

Inside Their Minds: Student Reactions to a Game-Based Learning Environment

Amanda MacCormac
North Carolina State University
Raleigh, NC, USA
atmaccor@ncsu.edu

Robert Monahan
North Carolina State University
Raleigh, NC, USA
rpmonaha@ncsu.edu

John Nietfeld
North Carolina State University
Raleigh, NC, USA
john_nietfeld@ncsu.edu

Abstract: This study sought to better understand students' perceptions of their user experience in a game-based learning environment (GBLE) called *Missions with Monty*. The GBLE was designed to promote fifth grade students' science literacy and to scaffold metacomprehension skills for informational texts. The program was intended to be utilized as a tool for teachers to use in parallel with classroom instruction as it is aligned with state and national science curriculum. *Missions with Monty* is narrative-centered with an animal theme and requires players to take the role of a scientist and use inquiry skills to solve a science-themed mystery. Students who have completed this program demonstrated improvements in reading comprehension, science knowledge and metacognitive monitoring accuracy. Individual interviews with 15 students after playing for approximately 2 weeks focused on their perception of the GBLE as a learning tool, their motivation, academic performance, and suggestions for improvement. Major findings revealed that students were unanimous in their belief that *Missions with Monty* improved their reading comprehension and the majority also reported a preference for reading science text via the GBLE rather than paper-based sources. The researchers plan to utilize this information to inform design decisions for subsequent versions of the game.

Introduction

Research demonstrates that game-based learning environments (GBLEs) designed with best instructional practices increase achievement compared to traditional classroom instruction (Clark, et al., 2016; Sailer & Homer, 2020). GBLEs provide a unique context in order to promote and develop self-regulated learning strategies that require metacognitive awareness, monitoring, regulation, effective strategy use, and motivation (Nietfeld, 2018). GBLEs help personalize learning experiences by providing immediate feedback to shape the players' strategy use and performance to support the player's metacognitive skills. Additionally, GBLEs are highly correlated with increased and sustained student academic engagement and motivation (Kim & Castelli, 2021; Pintrich, 2000). Subsequently, GBLEs are becoming more prevalent, with a wide diversity in approaches. While GBLEs are often created to support students' academic achievement and interest, student perspectives of their GBL user experiences are underrepresented in the literature and curricular design. Student perceptions, perspectives, and responses to their GBLE experiences provide valuable insights into improvements and learner behavior, including self-efficacy towards GBLEs (Lu & Lien, 2021).

A 2022 survey by Project Tomorrow reported that 71% of principals and 85% of district administrators believe that "effective technology use" in schools is necessary for students' academic and professional success (Project Tomorrow & Spectrum Enterprise, 2021). Additionally, teachers' main concerns regarding instruction are

lack of student engagement, inequitable access to technology, and suboptimal student wellbeing. In a 2021 survey of 1,000 parents on their perceptions of the effects of video games on their children, parents reported that games influence their kids more than any other form of content, including social media, TV, movies, books. Nearly 63% of parents believed video games positively impact their child, while 22% were neutral and 15% thought they have a negative impact (McGuinness, 2021).

To best address students' evolving learning needs, a GBLE called *Missions with Monty* was designed to promote fifth grade students' literacy skills and science content knowledge. The program facilitates science literacy by teaching self-regulated learning strategies, such as metacognitive comprehension monitoring, summarization, and highlighting skills. The GBLE is a response to the importance of intersecting literacy skills and STEM-related knowledge. Students who have completed this program demonstrated improvements in science knowledge and metacognitive monitoring accuracy (Nietfeld, Syal, & Sperling, 2022) as well as higher reading comprehension and reading motivation when compared to students who learned via a matched computer-based learning environment (Syal & Nietfeld, 2022). Based on these recent findings, the present study seeks to interview participating students and teachers to better understand students' perceptions of their GBL experience, motivational factors and suggestions.

Present Study

This study sought to understand students' perceptions of and experiences with *Missions with Monty*. More specifically, the researchers wanted to understand how playing this GBLE impacted their learning of science content knowledge, reading comprehension skills, and interest in science content and reading. Given the burgeoning literature in serious games, there is surprisingly limited research focusing on the perspectives of the students themselves after playing GBLEs, as much of the literature is focused on development and performance (Lu & Lien, 2020; Oswald et al, 2014). Assessing students' perspectives is important in order to provide a better perspective from the user standpoint when developing serious games. In addition, insight can be gained into the process of developing more effective learners in GBLEs. The present study focused on the experiences from students in one classroom that was part of a larger project related to the development of *Missions with Monty*.

