Saving Earth, Populating Mars: Learning affordances of a game-based 3D Virtual Environment

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Setting the scene

- **Subject title:** Land Administration Systems
- **Subject code:** GEOM30013
- **Level:** 3 (Undergraduate)
- **Prerequisite:** N/A
- **Size:** 80 students
- **BSc and BDes:** Spatial Systems, Civil Systems, Environmental Eng. Systems, Property, Urban Design and Planning
Intended Learning Outcomes

1. Explain social, economic and environmental importance of land in societies
2. Describe land administration process and its subsystems
3. Classify technical and non-technical options for designing and managing land information infrastructures
4. Analyse local and overseas approaches to land administration in both developed and developing country contexts for sustainable development
5. Design land administration systems for specific country contexts
Assessments

• Assignment 1 (5%) associated with intended learning outcomes 1 and 2:
  • 700 Word report on land policies of individual territories due in weeks 4
• Assignment 2 (5%) associated with intended learning outcomes 1 and 2:
  • 400 Word report on peer review of assignment 1 due in weeks 6
• Major Project, (20%) Associated with intended learning outcomes 1-6
  • 2000 Word report on designing a land administration systems, due at the end of teaching break
• Assignment 3, (10%) Associated with intended learning outcomes 1-6
  • 500 Word report on peer review of the major reports due at the end of Week 11
• Assignment 4 (10%) associated with intended learning outcomes 1-6:
  • 10 minute presentation on the major projects due in weeks 12
Motivation

• Student feedback
  • Some concepts are abstract
  • Looks like a research subject

• Better Student Experience
  • Fun subject
Methodology

- Prototype
- Student acceptance testing (qualitative, quantitative)
- Improve
Saving the Earth, Populating Mars
Evaluation

• In a survey, students were
  • required to respond to positive and negative statements related to their interaction with the game (quantitative)
  • required to provide compare the game to their existing learning through written comments and feedback (qualitative)
  • required to provide age, gender, experience
## Quantitative

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>NO RESP.</th>
<th>1 STRONGLY DISAGREE</th>
<th>2</th>
<th>3</th>
<th>4 STRONGLY AGREE</th>
<th>5</th>
<th>TOTAL RESP.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I was engaged in the learning experience in Saving Earth Populating Mars</td>
<td>1</td>
<td>2</td>
<td>12</td>
<td>26</td>
<td>30</td>
<td>7</td>
<td><strong>77</strong></td>
</tr>
<tr>
<td>Saving Earth Populating Mars is a helpful program for my learning</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td>34</td>
<td>27</td>
<td>5</td>
<td><strong>75</strong></td>
</tr>
<tr>
<td>I enjoyed the 3D virtual environment as an information delivery system</td>
<td>1</td>
<td>0</td>
<td>9</td>
<td>20</td>
<td>35</td>
<td>13</td>
<td><strong>77</strong></td>
</tr>
<tr>
<td>In the future, I would prefer to learn with 3D Virtual Reality software than with textbooks</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>17</td>
<td>24</td>
<td>23</td>
<td><strong>77</strong></td>
</tr>
<tr>
<td>In the future, I would prefer to learn with textbooks than with Saving Earth Populating Mars</td>
<td>2</td>
<td>9</td>
<td>22</td>
<td>25</td>
<td>14</td>
<td>6</td>
<td><strong>76</strong></td>
</tr>
<tr>
<td>Learning would be easier with Saving Earth Populating Mars</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>36</td>
<td>23</td>
<td>8</td>
<td><strong>78</strong></td>
</tr>
<tr>
<td>I was willing to explore the program</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>11</td>
<td>33</td>
<td>26</td>
<td><strong>77</strong></td>
</tr>
<tr>
<td>I liked using Saving Earth Populating Mars as an additional learning tool</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>23</td>
<td>21</td>
<td>26</td>
<td><strong>77</strong></td>
</tr>
<tr>
<td>The visual representation of data in Saving Earth Populating Mars is better for my understanding</td>
<td>1</td>
<td>1</td>
<td>13</td>
<td>28</td>
<td>25</td>
<td>10</td>
<td><strong>77</strong></td>
</tr>
<tr>
<td>The 3D spatial distribution of the game play keeps me entertained between information bursts</td>
<td>1</td>
<td>3</td>
<td>10</td>
<td>22</td>
<td>26</td>
<td>16</td>
<td><strong>77</strong></td>
</tr>
<tr>
<td>Saving Earth Populating Mars is a waste of time</td>
<td>2</td>
<td>13</td>
<td>36</td>
<td>20</td>
<td>5</td>
<td>2</td>
<td><strong>76</strong></td>
</tr>
</tbody>
</table>
Qualitative

1. How was Saving Earth Populating Mars different/better than Course or LMS online tools?
2. What is the one thing you would change about Saving Earth Populating Mars?
3. What is one thing you liked about using Saving Earth Populating Mars?
4. What would need to be included to make the 3D Virtual Environments more engaging for your learning?
5. Which part of the 3D Virtual Reality in particular do you think will improve your learning?
Quantitative Analysis
Statements

