

The Amazing Math Gladiator

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ABSTRACT

Math Gladiator is an educational game targeting basic mathematical skills of pre-teens. Built using a turn-based style of game play, the user answers math questions to defeat the opposing gladiator and to continue on to the next level. Users can practise the four basic mathematical operations and create their own questions as well. Using age appropriate graphics and a combat setting, we intend the game to be appealing to the target audience.

Keywords

- Educational Game
- Mobile Usability
- Turn Based style
- Math Focused

1.DESIGN PROBLEM

Math Gladiator is an educational game that is targeted at pre-teens, and is designed to improve users basic mathematical skills. All education games face the problem of making a game that is fun but also teaches the concepts that it addresses. Math Gladiator does not teach users the rules of mathematics, but it provides the user with effective feedback on incorrect answers while still increasing difficulty in levels and assessing user performance on each level.

Math Gladiator is similar to other games in how it uses an in-game calculator to get input from the user and in how it uses a turn-based style of game play. Games such as Math Defence and Math Adventure already use these aspects, however, Math Gladiator is different in terms of its theme, objectives and art work. In addition Math Gladiator uses these similar aspects in its own unique, blended way to create a new, interesting game.

2.DESIGN GOALS

As developers, goals that we focused on were:

- making the game fun (1)
- presenting math questions in an interesting way (2)
- creating our own humorous art style (3)
- improving the users' math skills (4)
- making the game as unique as possible (5)

Ensuring that the game was fun to play was a mandatory characteristic for our game as it should be for any game, because if a game is not fun then not many people will spend time on it. Another important characteristic was that our game needed to be unique and one feature we focused on was the delivery of our

math questions to the user. All math games at some point present the user with math questions and we wanted the delivery of our math questions to be unique in order to engage the user and keep them playing. Graphics are an integral part of any game and must be treated as such. Being Science students, we know our graphic design capabilities are minimal, so we made our own unique art style that we hope our audience will find humorous and pleasant. Our game is an educational math game and it would be pointless if it didn't do its job of improving users math skills. Of course all educational games have this objective and all have similar ways of completing this objective. As a result one of our goals was to make our game unique. However there are limits to this goal, as ultimately we will have to ask the user math questions, we will use a game style that already exists and the core of our game will share similar traits with other games. We tried to make our game unique with the use of our gladiator theme and art work. Uniqueness is important for games because users are looking for new experiences not a repeat of old ones, while still feeling familiarly comfortable with the interface.

It is difficult to fully implement all of the listed features into a single game but as for making the game fun and interesting we think we succeeded by using our theme and art work. For the educational aspect of our game, we made a good effort by making levels improve in difficulty as the user progresses and gains competency, but it may be that our levels are skewed slightly as they have never been tested by the target audience.

2.1.Pedagogical Goals

The pedagogical goal of our game is to have the user improve on his/her understanding of the four basic mathematical operations. This goal should be achieved through practice of easier questions and progressing through the levels of the game. The user should become more confident and knowledgeable in the field of rudimentary mathematics.

2.2.Entertainment Goals

We hope that the user will want to play each level of our game in each mathematical operation and that the user will want to play enough to purchase items from our in-game store. Items in the store require gold obtained from successfully completing levels. We also hope that if the user has a positive experience playing the game that they will recommend it to their friends.

2.3.Development Goals

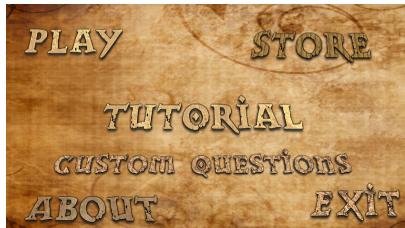
From a development perspective we hope that the content is appropriate for our target audience and that users spend around 2 to 3 minutes per level. We also hope that the users use the tutorial created for them, and potentially even visit the about page to learn more about the origins of the game.

3.Math Gladiator

This section details a user-oriented walk-through of Math Gladiator

3.1.Game Sections

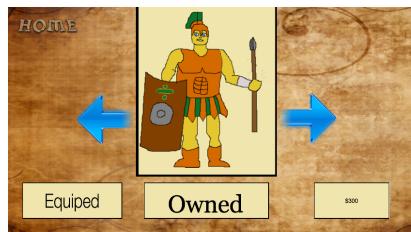
3.1.1 The Menu Screen



(Figure 1)

Above shows the menu screen of our game. Here is the main navigational page where the user can get to any feature of the game. The Exit button will cancel the game and the about button will display information about the creators of the game.

