Gamifying an Online Instructional Design Course: An Educational Design Research Study

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Abstract

This paper presents the results of a two-year educational design research (EDR) initiative focused on the challenge of increasing learners’ motivation and engagement in an instructional design (ID) course. Class observations and student evaluations from prior semesters clearly showed the need to redesign a foundational graduate course at a large university in the southwestern US. Following the principles of EDR, a team of three faculty and two graduate assistants addressed this need through multiple cycles of analysis, development, testing, and refinement. The literature review conducted during the analysis and exploration phase of EDR indicated that gamification as a pedagogical technique could improve student interest and engagement. Gamification elements were introduced to the course design during the design and construction phase and were subsequently tested and refined during the evaluation and reflection phase. Data collected included notes and drawings created during the research team’s brainstorming sessions and from the course archives on Blackboard. The archives included text from various course discussion forums, assignment content, messages from students, and feedback from students about their perceptions of the game elements. The redesigned course has been offered for two iterations, and 63 graduate students have completed the course. Five design principles that are relevant in real-world educational contexts emerged through the systematic introduction of various interventions and adjustment of the components of the educational content of the course. This EDR study demonstrates how technology-based gamification elements could be used to enhance student engagement and motivation and can serve as a model to inspire others who may consider gamifying their online and blended courses.
Introduction

Students’ interest and active engagement in a course are critical for learner academic achievement (Soffer & Cohen, 2019). Through class observations and student evaluations from prior semesters, the course instructor of an instructional design (ID) course at a large university in the southwestern US found that some of her students perceived the course to be dry and uninteresting, struggling to stay engaged with the content in the first half of the course. Following the principles of educational design research (EDR), a team of three faculty and two graduate assistants worked through multiple cycles of analysis, development, testing, and refinement to redesign the course with the aim to improve students’ interest, motivation, and early engagement in the content. This case study reports findings from this two-year educational EDR initiative and describes how game elements of fantasy storyline, avatars, gamified points structure, badges, leaderboard, and interactive multimedia supported immersive play experiences within the online course.

Background

Smith and Ragan (2004) define instructional design (ID) as a systematic and reflective process of translating learning principles into instructional content. Having a good understanding of the instructional design process can help educators create courses that are more likely to be effective and engaging. Research studies have shown the positive impacts of effective instructional design in many professional education settings, such as in medical training (Melo, Falbo, Muijtjens, Vleuten, & Merriënboer, 2016), librarian education (Mullins, 2014), and preservice teacher training (Kumar & Hamer, 2012).

Given the importance of instructional design for students pursuing a degree in instructional technology, a foundation ID course has been one of the core courses of our Learning, Design, and Technology graduate program since the program’s inception in 1979. The course, entitled CUIN 7390: Instructional Design, introduces students to the theoretical, experiential, and critical components of the instructional design process. In addition to core knowledge, students gain practical experience by designing stand-alone instructional modules that can be used in real educational settings (“Course Descriptions,” 2017). The design of the course adopts the systematic design of instruction model introduced by Dick, Carey, and Carey (2014) and uses the textbook written by these authors, The Systematic Design of Instruction.

The initial design of CUIN 7390 followed each phase of the Dick and Carey instructional design process and was structured such that each week’s instruction corresponded to a step in the design process. The course began with the analysis phase of instructional design (e.g., needs assessment, learner analysis, and performance objectives) that would eventually lead to students developing instructional materials for their individual projects. At the end of the course, the students formatively evaluated the materials that they created with a sample of their target population (Figure 1).


