

The Effects of Digital Game Based Learning on the Classroom Dynamic*

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Abstract

This paper introduces an e-learning game called 'Furious Frogs' and talks about its effects on the classroom dynamic in an ESL teaching context. Digital game based learning (DGBL) seems useful in theory; however this paper reflects on whether practical barriers exist when implementing it in a classroom, and whether such barriers can be overcome?

Trial and error was used in this case study to outline a series of steps that can be taken so that DGBL could be effectively introduced to the class. The application of video games within a classroom is not without its difficulties, however, when properly implemented the benefits to the students' attention and motivation were quite evident through direct observation.

The game design of *Furious Frogs* is critiqued in this paper and suggestions are made about how the game could be improved. This paper shows that an important strength of DGBL lies in the improvement of the students' attention and motivation. Academic performance gains have not been assessed in this paper as the game design of *Furious Frogs* does not sufficiently track student performance data to allow this.

Keywords: Digital Game Based Learning, E-learning, Classroom, Dynamic, Case Study, Furious Frogs, Critique, Arcademics, Game Design

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1. Introduction

During my time teaching at an 'English Village', (a school designed to teach through immersion and interaction) I was required to teach students using computers as a medium. The students' English skill ranged from beginner to intermediate, and their ages ranged from eight to fifteen years. Classes had a maximum seating of twelve or sixteen students depending on the skill level of the class (beginner and intermediate respectively).

Although the students in this study are much younger than in students attending third level institutions I have experienced similarities in teaching both age groups. The techniques that I use to break down the subject matter and to manage the lab for the younger students formed the basis of my adult lectures at Keimyung University. More age appropriate techniques have been included in this report for higher level teaching.

Prior to teaching at the English Village, I had undertaken some post-graduate research into the effects of Digital Game Based Learning. I had created my own game called 'Operation Conjugation' and carried out some testing. However, the testing was done via a controlled experiment and, in hindsight, I felt that testing DGBL in this type of environment was not fully testing the practicality of the theory. I saw the English Village as an opportunity to test DGBL in a real world classroom setting.

Creating games is intensive work, so instead of creating a new game for the school I searched online for existing teaching games and found a website called "*Arcademics*", this website is run by the University of Kansas and was created based on the ideas of Dr. Jerry Chaffin (Arcademics, 2015a). It had some English games available that were suitable for use in the computer class.

The game that I decided upon was called '*Furious Frogs*'. This game was chosen because it was challenging and fast paced, but more importantly it had multiplayer functionality. I was interested in seeing the effects of the multiplayer element on the students, and assessing whether or not it was possible successfully to introduce a competitive video game into a live classroom.

Another aspect of the game that made it suitable for selection was that the subject matter. Antonyms are very easy subject to teach and the concept can be understood within a short time. The students that attend the school come from all over the province and have very different levels of English. The school has a very high turnover rate as students only stay for one week, with over fifty new students attending each week of the semester.

The students of the English Village only attend the computer class once. These classes are forty-five minutes long which meant that complex concepts could not be effectively introduced within the time limitations. Other games available on the *Arcademics* website could pose problems, for example *Giraffe Karts*, which tests verb agreement, could not be adequately explained and played within the time given.

2. The Game Design of Furious Frogs

Furious Frogs tests the player's knowledge of English antonyms. The game is limited to four players with a simple game mechanic. The goal is to select the correct antonym when prompted. For each correct answer, the player receives a point added to their score with incorrect answers lowering their score. In practice, cycling through this process could be very monotonous but *Arcademics* abstracted this basic mechanic into a colourful, fast and competitive game.

