Research Quest: Six Design Boxes and Six Iterations towards a Game to Teach Critical Thinking

Matt Jensen, Tallie Casucci, Madlyn Runburg, Ryan Bown, Roger Altizer

University of Utah

50 S Central Campus Dr., Room 3190, Salt Lake City, UT 84102

801-581-5460

CaptainKnightfall@gmail.com, tallie.casucci@utah.edu, runburg@umnh.utah.edu, ryan.bown@utah.edu, roger.altizer@utah.edu

ABSTRACT

Research Quest: Dino Lab is designed to encourage the acquisition of higher-order critical thinking skills of middle school students. In order to arrive at the design for the game, the team conducted several participatory design sessions utilizing the Design Box methodology. In doing so, the team was able to gather data and elevator pitches from the end user (students), stakeholders (teachers), and the development team itself. This process was undertaken concurrently with the development of the game, encouraging iteration as well as maintaining buy-in from participants.

The team conducted six Design Box sessions and six iterations as illustrated in the poster. This work enabled the team to quickly design and iterate upon game prototypes in order to find the right design for the game. Through this process, the team was able to create a game that will be undergoing testing in public school classrooms.

Categories and Subject Descriptors

K.8.0 [Personal Computing]: Games

General Terms / Keywords

Iteration, critical thinking, participatory design, design methods, The Design Box, game design, iteration, paleontology, video games, serious games, dinosaur

1. INTRODUCTION

The researchers at The GApp Lab at the University of Utah and the Natural History Museum of Utah (NHMU), with key support from several family foundations, believe our workforce and communities are can be strengthened through improved critical thinking skills. This belief and a desire to find innovative approaches that leverage technology to support critical thinking motivated the NHMU and EAE to create a program called *Research Quest* which combines in class investigations with serious games to create authentic, applied learning experiences designed to support critical thinking. *Research Quest* is both the name of the curriculum and the series name, that *Research Quest: Dino Lab* the game belongs to, designed to facilitate critical thinking. The curriculum and game are designed to equip learners with higher order critical thinking skills, such as evidence based evaluations, flexible thinking, information seeking, and interpretation.

In the development process, many different stakeholders and audiences were involved. In order to please these various entities, and to still tackle the main issue of encouraging higher level

critical thinking in the classroom, the development team turned to the Design Box [1]. It was this design methodology and the implementation of the iterative software development, "scrum," which assisted the team in realizing the needs of the various audiences, and eventually led to the creation of the serious game *Research Quest: Dino Lab* [2].
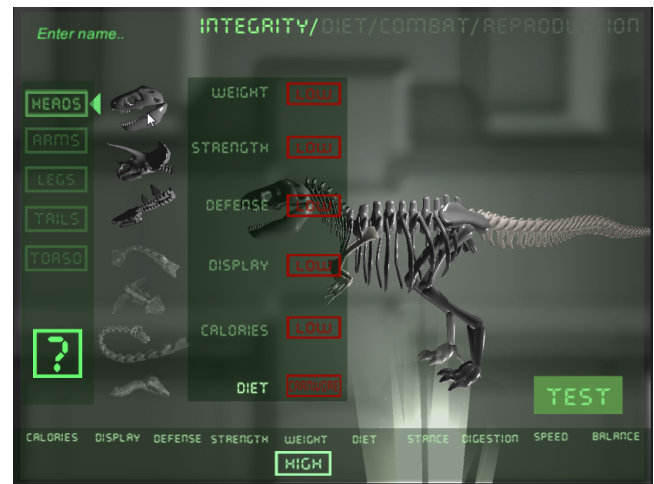

Figure 1. Build Your Dinosaur Interface of Research Quest: Dino Lab

2. GAME DESCRIPTION

In *Research Quest: Dino Lab*, students play the role of a paleontology research assistant in a futuristic university setting. Students are tasked to build their own dinosaur creations and test them in various settings (would the dinosaur be able to stand on its own, could it eat enough, would it survive in a fight, etcetera). While these levels are the playful moments of the game, the truly important sections revolve around what happens between rounds. After every round, players are given three questions concerning that round. Players are tasked with answering the questions based on dinosaur knowledge and deducing information. The player must think critically, research their creations and dinosaurs in general, and form hypotheses about the created dinosaur.

3. THE DESIGN BOX

In designing *Research Quest: Dino Lab*, the stakeholders formed a National Advisory Team (NAT), a team of thought leaders including research scientists in botany, paleontology, and anthropology; curriculum specialists, museum field leadership, learning research scientists, educators and NHMU leadership, and games researchers. During this meeting the goals of the game, and

how to go about achieving those goals, were discussed. It was decided that a "cool, inexpensive, and easy to implement tool" was needed to help teachers teach higher order critical thinking.