Since this course relies heavily on information in the textbook, students often reported that the large amount of reading was challenging. Student evaluations for the past ten years indicated that while the students found the overall quality of the course high, they sometimes remarked comments about the content such as, “Overwhelming at first!” (Anonymous student response on an end-of-course evaluation). Some students over the years described discomfort and stress that they felt in the first part of the course before they understood the ID
process as a whole. For example, one student commented, “In the beginning, there was no light at the end of the tunnel. It has, however, come full circle and made more sense” (anonymous student response on an end-of-course evaluation). In preliminary redesign discussions, the primary instructor shared that students who were organized, methodical, and self-regulated tended to engage with the course materials early in the semester and overall performed well in the course. However, she said that other students who were less detail-oriented, auditory, or visual learners appeared to find the systematic process dry and uninteresting and would often struggle in the first half of the course. Such students would typically have greater interest and engagement once they realized the big picture and how the planning phase of the ID process fit into the development phase as they started to put the pieces together about halfway through the course (Personal communication with the primary course instructor). Since this course is usually offered entirely online, we saw a strong need to redesign the course and apply innovative instructional strategies that could motivate students and engage them with the content earlier in the semester. We also felt that this course was a good candidate for applying gamification elements for three main reasons—

1) This course is an introductory course, but it is very important because students learn essential skills they will need in other courses in the program;
2) Because this is a theoretical course, the instructional design content did not change significantly from year to year; and
3) The course is taught every spring, enabling the research team to quickly evaluate what worked and what was needed to be revised for the next iteration the following year.

**Educational Design Research**

To address the need to enhance student motivation and engagement, we followed the principles of EDR to generate insights through multiple cycles of analysis, development, testing, and refinement (McKenney & Reeves, 2019). Central to EDR is the iterative testing and refinements on complex educational problems to derive evidence-based claims that may potentially impact naturalistic settings (McKenney & Reeves, 2019). When doing EDR (sometimes referred to as design-based research or DBR), researchers systematically introduce various interventions or adjust the components of their educational content to refine and produce practical knowledge or theories that are relevant in real-world educational contexts (Barab & Squire, 2004; Brown, 1992). DBR studies evaluate “what works; for whom; under what authentic, field-based conditions; and how/why this approach is effective” (Dede, Ketellhut, Whitehouse, Breit, & McCloskey, 2009, p.14).

Although it is not a linear step-by-step process, EDR typically involves three major phases. The initial analysis and exploration phase involves working closely with collaborators to acquire an understanding of a significant educational problem and investigate how others have addressed it. This phase gradually morphs into a design and construction phase that is focused on identifying or creating appropriate design principles and using these principles to develop a prototype intervention that addresses the problem. Finally, an evaluation and reflection phase of multiple iterations of data collection and analysis is conducted to test the prototype intervention and review the implications of the findings. Figure 2 depicts the EDR process.

![Figure 2](image-url)

*Figure 2. The process of conducting educational design research. From Conducting Educational Design Research (2nd ed., p. 83) by S. E. McKenney and T. C. Reeves, 2019, New York, NY: Routledge. Used with permission.*
Gamification

The literature review conducted during the initial analysis and exploration phase suggested that gamification as a pedagogical technique could improve student interest and early engagement (Betts, Bal, & Betts, 2013; Gibson, Ostashewski, Flintoff, Grant, & Knight, 2015). The term gamification refers to the “use of game design elements within non-game contexts” (Deterding, Dixon, Khaled, & Nacke, 2011, p. 1) and involves the use of “game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems” (Kapp et al., 2014, p. 54). While the application of gamification in education is still an emerging trend, its proponents suggest that it can be employed to enhance student engagement and prompt learning (Dicheva et al., 2015).

There are some elements that are commonly found in a gamified course: Story, rules, challenge, curiosity, character, interactivity, feedback, and freedom to fail (Buckley, Doyle, & Doyle, 2017; Kapp et al., 2014). It is not necessary to add all of these elements when doing gamification on a course. However, Nicholson (2014) suggested the use of “narrative, freedom to choose paths to explore, playful activities, and opportunities to reflect” (p.14) for a gamified course to be engaging and meaningful for students.