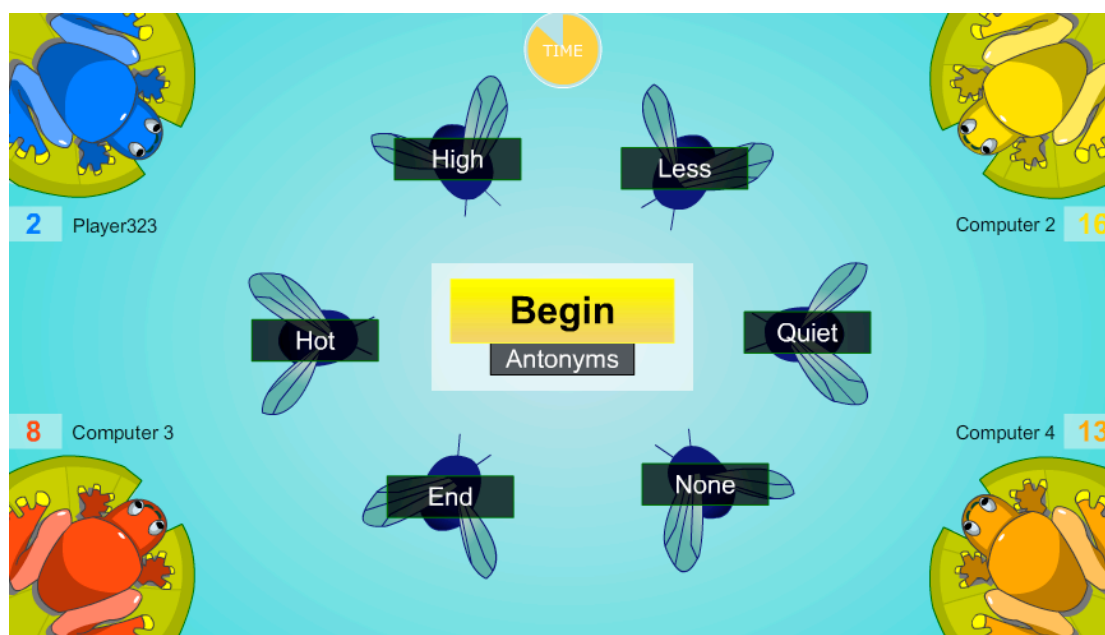


Figure : Furious Frogs screenshot (Arcademics, 2015b)

Before the game starts it needs to be setup for multiplayer so in order to fill the “game lobby” (the matchmaking area before the game starts) the students in the class were split into groups of four. One player must host the game by opening a game lobby. The other players can then join the game. Once they have joined they get to choose the colour of their frog avatar and input their name.

Each game is only one minute in length and the players must try to eat as many flies as possible within that time. The centre of the screen contains the word which the player has to find the antonym of; each fly has a different word placed on top of it, with only one fly having the correct answer. If the player selects the wrong antonym the frog won't eat the fly and the player loses a point. If the player selects the correct antonym then the frog eats the fly, the player receives a point and the word in the centre changes.

The game itself contains a random selection of about forty antonyms; although this number may seem small, it is suitable for younger students whose first language is not English. If a player does not remember the answer then they will have to guess. Randomly clicking will result in a lower score at the end of the game, so the player should take the time to make an educated guess.

