

## **Slippery Rocks and ALGAE: A Multiplayer Educational Roleplaying Game and a Model for Adaptive Learning Game Design**

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**Abstract:** A 10-week summer seminar explored how to foster engagement and collaboration using games and 3D immersive learning strategies for integrating massive open online courses (MOOCs) with 3D virtual worlds. Among the games that were designed and play tested, this paper presents Slippery Rock Falls, a multiplayer educational roleplaying game (MPERG) set in a virtual world that promotes communication through cooperation and introduces ALGAE, an Adaptive Learning Game Design model for educational game design.

### **Introduction**

The growing interest in massive open online courses (MOOCs) stimulated the question of how one might blend the expansive capabilities of a MOOC with the intimacy of learning in a 3D virtual world. The study was less concerned with how to support large numbers of students in a virtual world, but instead on how to promote activity and engagement using virtual world design thinking to develop integrated learning spaces for MOOCs.

The goal was to identify new pathways for fostering collaboration, communication and creativity in these open learning communities. This paper features the Slippery Rock Falls game depicted in Figure 1 that was designed and played during the course and introduces ALGAE, an adaptive learning game design model that illustrates the game design components and practices.



**Figure 1. The starting area for the Slippery Rock Falls game.**

## **Method**

To explore the opportunities presented by virtual world design thinking, 20 researchers attended a 10-week course during the summer of 2013 set in a virtual world region called Loire on Dreamland Metaverse within the integrated learning environment (ILE). The course used a participatory design during which the researchers as the sole participants were also content creators and co-hosted the weekly workshops, created problem-based learning activities, games and rubrics for use in the ILE's virtual world. The tools used to support data integration between the virtual world and the Moodle learning management system (LMS) included SLOODLE, a Simulation Linked Object-Oriented Dynamic Learning Environment, a Web streaming radio station, an Android app and AnyMeeting, a Web conferencing tool.

A Facilitator Guide for the Loire Session Topic was distributed to organize and support the preparation, synchronous session and asynchronous activities (see Figure 2).

# Session Flow



Figure 2. Facilitator Guide for the MOOC ILE weekly workshops

## A Multiplayer Educational Roleplaying Game Design

Slippery Rock Falls (Stricker, 2013) is an educational game designed by Andrew Stricker on the Loire region in Dreamland Metaverse and later migrated to Virtual Harmony. The game centers on player communication and collaboration during cooperative play within two-player teams. Four teams can play simultaneously while additional players observe and offer their insights. Figure 3 depicts a scene from the game with Spinoza Quinnell (Stricker's avatar) on the right guiding a player across the watery Red Path, at the start of one of the game's four paths.



**Figure 3. Playing the Slippery Rock Falls game**

In each of the two-player teams, one player becomes the Guide and clicks on the Team Control Board (depicted in Figure 4) to obtain and wear a heads-up display (HUD) device that shows a map that depicts the path to cross the water. The second player is the Traveler. When the Start/pause button is clicked, the Traveler steps onto the rocks and seeks a safe path across the water by following the instructions provided by the Guide. As seen in Figure 3, the rocks are visible and seem deceptively easy to navigate. The challenge for the Guide stems from discovering how to communicate the path to the Traveler, who interprets the instructions to safely navigate the slippery rocks. In addition to communication and cooperation skills, the Traveler needs to respond with precise motor skills to accurately execute those instructions.

### **In the Mind of the Traveler**

*Hesitating at the edge of the platform, you hear your Guide's instructions and take that first step onto the rocks. Turning when directed, you continue to cautiously move from rock to rock, and notice an alligator silently observing your progress. While this game should be easy to win with good navigational skills, you notice that your steps do not exactly match the placement of the rocks.*

*A timer displays the seconds and serves as a silent admonition not to delay as you move onto the next rock. Despite the care with which you turn and move, you slip into the water amid the roar of the alligator, and in the blink of an eye, you are transported back to the start point, bemused by how fast you lost, and gratified to be rescued from the imminent threat.*

### **Game Components and Game Flow**

The game components are located on the Team Control Board (Figure 4), and feature:

- 1) a button for obtaining a copy of the instructions
- 2) a button that distributes a copy of the HUD that the Guide wears to see the path's map
- 3) a Reset Stopwatch button for restarting the stopwatch
- 4) a start/pause button



While the game is easy to begin, each role presents certain challenges that affect the team's success. The Guide's responsibility is to provide clear directions on how to navigate the path. The Traveler interprets the directions and moves, but the degree and range of movement may vary.