Methodology

McKenney and Reeves (2019) suggest that EDR is not so much a specific research methodology as it is a genre of educational inquiry that seeks to maximize the practical impact of educational research while at the same time seeking to reveal new theoretical knowledge. For our study, we pursued EDR for two main reasons: (1) the parallel resemblances of its process with the ID process and (2) the naturalistic or real-life context emphasis of the method. Central to EDR is the iterative testing and refinements on complex educational problems to derive evidence-based claims that may potentially impact naturalistic settings (McKenney & Reeves, 2019). When using EDR, researchers systematically introduce various interventions to or adjust the components of their educational content to refine and produce practical knowledge or theories that are relevant in real-world educational contexts (Barab & Squire, 2004; Brown, 1992). EDR generates insights through its multiple cycles of analysis, development, testing, and refinement, from which new insights would be generated to improve the following cycles.

Research Questions

Our EDR initiative addressed two overarching research questions –

1. What is an optimal design for applying gamification elements in an online instructional design course to improve student motivation and increase their engagement as early as possible in the course?
2. What design principles can be identified that can be used to extend the application of gamification elements in other online or blended courses?

Data Sources

The data for this study included notes, drawings created during the research team’s brainstorming sessions, and reflection notes taken during and after the end of each course. We also examined the course archives on the Blackboard learning management system (LMS). The archives included text from various course discussion forums, assignment content, messages from students, and post-course feedback from students about their perceptions of the game elements.

This paper reports findings from two iterations of the redesigned ID course. In Year One, 24 students completed the course, and 39 students completed in Year Two. The students’ ages ranged from 23 to 54 ($M=6.67$, $SD=8.94$) with 20.6% identified as male and 79.4% female. At the beginning of the course, we asked students to complete an online survey that was modified from the student course engagement questionnaire (SCEQ) (Handelsmann, Briggs, Sullivan, & Towler, 2005). The survey was optional and not tied to their grades. The SCEQ is well-validated to measure student engagement and has been reported to have high-reliability scores (Ginns, Prosser, & Barrie, 2007; Handelsmann et al., 2005). The Cronbach alpha for this study was .832. The 23-item survey uses a 5-point scale ranging from 1 (not at all characteristic of me) to 5 (very characteristic of me). This survey measure student’s perception of course engagement in four categories – skills, emotions, participation, and performance. Several of the items were slightly reworded to match the course settings (see Appendix 1). For example, item 3 – “Doing all of the homework problems” substituted “homework problems” with “assignments.” Table 1 displays the SCEQ results for students who took the course in Years One and Two.
Table 1. Student course engagement questionnaire scores for the first and second years

<table>
<thead>
<tr>
<th>Year</th>
<th>Skills</th>
<th>Emotional</th>
<th>Participation</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>first year</td>
<td>38.31</td>
<td>20.63</td>
<td>24.50</td>
<td>14.5</td>
</tr>
<tr>
<td>N</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>SD</td>
<td>3.790</td>
<td>2.604</td>
<td>3.688</td>
<td>1.0</td>
</tr>
<tr>
<td>second year</td>
<td>37.80</td>
<td>20.97</td>
<td>22.77</td>
<td>13.55</td>
</tr>
<tr>
<td>N</td>
<td>30</td>
<td>31</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>SD</td>
<td>3.478</td>
<td>3.114</td>
<td>3.748</td>
<td>1.36</td>
</tr>
</tbody>
</table>

Educational Design Phases

Phase 1: Analysis and Exploratory Phase

In the fall of 2016, our team began the redesign process by reading and discussing the book, *The Gamification of Learning and Instruction Fieldbook: Ideas into Practice* by Kapp et al. (2014), as well as research articles about educational gamification. We held weekly meetings to discuss our ideas and brainstormed ways of making the game more engaging and authentic. We discussed the design of games that we had experienced, including older immersive games, such as *Myst* (Miller & Miller, 1993).

