

# Game Based Learning

## 1. Project Abstract

Gamification, or Game Based Learning (GBL), in higher education is an emerging mechanism for establishing an additional mode of student engagement<sup>1,2</sup>. Although gamification might appear to be an attempt to add “fun” to the learning process, it has been shown to learning enhancements for students. A game that generates curiosity on the part of the player leads to engagement, autonomy and meaning – key elements of critical thinking. *Engagement* is a critical element of Nexus Learning; *curiosity* is a Hallmark outcome of DECSYS.

One of the conclusions from a review of the literature regarding gamification of college level course work is that although many create active environments, there is often little actual gameplay<sup>1</sup>. The introduction of a well developed game play system increases engagement in addition to activity<sup>3</sup>.

The proposed game will engage players regarding systems thinking in the context of the design of a green building. This will feature environmental situations using economics, ethics, design and business models as key areas of focus. The game will be playable in a short time, have a small physical footprint, and provide the framework for deeper discussions about the concepts encountered during play.

Players will choose actions that have positive and negative economic and environmental impacts and predict the effect of these choices, encouraging students to access higher levels of Bloom’s Taxonomy learning outcomes. This is not a video game, it is a physical game. This choice is intended to maximize social interaction amongst players and allow instructors to employ the game independent of technology.

## 2. Explanation of how the Project Advances Nexus Learning

As far back as 1910, Dewey<sup>4</sup> proposed that science should be experienced, and students should not be passive recipients of “ready-made knowledge.” Pedagogical embrace of the importance of active learning has only increased in the intervening century. As we expand our

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<sup>1</sup> Ma, M., Oikonomou, A., and Jain, L., *Serious Games and Edutainment Applications*, Springer, 2011.

<sup>2</sup> Kapp, K., *The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education*, John Wiley & Sons, 2012.

<sup>3</sup> Pastore, C. and Suss, J., *The Importance of Game Play in Engaging Students in Serious Gaming*, Lilly Conference, Austin, 2015.

<sup>4</sup> Dewey, J. *How We Think*, D.C. Heath & Co, 1910.

understanding of the goals of student learning at Philadelphia University, it is necessary to explore and develop novel instructional activities such as serious gaming.

The key element of Nexus Learning advanced by this project is that of engagement. There are many aspects to engaging students in a classroom, and adding GBL to the faculty arsenal offers an opportunity to further engage the students. Additionally, the development of curiosity, although not specifically a Nexus Learning outcome, is a Hallmark outcome.

The experience of developing a course specific game will not be limited to a specific course. This will be deployed in both the undergraduate DECSYS 208 and the graduate SDN 601. The game development process will be documented and will include a framework for the development of other games in other courses by other faculty. This framework will also be considered for its ability to play the game in on-line courses in the future.

GBL as a learning technique<sup>5</sup> has been investigated and shows promising outcomes. This project intends to explore non-computerized gaming as an avenue to enhance the social interaction amongst the students.

### 3. Specific Project Goals and Learning Outcomes

Project goals are

- Develop an engaging game that addresses learning outcomes of a specific course
- Improve the play experience and maximize learning by play testing the game sufficiently
- Assess the game with students and measure the effectiveness of the game compared to traditional content delivery methods.

We have 5 primary learning outcomes from the use of this game in the classroom:

- Analyze complex interactions through systems thinking
- Evaluate the impact of decisions in the context of the problem
- Compare multiple avenues of “winning” the game
- Construct peer to peer communication regarding the content
- Explain ambiguous scenarios where multiple right answers are possible

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<sup>5</sup> Milan, E., and Gutierrez, R., *Learning by Playing: Is Gamification a Keyword in the New Education Paradigm?*, IGI Global, 2014.

## 4. Description of Activities and Timeframe

Summer 2016 will be the primary development and prototyping time frame. Undergraduate students will be employed during the summer to play, test and generate prototypes of the game.

Specific activities this summer include the following:

- Identify relationships between actions taken by designers, developers and clients in the green building marketplace.
- Develop avatars of architects, engineers, builders, clients and developers
- Develop scoring system that leverages a risk/reward relationship that places students in position of choosing between two “right” answers – each with their own set repercussions
- Develop engaging graphics that add to the allure of the game
- Develop game play rules
- Playtest alpha versions of the game, assess, and re-design.
- Prepare Beta version for deployment in the fall semester.
- Write a rule set and a Teacher’s Guide.

## 5. Project Assessment

After the game has been completed, it will be employed in DECSYS and Sustainable design courses in Fall 2016. Because of the large number of class sections in DECSYS 208 and 206 (18 sections estimated), the intent will be to use the game in 9 of those sections. An additional group of 18 students in two different sections of the MS in Sustainable Design program will also assess the game in two different sections of SDN 601.

Assessment will be based on a rubric of learning outcomes associated with both an exercise involving a specific task as well as each course’s final projects. The rubric scores will be compared between the classes using the game based learning and those classes using the traditional instructional technique. Statistical analysis of the differences will be made to assess if there was any specific different learning acquired.

Additionally, students will be surveyed to get a sense of their opinion of the activity and what they think they might have learned from the process.

Thus an assessment of specific learning outcomes will be performed after the students either employ this game or engage in a different activity (in the control group). The results of learning

achievements will be documented and statistically analyzed to develop a preliminary evaluation of the effectiveness of the game in achieving course specific learning outcomes.

## 6. Documentation and Dissemination

The results of the research will be shared internally with the community through a forum such as Celebrate Nexus Learning Week or the newly adopted EduSeries, and additionally will be developed as a paper that can be published and/or presented in an appropriate public forum, such as the *Games in Education Conference*, the *Lilly Conference*, the *Systems Thinking and Dynamic Modeling Conference*, the *International Journal of Environmental and Science Education* and other green building/architecture conference and publications.

If the game is successful, we will explore publication of the game and development of learning modules that can be used in the classroom at Phila U or other institutions of learning (college or high school).

## 7. Project Personnel

Two undergraduate students will be engaged as the primary prototype developers and play testers.

Christopher Pastore and Robert Fleming will oversee the student work and provide the primary game design and learning content. Dr. Pastore will implement the game in the DECSYS classes for assessment. Prof. Fleming will implement the game in SDN 601.

## 8. Budget Narrative and Worksheet

The budget is attached as a separate file. The required expenses are two undergraduate students to work the summer of 2016 for 200 hours each. Additionally a stipend of \$1,000 is requested for each of the two faculty investigators to nominally cover some of their time spent on the project.

## 9. Attachments (required)

Chris Pastore was co-PI with Leslie Browning-Samoni on a 2011 Nexus Grant entitled: *Incorporation of e-portfolios into DEC 101* regarding the development of e-portfolios in the IDP course. The results of this were presented at a Celebrate Teaching Seminar, and a paper submitted for the Lilly Conference in 2012 was not accepted.