How the Guide communicates the path can vary greatly, and the team needs to develop good communication skills, motor skills and develop a level of trust to win. The delicate balance that is required to navigate the path safely requires concentration, and as the players become engrossed in the game, they experience a range of possible mental states.

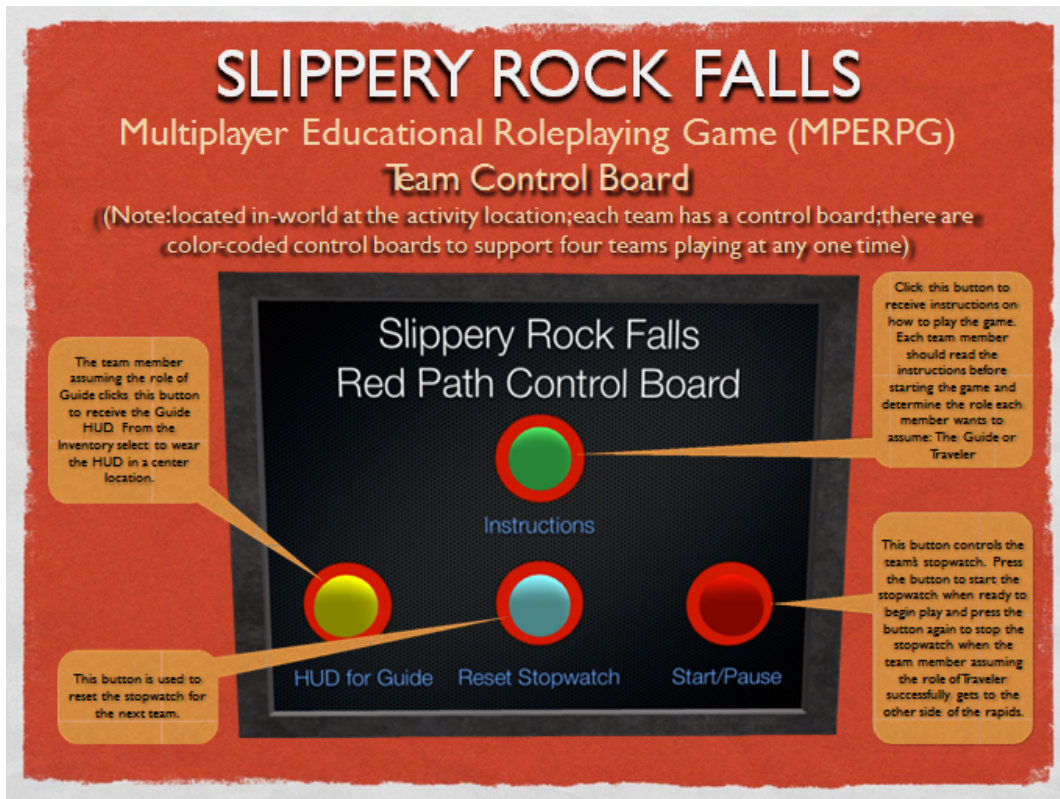


Figure 4. The game's control board distributes the Red Path's HUD and resets the timer.

The preoccupation with the game's mechanics and game play as the Traveler navigates the slippery rocks often leads to initial failure as a natural consequence of the game play, and the speed at which the Traveler lands in the water and is whisked to safety amid the roar of the alligator catches players by surprise, often with exclamations of delight or frustration. They are immersed in the game and may experience flow. Mihaly Csikszentmihalyi (2004) noted in his Ted Talk *Mihaly Csikszentmihalyi: Flow, the secret to happiness* that when a person is completely preoccupied in a creative or attention-focused activity, one of seven mental states of flow may be achieved.

