
</tr>
<tr>
<td>Expert (4)</td>
<td>The student feels confident in their abilities to control and manipulate the game. The student is able to do anything within the rules and/or constraints of the game.</td>
</tr>
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Students Develop Skill and Understanding of Game Mechanics During Manageable Learning Experiences
Student Habits of Mind-Self Assessment
How Players Follow Game Mechanics & Strategic Actions

**Student Rubric: Persisting**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Novice</th>
<th>Apprentice</th>
<th>Practitioner</th>
<th>Expert</th>
</tr>
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<tbody>
<tr>
<td>I can stay on task no matter how difficult it is to find answers to solutions</td>
<td>In a very limited way</td>
<td>In a limited way</td>
<td>Yes, with minimal difficulty</td>
<td>Yes, with ease and minimal hesitation</td>
</tr>
<tr>
<td>I can use a variety of strategies and resources to solve a problem</td>
<td>In a very limited way</td>
<td>In a limited way</td>
<td>Yes, with minimal difficulty</td>
<td>Yes, with ease and minimal hesitation</td>
</tr>
<tr>
<td>I always stay on task when trying to find answers or solutions to problems</td>
<td>Not really. Answers are difficult to find.</td>
<td>Most of the time, answers are still difficult to find.</td>
<td>Yes, with minimal difficulty</td>
<td>Yes, with ease and minimal hesitation</td>
</tr>
<tr>
<td>I try to complete tasks when the answers or solutions are not readily available, but I give up when the task is too difficult</td>
<td>Rarely. It is difficult for me to complete a task.</td>
<td>Some of the time. It is difficult for me to complete a task.</td>
<td>Most of the time. I do my best to find answers to problems but sometimes I give up.</td>
<td>Always, however I do not give up on completing tasks easily.</td>
</tr>
<tr>
<td>I get off task easily.</td>
<td>All the time. I do not like the activities in Minecraft Edu and I do not like learning in a virtual world.</td>
<td>Some of the time. I don’t know if I like the activities in Minecraft Edu. Virtual worlds are sometimes confusing.</td>
<td>Very rarely. I like the activities in Minecraft Edu and I like learning in a virtual world.</td>
<td>Almost never. I find myself engaged in the activity and I LOVE using Minecraft Edu to learn.</td>
</tr>
<tr>
<td>I give up easily and quickly on difficult tasks. I am unaware of available resources to help me find the answer to solutions.</td>
<td>Often.</td>
<td>Sometimes.</td>
<td>Rarely.</td>
<td>Almost never.</td>
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Design Packet

- Students worked in collaborative small groups
- Asked, imagining, built, evaluated and shared their scientific models.
- Developed solutions and models to promote:
  - environmental sustainability
  - responsible irrigation & water quality
Project Based Learning

- Create
- Analyze
- Synthesize
- Reference Background Knowledge
Design Packet

Students first used drawings to develop a diagram of their ideas and developed an active list of materials needed for their designs to come to fruition in the virtual world.
Design Packet

Students were motivated to explore how switches, pressure plates and redstone could be used in order to make their designs automated in order to preserve time, costs and labor.
Students tested their models in the virtual world, recorded the results and reflected if the model did what was expected.

They were also able to reflect upon the materials used in the design and if the materials worked or what others might be better.
Design Packet

As students actively explored the virtual environment, different limiting factors that could contaminate their water systems or derail their transportation systems were applied in the game. Students had to problem solve, revise and design ways to make their creations sustainable to contamination, weather and monsters (used in place of animals)
Results
Learning Behaviors vs. Mechanics

• Compared to the beginning of the unit, as students worked through manageable segments of instruction, their confidence and understanding of game mechanics improved.

• Consequently, as their understanding of game mechanics improved so did their student learning behaviors (perseverance/persistence, taking educated risks and imaginative thinking) when using a virtual world in the learning process.
## Student Learning Behaviors SA

### MDE ‘Gamification’ SA

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<th>Appraiser</th>
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<tr>
<td>I seek to understand the game</td>
<td>Feel motivated to learn how the game works before I play</td>
<td>Think I am knowledgeable about the game and how it works</td>
<td>I know about the Minecraft game and probably don't need to be motivated to learn how the game works before I play</td>
<td>I only know the basic rules and how to play the game.</td>
</tr>
<tr>
<td>I am comfortable with the game and can focus on the task’s objective</td>
<td>I am mostly knowledgeable about the game. It helps me to play games, and I can feel comfortable about it if I use the game in the right way</td>
<td>I am not too knowledgeable about the game and I am not too comfortable playing it.</td>
<td>I am not too knowledgeable about the game and I am not comfortable playing it.</td>
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<td>I expect a challenge when playing the game</td>
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<td>I feel confident enough that I can do anything with the rules of the game</td>
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Results

By expecting a challenge in the Minecraft game and learning about the blocks and their qualities, the students were able to collaborate with their peers, test their models with new materials and evaluate if the materials they used worked.
Results

Higher order thinking resulted as students imagined what changes they might make to improve their models, why they would make the change and evaluate if the model did what was expected.
Results

Manageable learning experiences resulted in better understanding of game mechanics. My students’ demonstration of content knowledge and their virtual products were direct results of their developing & proficient learning behaviors through the PBL framework.
It is not the final product that is most important in the virtual space, but rather the learning processes and experiences that enable students to problem-solve and understand the world around them.
Choose the farming activity that you liked best.

- MinecraftEdu
- Vertical Gardens Project
- Close Reading Articles
- Lipman Field Trip
Do you prefer to work in small groups or individually?
By aligning ‘gamification’ objectives related to game mechanics to intended student learning behaviors, games can be leveraged for learning in order to achieve something beyond traditional supportive learning communities.
References


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