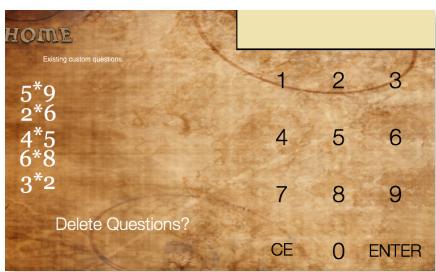
3.1.2 The Store



(Figure 2)

Here is where the user can purchase different gladiators to use in the arena. The user can equip a skin if it is owned and the user can purchase skins by using the in-game currency.

3.1.3 Custom Questions



(Figure 3)

Here is where the user can create questions of their own to be quizzed on later. Questions are stored in a file to be accessed later, and are stored even if the user turns the game off.

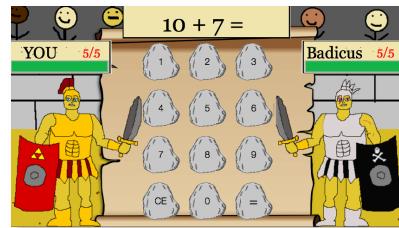
3.1.4 Level Picking



(Figure 4)

Above is the screen that the user is taken to once he/she presses on the play button in the menu screen. Here the user can pick the type of mathematical operator he/she wants to practise and a level to play. Users can also play games using custom created questions but this doesn't unlock any other levels. Users must play lower levels to unlock upper ones but unlocked levels can be replayed at any time.

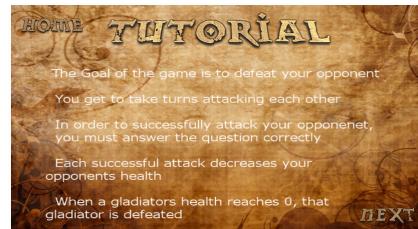
3.1.4 The Arena



(Figure 5)

Above is the arena where the users go to fight to the death using math. Each Gladiator has five health points and can do one point of damage by answering a correct math question. First gladiator to reach zero health loses. Users enter answers to the questions that appear in the box at the top using the calculator in the middle of the screen. Once the user has won a round the next level will be unlocked (unless the user is playing level 9, where there is no following level).

3.1.3 The Tutorial



(Figure 6)

Above is the tutorial screen where the user can go to learn about how to play our game. The user can get to this screen through the link on the menu screen.

3.2. Summary of Features

- 1) In-Game Store
 - Users can purchase different skins with gold earned within the game
- 2) User Generated Content
 - Users can generate questions of their own to be quizzed against later
- 3) In-Game Analytics
 - Game data is sent to parse.com so it can be referenced later

4. INITIAL FEEDBACK

4.1. Data Analytics

We quantitatively measured design goals 1 and 4 as listed in Section 2. To know if the user found the game fun or not we measured the total time the user spent during the game. In theory if the users found the game fun then they would spend more time playing it. Goal 4 was a little harder to determine how to know if the user has improved on their math skills. We recorded user statistics for every individual level of the game. The statistics recorded include how many questions were asked, how many were answered correctly/incorrectly and how long it took to finish the level. From this information it can be determined how the user is progressing through our game and if they are improving or not.

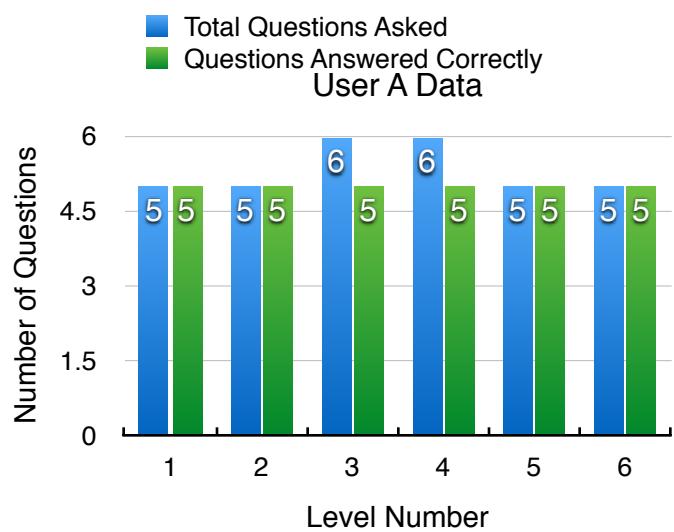
4.2. Participants

The participants for our game were unfortunately university students who volunteered to test our game. Participants were given a fresh version of the game and they were asked to complete a minimum of five levels in the addition section but they could continue on after if they wanted. Participants were left alone with the game and once complete we received their feedback. It only took about 5 minutes for the participants to be done.