The Game: Missions With Monty

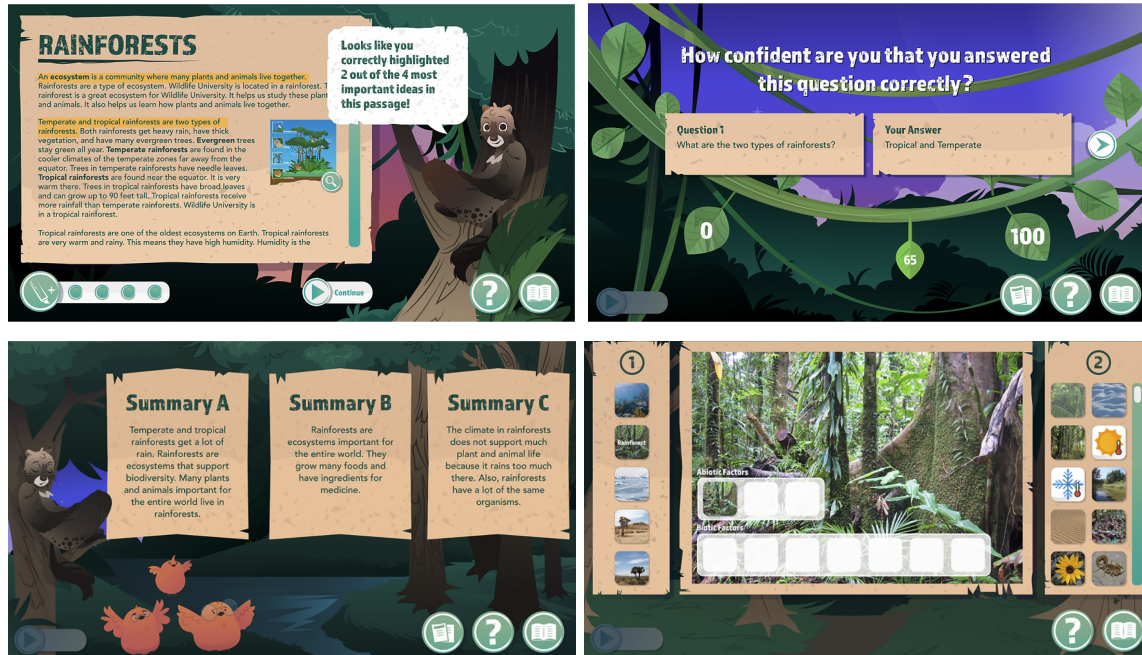
Missions with Monty is a game-based approach to teaching fifth-grade students to monitor their comprehension while reading informational science texts. By using a storyline and game-based elements, the game aims to engage students in learning science content while simultaneously improving their reading comprehension skills. The curriculum in *Missions with Monty* aligns with the Next Generation Science Standards (NGSS) and the Essential Standards for Science in North Carolina. As students work through "missions" in the game, they practice the following important strategies: highlighting main ideas, identifying expert summaries, answering content questions presented by characters, and providing accurate confidence judgments. Students will also be able to reflect upon their learning by using metered feedback and feedback from characters in the game. Students receive distributed practice and scaffolding across numerous text experiences as they navigate their way through the GBLE.

Gameplay

Upon entering the game, students will be greeted with a very important message. Monty the monitor lizard, the head of Wildlife University (WU) and a top researcher in the world, is investigating the cause of the epidemic sickness of WU students and faculty. Students meet Monty's colleague Lou the Zebra, who explains that Monty is onto a solution. Lou directs students to Monty's office to receive further instructions. However, the office is a mess, and Monty is nowhere to be found. Students watch a video that Monty recorded and find out that he has been taken from WU. Now it's up to the students to travel through the rainforest, savanna, and ocean to study and collect information through days of mini-games to figure out why the animals are getting sick and help save Monty.

In order to move from one mini-game to the next, students must complete a "Moment of Truth" challenge to demonstrate their comprehension across multiple sources. Once students complete all the mini-games, they will have enough information to figure out why the animals at WU are getting sick and to find Monty!

Before engaging in their missions, students complete Strategy Training Camp to receive explicit instruction and practice for the strategies necessary to complete the game. There are four strategies that students will learn about and practice in Training Camp: highlighting, summarization, and monitoring. Each strategy is taught by a different WU professor. Through their Missions Journal, students will be able to access Training Camp videos throughout the game.



Methods

Individual interviews with 15 fifth grade students who played *Missions with Monty* were conducted during a one-day in-person school visit. The elementary school is located in a rural area and educates over 350 students. Of these students, 24% are White, 23% are Latino, 48% are Black, and 5% are another or mixed race. 99% of these students qualify for free and reduced means. The interviews included seven questions about perceptions of GBLE experience and elements of the game. Students were individually interviewed outside of their classroom, in the absence of the teacher and other peers. Students were informed that the data could be used to make improvements to the game. All of the interviews are recorded, transcribed and coded using MAXQDA software. Whole class interviews were also conducted to glean group perceptions of the GBLE. Whole class questions are based on the mechanics of the game and were designed to elicit feedback about user experience (UX) to help drive design decisions of upcoming variations of the GBLE.