Choosing a story for the game was a critical first step in the process. Kapp et al. (2014) suggest that stories could help improve learner’s engagement, since they “evoke emotions, provide a context for placing information, and are the way humans have handed down information for centuries” (p. 236). Because of our proximity to Johnson Space Flight Center in Houston, Texas, we decided to use a space theme for the storyline. Throughout our brainstorming sessions, we discussed the script, characters, challenges, and possibilities for adding more interactivity to the course content. We also created sketches and flowcharts for ideas that could carry the content through the 15 weeks of the semester and still convey the essential ideas and skillset of the ID process (Figure 3). This spurred exploration into space terminology and content as we developed the prototype during the next EDR phase.
As ID process can be easily divided into five components, the research team decided that the space “crew” (the students) could visit five planets on their quest to find an “evil villain” who stole important ID documents. Planet names were based on Latin words that describe the focus of ID process component. For example, the first planet was named *Resolvere* (meaning “to analyze”), since identifying instructional goals using front-end analysis and analyzing learners and context were covered in this section. Students would have missions to carry out on each planet that would culminate with their completing their own ID project, and they worked individually and in teams through the ID process to create design documents for their content area.

We explored the idea of using commercial software to create the game, and we researched companies who developed these tools. We contacted two companies who had received recent design awards for their game software and evaluated demos of their programs. Commercial software appealed to us at first, because it offered many features including built-in leaderboards, avatars, and badges. However, the more behavioral aspects of the game software, as well as the high cost, deterred us from using this software and resulted in our developing the game using a variety of tools including Adobe Captivate and Photoshop, Camtasia, and features already existing in Google Sheets and Blackboard.

**Phase 2: Design and Construction Phase**

We began the design and construction phase by chunking the course content and aligning it with the storyline using a Google Doc shared with the team. This allowed team members to interact continuously by leaving comments and editing the text (Figure 4).
Music, ideas for graphics, and scripts for the audio were also added to this document as the design was finalized. As the construction of the course began, we also added a Google Doc to keep track of changes needed and completed (Figure 5).

As we worked on the storyline and learned more about space exploration through conversations with space subject matter experts, we added elements such as a “wormhole” for “disappearing” during spring break, used a photo of the mission control room at NASA as the background for the Commander (instructor) videos, and created assignments for small groups to create educational materials for the actual eclipse that would take place the summer after the revised course was offered. On each planet, we planned interactive multimedia elements for the students that would reveal the next chapter in the “Captain Beltran” story and enable them to “unlock” the next section of course materials by locating passcodes and completing content-related tasks within the game. Course instructors became facilitators, and they would communicate through instructional videos, supportive handouts, and feedback to guide the students throughout the course.

When we began discussing how we would construct the game interface, we realized that we could not carry out the complete vision of our online course experience solely using the functions of Blackboard. This challenged our team to identify and bring in new tools, such as Voki for creating the student avatars and talking avatar “explainer” videos, Google Sheets for running a live class leaderboard with a linked “behind the scenes” instructor sheet, and Camtasia and Adobe Captivate for generating interactive multimedia game-play. We transformed our online discussions from a *post once, reply twice* expectation to a team-driven, goal-oriented discussion framework. We found that students were so invested in their teamwork that they posted more actively and initiated even further discussion through student-created Google Docs, Hangouts, and Slack channels.

Much of our design discussion centered on how to transform the previous points structure of the course into the game format. Students accumulated “flight hours” (points) for completing missions, quizzes, and bonus “Power Up” challenges and for actively participating in discussions. The “space crew” leaderboard showed students’ current standings with regard to flight hours earned, game levels achieved, and badges earned. Students were represented by avatars and the game names they created, which were not their real names, enabling them to assess how they...
were performing against the other team members while maintaining their anonymity. The leaderboard was easily accessible to students through a link in the main menu of the Blackboard course, and we recognized the current leaders on each planet in course announcements. We also designed three different badges that were displayed on the leaderboard. One badge, *Patches Earned*, represented the student’s current astronaut rank earned. Students began the course as *Junior Astronauts* and then rose to higher positions as they earned “flight hours” (points). Another badge that was incorporated into the leaderboard were wings that were also aligned to students’ current rank. The third badge displayed any points earned from the “Power Up” challenges, which were bonus activities for each planet. Figure 6 shows a portion of the leaderboard with student-created avatars and names, as well as the three types of badges, “total hours in space” (accumulated points), level, and hours needed to move up to the next level.