In the Slippery Rock Falls game, these mental states can vary from worry and anxiety to arousal, control and even relaxation. If the level of difficulty and challenge feels insurmountable to the

player, they may experience negative mental states, such as boredom or apathy. The humorous threat of the alligator's roar coupled with the rapid reorientation of the player at the start location is exhilarating, and encourages the players to persevere.

During the play test of the game, the players experienced Flow during the struggle, failure and one team won after several attempts. The rest of the paper describes this experience.

The ALGAE engine in Figure 5 depicts the relationships between the players, conflict, cooperation and learning within the game. As the players progress through the Slippery Rock Falls game, they learn from failure and modify their tactics for how the Guide communicates the path, and how the Traveler navigates it.

Games satisfy certain basic human needs, as Jane McGonigal (2011) noted in her book *Reality is broken: Why games make us better and how they can change the world*. The game's devices and terrain in Slippery Rocks are attractive, and the movement, sounds and game feedback strengthen the play experience. Due to the participatory nature of the workshop, when the first set of games began, the permissions for the HUD were reset to support cooperative play.

In Slippery Rock Falls, the game's story urges the player who is the Traveler to cross the rapidly moving water by stepping on slippery stones while avoiding hungry alligators who lie in wait for unwary travelers. Unfortunately, the path is obscured by the moving water, and the Guide is needed to safely cross to the other side.

At the bottom of the ALGAE model, the core components of a game's design reflect the importance of the story and game mechanics from Jesse Schell's Elemental Tetrad, as described in his book, *The Art of Game Design – A Book of Lenses* (2008). While game designers may debate the importance of story within certain games, such as arcade and puzzle games, in its most abstract sense, every game has a story. The story may focus primarily on the conflict or objective, but it needs to make the player want to play. The order of events within a game support the story's framework and the game's activities build with each new conflict, offering a struggle that engrosses the player and offers opportunities for triumph.