Individual Interview Questions:

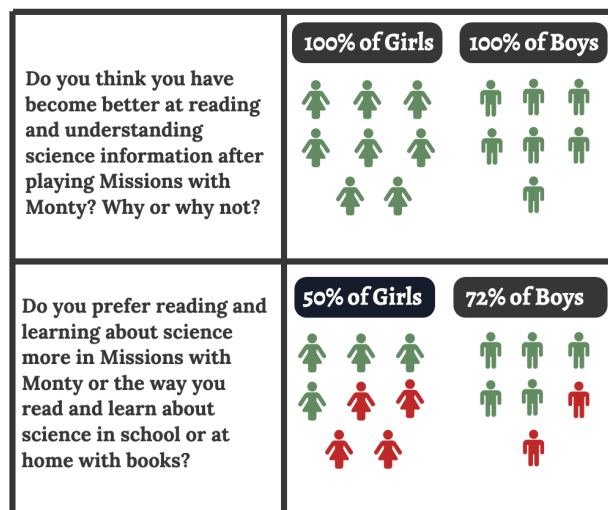
1. If there was one thing you could tell us about the game that you liked, what would it be?
2. If there was one thing you could tell us about the game that you didn't like, what would it be?
3. What are your suggestions for any changes or improvements to the game?
4. Do you think you have become better at reading science texts after *Missions with Monty*? Why or why not? What do you think makes someone a good reader?

5. What was the most challenging part of *Missions with Monty*, whether actually playing the game or the content of the game?
6. Do you prefer reading about science more in *Missions with Monty* or the way you read science in school when you are not playing *Missions with Monty*? Why?

Findings

The researchers observed several themes based on talking with students related to engagement, enjoyment and reading comprehension. When students were asked if they felt that they had become better readers due to playing the game, all 15 respondents said that they felt that they are better at reading and comprehending science texts after completing the game; five students commented further that they felt they improved their reading skills due to feedback and strategy training within the game. The narrative and gamification elements elicited and maintained student interest and engagement: all 15 students enjoyed the narrative elements of the various characters, solving the mystery of what happened to the main character Monty, and exploring the environments. More specifically, ten students made detailed positive comments about enjoying the graphics, sounds, and mystery, and preferred the researchers further emphasize these elements. Student engagement and completion may possibly be altered by the structure of the content, as nine students suggested that the researchers reduce the length of the reading passages. Five students suggested that the researchers reduce the number of questions and incorporate more character development and movement because they prefer these elements in the recreational games that they choose to play. When asked what they would like to have changed, eight students requested that the next version of the game include more mini games and adventures with the characters in between the passages and questions. Five students suggested that the researchers incorporate a personalizable avatar and a form of currency to spend on accessories, clues, and extra games. Nine of 15 students reported that they prefer to read science text in *Missions with Monty* compared to reading informational science texts on paper.

STUDENT RESPONSES



Implications

Regarding the theme of student engagement, the researchers observed that students expressed a shared preferred level of visual and auditory stimulation that elicits enough situational interest to promote student engagement with the academic content that is woven into the learning experience. Students expressed that they

enjoy more movement, sounds, and interactive personalized and adventure-like elements, so when these stimuli are included and are supportive details of the academic content, perhaps students' perceptions of their interest and knowledge of the content, and personal goals may be affected. Understanding students' attention span and response to stimuli may greatly benefit instructional design, as game-like elements correlated with students' increased self-perception of their reading comprehension abilities. Accommodating students' need to interact and explore their environments may increase their attention span and motivation to pursue academic activities.

During initial student responses, the researchers realized that asking clarifying questions about students' perceptions is critical to interpreting the context of their thoughts. For example, six students preferred reading via paper format, and when asked "why?," they also expressed either a preference for the increased flexibility of reading via paper format, such as "I like to read while I watch TV" and "I like to read when I am laying down," a dislike of screens, a preference towards physical books, and a caution for trusting information from the internet versus a printed source, "my teacher said information on the internet isn't always reliable." Researchers became curious about students' perceptions of the questions themselves and the importance of incorporating clarifying questions into the interviews, and clarifying explanations of research questions for the interviewed.

The aim of this study was to better understand student perceptions of a GBLE, *Missions with Monty*, particularly given that most research focuses on student performance more so than student experience and preferences. Considering that many children enjoy and choose to play recreational video and digital games, the researchers seek to better understand how to incorporate these effective and enticing elements into GBLEs. The researchers wanted to identify GBLE elements that motivate students to successfully engage in reading informational science texts while increasing and improving students' metacognitive strategy use. Based on the students' feedback regarding their engagement and interest, the researchers plan to incorporate and test features that more closely mimic the structure of major online recreational games, such as additional activities and narratives in between shorter passages to simulate more interaction with smaller chunks of content in multiple formats.

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