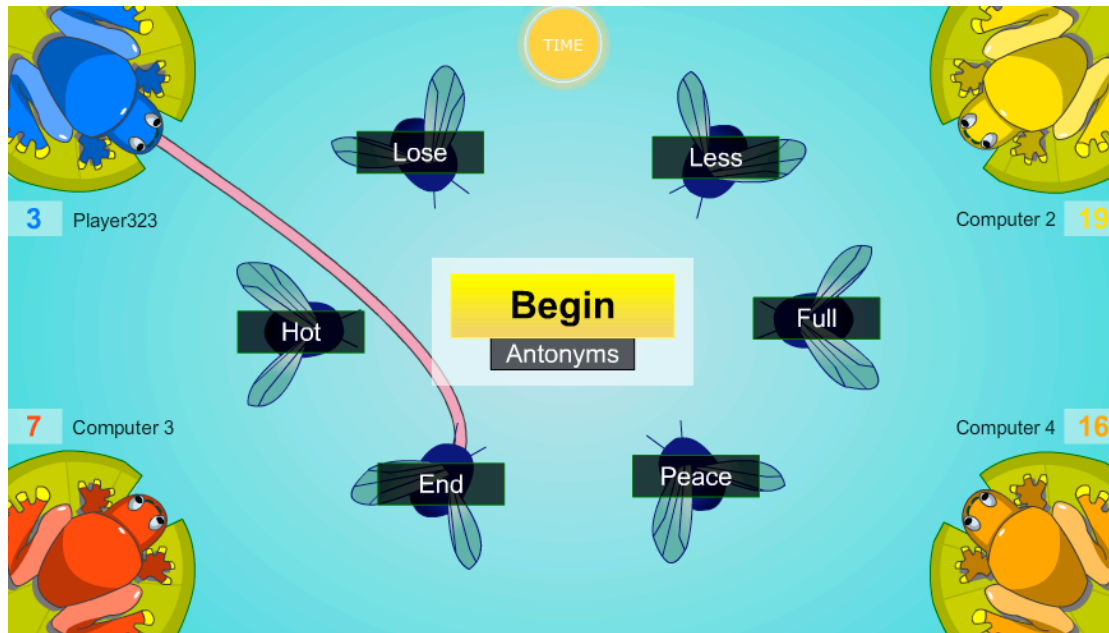


Figure : A player selecting the correct answer

Each player sees a different word in the centre, meaning that no two players would ever have the same answer and try to eat the same fly. During the game the players can see each other eating flies and getting wrong answers in real time, this mechanic adds to the excitement of the game as the visuals look chaotic

3. Setting up the Game Class

The purpose of this section of the paper is to take the reader through the steps taken in setting up the class game, outlining the questions and challenges that arose and the solutions found. I have adopted a very practical descriptive approach here in order to maintain the link to the actual classroom work. The question of whether it was possible for students to successfully play the game in the classroom without either losing interest or being frustrated in the process was my starting point. In my opinion there was potential for a significant barrier to the implementation of DGBL in a live class but one which could be overcome by sufficient classroom organization.

Teaching the subject matter was no different than a normal English class; the concept of antonyms was introduced via group answering and then tested using individual exercises. After the students had completed their exercises they were allowed to use their computers.

It was clear after the initial classes that the students had difficulty accessing the game. To begin with, I had assumed that most students would be able to navigate to the website and launch the game by following a live demonstration on the projector screen. However, not all students were able to complete this task with ease. Some students had problems simply entering the web address and some didn't even select the correct game. From the outset, the sharing of information between the teacher and the students had broken down.

What was making this seemingly simple task so difficult? A few problems were immediately apparent during the class. The computers themselves were distracting the students. The better students would generally play with the keyboard or mouse while they were waiting on the other students to complete the task (e.g. typing the web address). In their boredom students would experiment and start randomly clicking on other games on the website, which made the co-ordination of the class incredibly difficult.

The result of these initial classes showed that student didn't follow live instruction very well and would often stare into their monitor instead of looking at the projector screen or listening to instructions from the teacher. Another disadvantage was that it was impossible to monitor the students' progress whilst performing the live demonstration from behind the podium computer.

This was a disheartening start but these initial classes built the foundation for a more organized approach to implementing DGBL in the class. A fundamental rewrite of the approach had to be undertaken with a focus on strict co-ordination of the students. There were a few problems that needed to be addressed before trying again.

Some teachers may be reluctant to include computer games within their classroom due to the extra preparation time and the difficulty organizing the class. However, the following approach shows that implementing DGBL in the classroom is achievable and the attention and motivation benefits are worth the time it takes to set up.

3.1 Shortcuts

The first problem encountered was that entering the web address and navigating through the website took too much time. This created time for the students who had finished to click on different games. This was solved by creating a bookmark shortcut on the desktop that took the students directly to the game.