The initial stakeholder meeting identified the potential game concept, but narrowing the focus and building the mechanisms to facilitate critical thinking remained a challenge. Often times, the most daunting part of creating a new video game is conceiving the initial idea. Designers can often become mired in a sea of ideas and lost in creativity. In order to avoid this issue, the team used the design methodology of the Design Box [1]. The Design Box was created in an effort to help designers collaborate with partners and narrow the project's needs. Design Box methodology starts with four walls that restrict the elevator pitch: Technology, Audience, Aesthetics, and Question/Problem to Solve. Each wall focuses on a core part of the design that answers a specific question and determines the overall goal of the future game. Additionally, this process defines what can and cannot be pitched. Once all four walls are defined, participants pitch ideas 'in the box' that take into account all four walls.

During development, six Design Box sessions were held with teachers, students, and stakeholders. Through these sessions various conflicting opinions arose within each section of the Design Box. For example:

Technology: For this wall, the students said it needed to "look educational" otherwise the teachers would not let them play it. The teachers on the other hand, were more interested in the technology being easily accessible. Teachers explained that computer labs were difficult to use due to scheduling conflicts and time constraints. Meanwhile, the stakeholders were more interested in the "wow factor". They wanted *Research Quest: Dino Lab* to look good, play well, and, if possible, make use of cutting edge technologies, such as 3D printing.

Aesthetics: This wall resulted in interesting responses from students. Students used this wall to play the role of game designer. Features often found in mobile/free-to-play games, such as monetization and micro-transactions, were pitched. However, in reality, the students did not *want* any of those features, they simply thought those were what made "good games."

Audience: This wall once again met with opposing opinions. The students claimed it needed to be educational. Teachers acknowledged that *Research Quest: Dino Lab* needed to look like a video game to get the students' attention; however, it could not look too much like a video game, otherwise the students would get lost in the game aspects and lose focus.

Question: This wall had already been answered from the beginning of the project: "teach higher order critical thinking through evidence based games."

Inside the Box: After the walls of the Design Box had been refined, the audiences would then pitch game ideas that fit these walls. Two styles of games were mentioned often: C.S.I. mystery style games and dinosaur building simulation games. These styles of games were also present in the development team's Design Box sessions.

4. ITERATIVE DEVELOPMENT

Now supplied with the varied opinions and information provided by the Design Box, the development team set to work on developing *Research Quest: Dino Lab*. Throughout development, the team used the agile development process known as Scrum [2].

Through this process, the team created various iterations of the game quickly, allowing them to iterate on ideas, and discover what worked and what did not. Over the course of development, six different iterations of the game were made.

Iteration I – Museum: The first iteration was set in a museum and placed the player in the role of a detective. The role of the player was to uncover the mystery surrounding the disappearance of a dinosaur artifact.

Iteration II – Dino Builder: This initial prototype served as a proof of concept in creating a dinosaur by snapping together parts and pieces. This prototype focused on the technical side and ways the player could interact with the bones and pieces in a three dimensional environment.

Iteration III – Dino Identifier: The idea behind this prototype was to simulate an entire paleontological work flow, beginning with finding an excavation site to statistically analyzing a recreated dinosaur bone structure.

Iteration IV – Dino Biome: This prototype expanded on prototype two. The player was given the tools and bones to create a dinosaur with specific attributes. After creating a dinosaur, the player placed the created dinosaur in an environment and observed how the dinosaur reacted.

Iteration V – Dino Lab: Expanding on ideas in iteration four, Dino Lab tasked players with building dinosaurs and testing them through environmental factors. Utilizing a point system, players received feedback for the tests. Positive feedback awarded additional points allowing the player to create better dinosaurs.

Iteration VI – Research Quest: Dino Lab: This iteration (described in Section II) put more emphasis on understanding and thinking, and less on winning and making "the ultimate dinosaur."

5. FUTURE DIRECTIONS

Research Quest: Dino Lab is in its first year of a multi-year plan to increase higher level critical thinking. It will be released in fall of 2015 in local public schools where it will receive more play testing. The team envisions future Design Box sessions and iterations based upon student and teacher feedback and evaluation. One feature that teachers may find useful is the ability to review students' progress and answers in the game. So far, the Design Box methodology and Scrum iteration development have proven extremely effective in the development process of this serious game with numerous stakeholders.

6. REFERENCES

[1] Altizer, Roger & Zagal, Jose P. 2014. Designing Inside The Box Or Pitching Practices In Industry And Education. In *DiGRA '14 - Proceedings of the 2014 DiGRA International Conference, 2014. Volume: 8.* (Snowbird, UT, August 3-6, 2014). *http://www.digra.org/digital-library/publications/designing-inside-the-box-or-pitching-practices-in-industry-and-education/*

[2] Chandler, Heather Maxwell. 2013. *The Game Production Handbook. Third Edition*. Jones & Bartlett Learning, Burlington, MA.