![Course leaderboard](image)

Figure 6. Course leaderboard.

Another complex task involved tracking the different points that students could earn while on each planet. Figure 7 shows a screenshot of the activities for one planet in the tracking system we used to assign points and bonus points for the challenges.

![Screenshot of online tracking system](image)

Figure 7. Screenshot of the online tracking system for possible points on Planet Resolvere.
Lastly, throughout the process, we also created short videos to provide an overview of each planet and introduce the “mission” (assignment) that they had to complete on the planets. We also created interactive activities on each planet.

The gamified course was first implemented in spring semester 2017. Figure 8 shows the course schedule for the first implementation of the course in spring 2017.

<table>
<thead>
<tr>
<th>Dates</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Getting Ready: Space Camp!</strong></td>
</tr>
<tr>
<td>1/16 - 1/21</td>
<td>Ch. 1: Introduction to Instructional Design</td>
</tr>
<tr>
<td>1/22 - 1/23</td>
<td>“Flying to Planet Resolverse” / Recharge</td>
</tr>
<tr>
<td></td>
<td><strong>Planet Resolverse (“Analyze”)</strong></td>
</tr>
<tr>
<td>1/24 - 2/4</td>
<td>Ch. 2: Identifying Instructional Goals</td>
</tr>
<tr>
<td></td>
<td>Ch. 5: Analyzing Learners and Contexts</td>
</tr>
<tr>
<td>2/5 - 2/6</td>
<td>“Flying to Planet Artem” / Recharge</td>
</tr>
<tr>
<td></td>
<td><strong>Planet Artem (“Skills”)</strong></td>
</tr>
<tr>
<td>2/7 - 2/18</td>
<td>Ch. 3: Conducting a Goal Analysis</td>
</tr>
<tr>
<td></td>
<td>Ch. 4: Identifying Subordinate and Entry Skills</td>
</tr>
<tr>
<td>2/19 - 2/20</td>
<td>“Flying to Planet Consilium” / Recharge</td>
</tr>
<tr>
<td></td>
<td><strong>Planet Consilium (“Design”)</strong></td>
</tr>
<tr>
<td>2/21 - 3/4</td>
<td>Ch. 6: Writing Performance Objectives</td>
</tr>
<tr>
<td></td>
<td>Ch. 7: Developing Assessment Instruments</td>
</tr>
<tr>
<td>3/5 - 3/6</td>
<td>“Flying to Planet Materia” / Recharge</td>
</tr>
</tbody>
</table>

*Figure 8. Screenshot of course schedule for 2017 spring semester showing the activities on each planet.*

**Phase 3: Evaluation and Reflection**

After the first implementation of the course, the team met to reflect on the experience. We shared student comments we had gathered throughout the course. Overall, debriefing data centered on the learning of new technology skills. There was a feeling of accomplishment about how we had created a vision for the course and designed innovative ways to make it a reality. For example, since we did not use commercial software to create the game, we had to design our own leaderboard from scratch with Google Sheets and embedded graphics using formulas and displays that we learned how to use during the construction phase. We also used Blackboard’s advanced features such as SCORM and adaptive release of content. In addition to technology skills, we also acquired new pedagogical skills, as we spent time in the design and construction phase trying to create activities that would challenge students, while, at the same time, allowing them to practice ID.

The team noted two areas that needed improvement after the first-year implementation. In Year 1, the students were divided into small groups; in these small groups, students followed a simplified ID process and created educational materials about the eclipse which would take place in August 2017. We felt this would give students a chance to support each other and learn how to use the ID process collaboratively. However, there were too many things happening at the same time; students were working on their own ID projects as well as their group project while they were also on a journey through space and learning about the ID process. In Year 2, we changed the assignments in the small groups so that students shared their progress on their own ID project with their group in order to give and receive peer feedback.