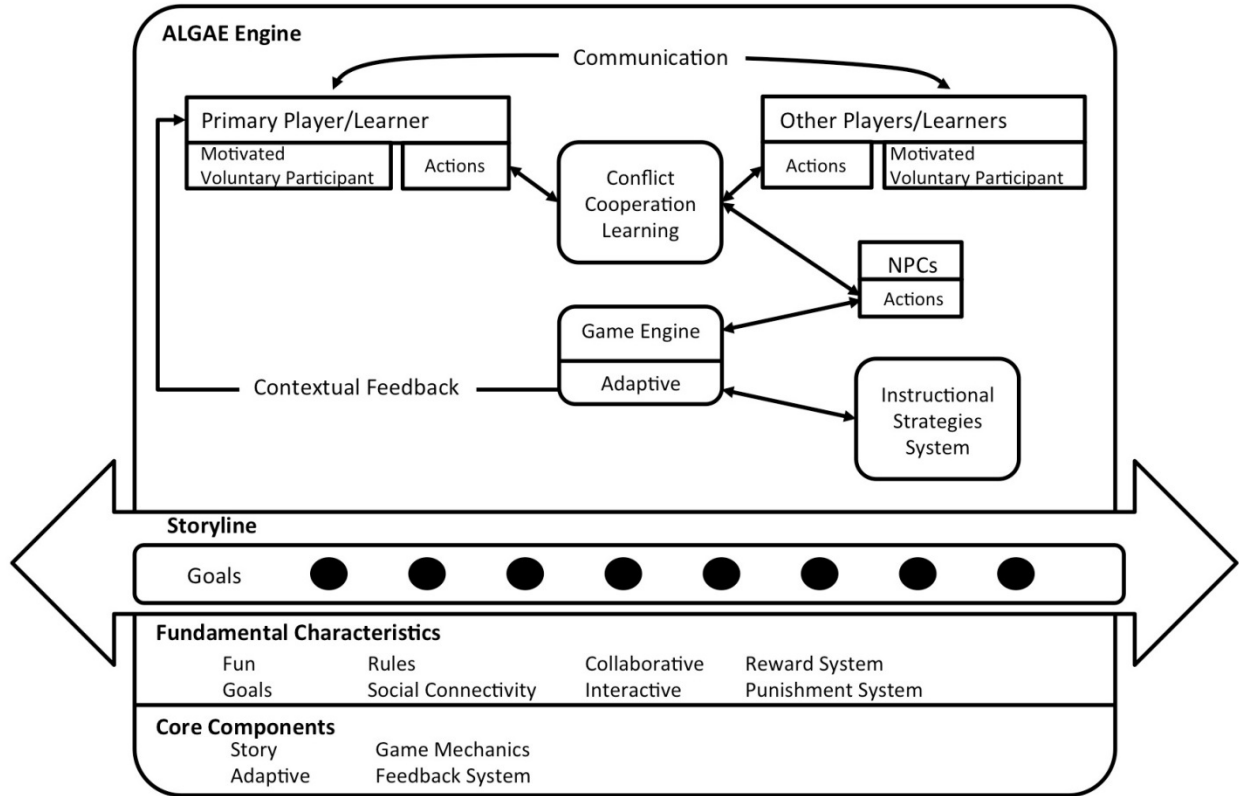


Figure 5. The ALGAE Model (Lavieri, 2013).

Several seminal works illustrate the importance of story and how it can drive the action through conflict, including Joseph Campbell’s characterization of the Hero’s Journey in *The Hero with a Thousand Faces* (2008) and Christopher Vogler’s exploration of a story’s need for increasing amounts of tension through conflict that builds until the story’s climax in *The Writer’s Journey: Mythic Structure for Writers* (2007).

Games leverage the tension in a story with incremental periods of conflict and resolution with the intent of providing the gamer with a satisfying struggle. While there may be a variety of heroes (or anti-heroes) within a game, the protagonist is the player, and for the player to remain engrossed in the game, the conflict needs to build with each challenge until the conclusion.

In a game, conflict in the story takes the form of challenges, quests and puzzles through which the player has an opportunity to connect with the story, to struggle and to triumph. If it is easy to overcome the conflict, if the gameplay does not meet basic human needs or if the path in the game becomes predictable once the mystery within the story is known, future game play may be dissatisfying and players will be less likely to want to play the game again.

Players who are engrossed in the game are compelled to make repeated attempts to succeed despite past failures, yet this driving need is at odds with the desire to succeed when other players are watching. When the struggle is purposeful and has the potential to result in triumph, the players will try new tactics to adapt the changing requirements of cooperative play.

This desire to succeed is what drives the players to continue, despite the discomfort that comes from failing to achieve success while others are watching. As the Traveler moves along the rocky path, the rest of the players observe the Traveler's progress, the pattern of success and the speed at which the player slips off the rocks, hears the roar of the alligator and shifts to the start of a new game. The transition is so fast that it is startling, humorous and deeply gratifying, for without that rapid transition from failure, threat and the return to the beginning of the conflict, failure would be annoying and humiliating. The timing of the game is fast, and facilitated by these rapid transitions, the game is entertaining to observe and to play.

### **Alternative Paths**

After numerous attempts and failures, frustrated players may feel that it is impossible to win using the normal game strategies. Similar to the Kobayashi Maru's no-win scenario noted in the movie, *Star Trek II: The Wrath of Khan* (1982), the players may look for alternative ways to alter and win the game. In education, altering the win conditions and game play may be unfair, but in games, players look for opportunities to leverage glitches or weaknesses in the game's design to their strategic advantage.

One potential method in this game is to activate the ability to see transparent objects. When players turn on the Highlight Transparent option using the ctrl key + alt key + T simultaneously, the game path and all of the transparent textures in the room glow red. Using this method does not guarantee that the Traveler will win, as the red glow increases the level of tension and is a distraction for some players due to the high volume of transparent (alpha) textures. With each step, the camera angle shifts, making it difficult to see a clear path to the other side of the falls.