The game offered a different way of learning

Agreed

Other

Students would prefer to learn with 3D Virtual Environments and not textbooks

Agreed

Other
Statements

The game is a waste of time

- Disagree
- Unsure
- Agree

The learning would be better with 3D Virtual software

- Agree
- Unsure
- Disagree
Age

• The age range of 18-20 includes statements where differences were observed.
  • I enjoyed the 3D virtual environment as an information delivery system has a 75% agree rate compared to 62% for the core analysis, and

• The 23-24 age range, with these users having a more negative experience with the game.
Gender

• There were 58 male respondents and 19 female respondents.
• In the majority of statements, females tended to have lower agree values compared with core analysis agree values.
# Experience

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DESCRIPTION</th>
<th>STUDY POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>The person has no experience with gaming</td>
<td>5</td>
</tr>
<tr>
<td>Low</td>
<td>The person may have no experience with computer platform gaming, however, has experience with mobile gaming applications</td>
<td>37</td>
</tr>
<tr>
<td>Medium</td>
<td>The person may have some experience with computer platform gaming and has experience with mobile gaming applications</td>
<td>16</td>
</tr>
<tr>
<td>High</td>
<td>The person has significant gaming experience in both computer-based systems and mobile applications</td>
<td>19</td>
</tr>
</tbody>
</table>
Qualitative Analysis
How was Saving Earth Populating Mars different/better than Course or LMS online tools?

• “felt more practical through the virtual environment”,
• “integrates textbook knowledge with interesting environment”
• “more engaging, visually stimulating”
• “useful as an additional learning tool”
• “helps to visualise 3D environments”
• “would highly recommend it for Engineering subjects as well, as there are lots of 3D modelling involved”
• “visual representation of data gives better understanding, but the game needs to improve”
• “entertaining but not as substantial. Engaging though”
What is the one thing you would change about Saving Earth Populating Mars?

• “smoother game play”
• “better quicker rendering. It made me really confused & have a headache”
• “very glitchy, very laggy, I think this needs to be addressed before any more useful criticism/feedback can be provided”
• “less area between checkmarks”
• “time wasted on walking around to find information”
• “reduce scale or increase number of information points to reduce travel”
• “incorporate info into the game such as talking characters, short movies, short movies, environment game”
• “bring in more tools to make the game more player friendly”
• “create clear objectives/missions to make the game more challenging e.g. Add features that benefit our learning”
What is one thing you liked about using Saving Earth Populating Mars?

• “Interactive”
• “It was visually stimulating and a great way to learn information”
• “engagement in learning in a more ‘exciting’ environment”
• “it went straight to information”
• “Answering trivia based upon provided website data. A new learning experience that appeals to me as someone who enjoys video games”
What would need to be included to make the 3D Virtual Environments more engaging for your learning?

• “People to interact with opposed to information boards.”
• “Increased influence of player actions on the game and a feedback beyond the score displayed, eg. expanding the city when you get population right or assigning policy to create different things in game.”
• “Different roles, which would hopefully come about in the next phase of development.”
• “Not just have learning occur at info points more throughout the game.”
• “Streets blocks craters more dense buildings/towns.”
• “Clever incentives introduced. How do you lose?”
• “Add more environment change “
• “Direct linkage to course content and assignments”
Which part of the 3D Virtual Reality in particular do you think will improve your learning?

- “The question based progressions”
- “Using learning objectives as tools required to complete a different game objective”
- “The trivia questions as it stands in future as a feedback mechanism in which policy can be experimented with”
- “The ability to make land administration decisions and see how they play out”
- “Starting a LAS from scratch”
- “Access to content”
- “The links given than encourages the learning”
Experienced users

• Q1. HOW DO YOU FIND THE VISUAL REPRESENTATION OF THE MATERIAL IN THE GAME?
  • Lacking. Don’t use Earth buildings, you're on Mars. Domes, not bricks and mortar.

• Q2. WHAT ELEMENTS ARE MISSING THAT WOULD MAKE THE GAME A BETTER LEARNING EXPERIENCE?
  • A multiplayer experience (mainly with your group) would be fantastic. I am imagining a multiplayer world where my group can work together to build our environment, while also visiting other groups areas (without editing them). Creates a competitive group v group for who can create the best environment”. 
Experienced users

• Q3. HOW DOES THE GAME PLAY RUN? IS IT SMOOTH? WHAT ELEMENTS COULD BE IMPROVED TO HELP MAKE THE PLAYER MORE COMFORTABLE?
  • Not smooth -- camera angles need more varieties. It is pixelated and movement using the keyboard and mouse are too sensitive. Try to follow like games such as Counter Strike.

• Q4. IS THERE ENOUGH VARIATION TO KEEP YOUR INTEREST? IF NOT, WHAT CAN BE DONE TO CREATE INTEREST? SCENARIOS, CHARACTERS, INFORMATION POINTS, ETC.
  • Actually simulate a colony on Mars, develop a LAS and see how it develops.
Conclusions

- Learning
- Engagement