At the end of the course, we asked our students to provide voluntary feedback regarding the structure of the course and its game elements. We designed this survey to gather input about components of the course that they perceived helpful in motivating and keeping them engaged with the course content and components that they felt...
could be improved. The survey is composed of sixteen items, with fourteen Likert-type items, one rank-order item, and one open-ended item. Table 2 shows student post-course survey responses for the Likert-type items.

Table 2. Descriptive Statistics Results from the First and Second Iterations’ Post-Course Survey.

<table>
<thead>
<tr>
<th>Item</th>
<th>first iteration</th>
<th>second iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>1 The gamification elements in CUIN 7390 made it feel like a real game.</td>
<td>16</td>
<td>3.88</td>
</tr>
<tr>
<td>2 In general, how effective was the gamification approach used in CUIN 7390?</td>
<td>16</td>
<td>3.31</td>
</tr>
<tr>
<td>3 Your motivation in this gamified course</td>
<td>16</td>
<td>3.75</td>
</tr>
<tr>
<td>4 Your engagement in this gamified course</td>
<td>16</td>
<td>4.00</td>
</tr>
<tr>
<td>5 The amount of work overall in this gamified course</td>
<td>16</td>
<td>3.88</td>
</tr>
<tr>
<td>6 The difficulty of this gamified course</td>
<td>16</td>
<td>3.31</td>
</tr>
<tr>
<td>7 The ease of navigating the course materials in this gamified course</td>
<td>16</td>
<td>3.31</td>
</tr>
<tr>
<td>8 Time spent reading and viewing course materials in this gamified course</td>
<td>16</td>
<td>3.63</td>
</tr>
<tr>
<td>9 Time spent discussing course content with classmates in this gamified course</td>
<td>16</td>
<td>3.50</td>
</tr>
<tr>
<td>10 Time spent completing the assignments in this gamified course</td>
<td>16</td>
<td>3.69</td>
</tr>
<tr>
<td>11 Overall, how useful were the course activities in helping you become more knowledgeable in instructional design?</td>
<td>16</td>
<td>4.00</td>
</tr>
<tr>
<td>12 The textbook and supplemental learning materials used in the course were:</td>
<td>16</td>
<td>4.13</td>
</tr>
<tr>
<td>13 The instructions for the weekly course activities were:</td>
<td>16</td>
<td>4.44</td>
</tr>
<tr>
<td>14 This was a worthwhile learning experience.</td>
<td>16</td>
<td>4.37</td>
</tr>
</tbody>
</table>

Design Principles for Gamifying an Online ID Course

The evaluation and reflection phase of this EDR project revealed design principles related to the integration of gamification elements into an online ID course.

Principle 1: Apply a Team Approach in Course Gamification

The redesign of CUIN 7390: Instructional Design was a collaborative effort of a team of three faculty and two graduate students in the Learning, Design, and Technology area. We began working on the project at the beginning of Fall 2016 and went through the iterative process of EDR to first clarify the problem, then create and test practical interventions, and finally engage in reflection to reveal theoretical insights to improve student interest and engagement. Once the literature review indicated that gamification might be a viable solution for increasing
student motivation and engagement, the team members read about gamification in *The Gamification of Learning and Instruction Fieldbook: Ideas into Practice* (Kapp, Blair, & Mesch, 2014). We also studied published research on how gamification has been applied in online courses, and reviewed digital tools that could support various game elements. Analysis of our design notes made it evident that the team reexamined and redefined in each iteration the approach in which the course was delivered to better connect with the learners and explore the content more deeply.

**Principle 2: Use Story to Reinvigorate and Provide Continuity in Online Course Content**

Viewing the course through a new lens for teaching online using gamification provided inspiration for the designers to “play” with teaching ideas, providing a refreshed perspective on content that had been previously taught in much the same way for years prior. Story and role-play elements were incorporated in the redesigned course through the space exploration game segments and learner avatars and screen names. The “space crew” leaderboard showed students’ current standings in regard to flight hours earned, game levels achieved, and badges earned. Students completed tasks individually, as well as worked in teams to design informal instruction for a simulated NASA project. Story became a powerful way to engage students in learning a potentially intimidating process of systematic ID.