### **Winning the Game**

It was not the most experienced of users who won that workshop's game session, disabusing us of the notion that experienced virtual world users will triumph. While it might seem important on the surface that the players have knowledge of the controls for movement and camera controls for viewing the path, these skills were developed through repetition during the game, and the experienced users fared no better than the novice players.

After numerous attempts, the strategic advantage offered from prior experience in 3D worlds was noted to be negligible, as novices and expert virtual world users repeatedly failed to navigate to the other side and developed new strategies and tactics for subsequent attempts. The importance of clear communication, working together and developing trust were more important.

### **Self-Assessment**

The self-assessment rubric used in the Figure 6 blends George Miller's assessment framework (1990) to measure the action, performance, competence and knowledge that a learner exhibits while playing the game. A variation of the assessment instrument was used in several challenge-based learning games, including the Hostage Rescue Game (Calongne & Stricker, 2009, 2011).



The categories note whether the learner, and in this context, the gamer:

- **Knows:** is able to recall of facts, principles, and theories.
- **Knows how:** demonstrates the ability to solve problems and describe procedures.
- **Shows how:** demonstrates the skills in a controlled setting.
- **Does:** demonstrates the ability to imitate or replicate techniques, apply principles in a familiar situation, adapt principles to new situations, and associate new knowledge with previously learned principles.

# SLIPPERY ROCK FALLS

## Multiplayer Educational Roleplaying Game (MPERPG)

		LEVELS OF ASSESSMENT				ROLE	
		Know about	Knows how	Shows how	Does	Guide	Traveler
In-world Skills	Use in-world voice tool to communicate with my partner						
	Use avatar movement keys and camera controls to see what needed to be seen for activity						
	Use avatar movement keys to obtain needed information or make selections for activity						
Problem-based Learning (PBL) Activity Skills	Communicate essential information to help my partner in the activity						
	Ask questions to clarify misunderstanding or confusion for doing the activity						
	Repeat information when necessary to check if my partner understood my communication						
	Provide constructive feedback on the team's performance to help improve doing the activity						
	Work as a team to accomplish the activity						

**Rubric Rating Scale**

1 - Poor  
 2 - Fair  
 3 - Good  
 4 - Very Good  
 5 - Excellent

Complete this self-assessment rubric after finishing the activity. The team can use this rubric to discuss how well they performed with the activity.

**Definitions**

- **Knows:** refers to the recall of facts, principles, and theories.
- **Knows how:** involves the ability to solve problems and describe procedures.
- **Shows how:** involves demonstration of skills in a controlled setting.
- **Does:** can demonstrate the ability to imitate or replicate techniques, apply principles in a familiar situation, adapt principles to new situations, and associate new knowledge with previously learned principles.

Figure 6. Self-assessment rubric for the Slippery Rock Falls game

For the Slippery Rock Falls game, participants received a copy of the self-assessment tool and instructions on how to use it during the workshop's session. The two knowledge areas featured in the self-assessment tool included virtual world skills and problem-based learning (PBL) activity skills and used an ordinal educational scale from poor to excellent (see Figure 6). The teams were given the self-assessment tool and discussed how they might use it in their future sessions, but no data was collected after the game play.

Slippery Rock Falls was so engaging that the players had a hard time tearing themselves from the game, and several teams continued to play after the end of the session.

## Future Work

The Slippery Rock Falls game is modular, and the game components could be migrated to other virtual world platforms. To extend it, the Guide's HUD could be modified to depict different game paths or to support a related team activity, and the path could be altered to increase the level of threat and to make it difficult to glimpse the path.

It would be interesting to expand the game to include more players, extend the communication alternatives, add logical as well as physical paths and offer new feedback mechanisms and branching logic within the game. The Loire region has been moved to Virtual Harmony, an OpenSim virtual world for ongoing research.

The ALGAE model was designed to support the future of adaptive learning game design, a field that shows great promise for educational games that reinforce competency development and knowledge assessment. Future work will evaluate the use of the model in educational game design.

## Disclaimer

The opinions and viewpoints expressed in this paper are solely those of the authors and do not reflect official policy or position of the US government or the Department of Defense (DoD), Colorado Technical University, the United States Air Force, or Air University.

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