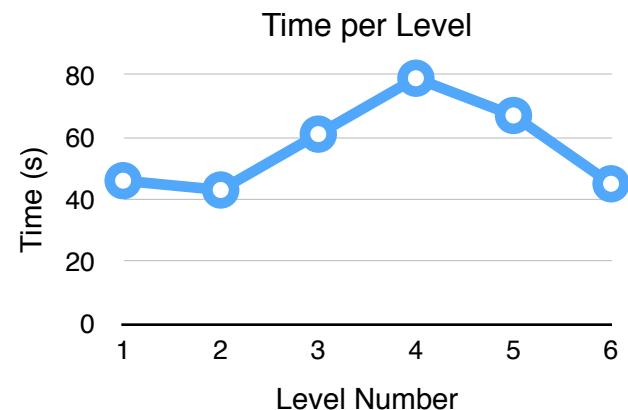
4.3. Results

Figure 7 shows the total number of questions asked displayed, next to the number of questions answered correctly on each level. In the case of user A, the user only decided to play up to level 6. The graph shows that the user only got a maximum of one question wrong and this is not surprising since the user is far beyond the age range of the game. The incorrect question may be due to a miscalculation or an accidental click, but it is clear that the user understands the concepts and would have gotten bored quickly. This data supports the idea that it may be beneficial to have the game adapt to users' scores in order to provide more proficient users with harder questions in order to challenge them more and potentially increase their engagement with the game.

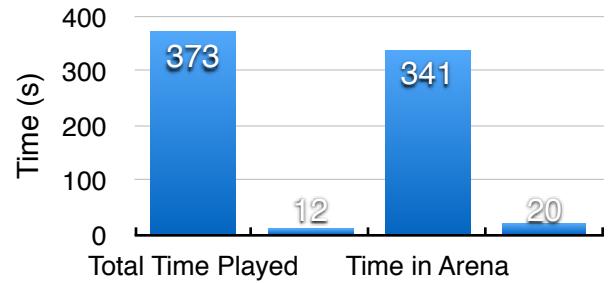
Figure 8 shows the time spent on each level. This trend is not what we are looking for, as we would expect the user to spend more time on each level as each level should be harder than the previous one. This inconsistency can be attributed to the current implementation of the program. Currently as users progress through levels they have a chance of encountering harder problems but they can encounter easier ones from earlier levels as well. As we can see from the graph the user is encountering hard questions that make her take a little longer on each level. On levels



(Figure 7)



(Figure 8)
Time Distribution



(Figure 9)

five and six, by chance, she encountered some easier questions which allowed her to answer more quickly. Comparatively, level three and four each have one more question than the other levels, which would cause the user to spend more time. A more accurate way of interpreting the data would be to take the average time spent playing per level. In our final implementation we will make sure the user is guaranteed to encounter harder questions and not see easier ones. With this implementation we would expect to see more of a positive parabolic shape with time increasing on each level as compared to the level before.

Figure 9 shows the distribution of time spent throughout the game. We can see that the user spent a total of

- 1) 373 seconds (6 minutes and 13 seconds) playing the game
- 2) 12 seconds in the tutorial
- 3) 20 seconds navigating throughout the app in total
- 4) 341 (5 minutes and 41 seconds) playing the levels (times are stated like this because not all the titles fit)

This data shows what we were hoping to see; mainly, that most of the time is spent playing the game and little is spent navigating. We do need to incorporate a “Play next level” button so that once the user completes a level they can be taken directly to the next level without having to return to the home screen. The addition of this button will drastically reduce navigation time. Time spent in the tutorial is as expected. Our tutorial is still only one screen so we do expect the time to increase in the future as the tutorial is expanded, but it is our goal to keep it as minimal as possible since pre-teens have a short attention span.

5.ACKNOWLEDGMENTS

Math Defence, Created by a group known as Die Spider Die on June 6th 2013.

Math Adventure, Created by a group known as TabTale on December 21st 2012.