**Principle 3: Integrate Multimedia Tools to Support Gamification Application**

The complete vision of the gamified online course experience could not be accomplished solely using the functions of the LMS. The team used Google Docs for online collaboration in the design process, identified image and video creation tools for creating avatars and talking avatar explainer videos, created cloud-based spreadsheets for the live class leaderboard, and used Adobe Captivate for generating interactive multimedia game-play. Online discussions were transformed to be team-driven and goal-oriented. It was found that students were so invested in their teamwork that they overall posted actively and initiated even further discussion through student-created documents, synchronous sessions, and asynchronous communications.

**Principle 4: Integrate Interactivity in Gamification**

A key outcome of this project has been maximized student academic learning time. We found that embedding interactive online multimedia throughout the course modules immersed learners in a powerful story and provided opportunities for them to acquire, practice, and apply ID concepts and skills. They increased their time exploring materials in the course site, often completing optional activities above and beyond the required assignments. The novel approach to grading through the accumulation of “flight hours” for successful completion of activities made it possible for students to extend their learning in directions that were meaningful and useful for them and served as a motivator to encourage them to reach increasingly higher levels in the course.

**Principle 5: Provide Opportunities for Peer-to-Peer Interaction**

Even though students were separated by physical distance, the team-based discussions relating to the development of the solar eclipse instructional units connected students to each other and the content through shared design work and contextualized their learning within a realistic ID case. The course content that may have felt at times complex and difficult to understand became more palatable, as our redesigned course offered an abundance of varied examples and practice with visual, auditory, and hands-on elements aimed at helping students grasp the essence of the ID process. The examples and practice experiences were tied together through the space adventure storyline, demonstrating to students that ID can be playful and creative.

**Discussion**

This study has demonstrated how technology can be used to enhance student engagement in online environments and to serve as a model to inspire others who consider applying gamification to their online and blended instruction. Some might ask why we used EDR to address the need to redesign the ID course instead of the systematic design of instruction model (Dick et al., 2014) taught in the course. ID models are adequate if the primary goal is to develop a more effective course alone, but we sought to accomplish the twofold mission of EDR, which is to solve a real-world problem (enhancing student motivation in online learning) and to identify new or refined theoretical knowledge (reusable design principles related to the use of gamification elements in online or blended courses).

The course discussed in the study incorporated game elements of a fantasy storyline, role-play, gamified points structure, badges, leaderboard, and interactive multimedia that support immersive play experience. It shows the variety of ways that content can be represented, organized, and presented to the learner through graphics, audio,
video, text-based handouts, and hands-on explorations. Course designers may apply the design principles that emerged in this study as an inspiration for gamification of online and blended courses in other instructional contexts. Future research may focus on specific game elements that can be used to support an immersive play experience.

References


Appendix 1.
Online Student Engagement (OSE) Scale (Handelsmann et al., 2005)

Within that course, how well do the following behaviors, thoughts, and feelings describe you?

Please answer using the following scale:
1. not at all characteristic of me
2. not really characteristic of me
3. moderately characteristic of me
4. characteristic of me
5. very characteristic of me

Skills subscale:
1. Making sure to study on a regular basis.
2. Looking over class notes to make sure I understand the material.
4. Taking good notes.
5. Listening carefully.
6. Coming to every class (face-to-face or online).

Emotional subscale:
7. Putting forth effort.
8. Finding ways to make the course material relevant to my life.
9. Applying course material to my life.
10. Finding ways to make the course interesting to me.
11. Thinking about the course between class meetings or online class activities.
12. Really desiring to learn the material.

Performance subscale:
13. Doing all of the assignments.
14. Getting a good grade.
15. Doing well on different class assignments.
16. Being confident that I can learn and do well in the class.

Participation subscale:
17. Raising my hand in class or participating in online class activities.
18. Asking questions when I don’t understand the instructor
19. Having fun in class.
20. Participating actively in small-group discussions.
21. Using discussion forums or talking to the professor outside of class to review assignments or ask questions
22. Helping fellow students.