3.2 PowerPoint Clicker

A major problem was that the live demonstration was not working as intended. Coordinating the class from behind the podium was very difficult. The live demonstration had to change into the form of a step-by-step presentation. The PowerPoint used was simply a progression of screenshots of the game. This was quite effective as the students could navigate through the menus with relative ease.

The use of a PowerPoint clicker was essential in this process: being free from the podium computer allowed the teacher to monitor the students' progress. It also had the added benefit ensuring that all students had finished the task before advancing the entire class to the next step. Now that the teacher was directly behind the students and in view of the students' monitors, the amount of students who tried their own 'experimentation' was reduced and also allowed the teacher to assist any students who may have gotten lost.

3.3 "Hands on your Head!" Technique

Even though the use of the PowerPoint clicker reduced the amount of students 'experimenting' there still was the issue of students playing with the keyboard and mouse while they were waiting. A simple 'hands on head' technique was implemented so that the students would not be completely distracted by the computer itself. After each PowerPoint slide the students were asked to put their hands on their head once they had finished the task.

The goal of the 'hands on head' technique is to prevent the students from being distracted by the computer during instruction. While this was an age appropriate strategy for the English Village, alternative approaches were implemented during my adult labs at Keimyung University. Instead of this technique I ask students to switch off their monitors during periods when I need their attention. After implementing this technique I found that I didn't need to re-explain instruction as often.

Once everyone had completed the task the presentation progressed to the next slide and the students could use their computers again. This technique streamlined the whole process and greatly increased the amount of time in which the students were actually playing the game.

4. The Classroom Reaction

While the students were playing the game they were quietly focused, however after the game had ended their reaction was startling. There was a sudden, unexpected burst of energy from all the students, including one student who jumped out of his seat with excitement after winning the round.

Some were shouting victory, others were crying foul but all the students were on edge demanding to play another game in order to even the score. Inkpen et al. (1995) had stated that children were more motivated to continue playing when they had a human partner. This can be seen in the class as the effect of multiplayer (i.e. social competition between students in the class) had created a surge of motivation and a desire from the students to replay the game.

The change of atmosphere in the class was so unexpected and instantaneous that order had to be restored before allowing the students to continue. The response from the students was surprising in part due to what they had actually been doing during class. In a regular class the students would have only been answering questions by themselves in a simple time-restricted quiz. Students would find the opposite word for one minute and after the time had elapsed, the quiz would be over and the teacher would correct it.

However, in the virtual world the students were playing a game in real time and in direct competition with their classmates. This created an intense and exciting experience for the students. This energetic reaction lines up with Habgood's description about the benefits afforded by DGBL '[video games offer] a significant boost to the fatigue and apathy created by the frequency of testing in the education system' (Habgood, 2007)

The game was repeated for about ten rounds until the class had finished. This repetition was not seen as boring but as something that the students actively wanted to do. In comparison, if a teacher tried to implement via a traditional quiz students would generally object to a second or a third quiz. Also, the students were able to experience more problems and experiment with more solutions than they could ever achieve by using traditional means (Oehlert, 2005).

When the class was over, most of the students complained about not having enough time to play the game. Some were questioning the fact that the thirty minutes had actually passed. The experience where someone loses track of time fits in the idea of the 'flow' state (Csikszentmihalyi, 1990). This is where the tracking of time can be disrupted due to people being completely absorbed in the activity they are currently doing.

This case study suggests that DGBL vastly increases the students' attention and motivation while doing repetitive tasks. A much more thorough analysis needs to be conducted in order to backup any claims of academic improvement due to the game itself. In order to do this it would be beneficial if the game gathered detailed performance data on the players in order to verify any academic related gains. It is my

view that the reaction to the game shows the potential for DGBL to transform a dull repetitive task into an exciting engaging experience. The application of this could improve the learner's ability to overcome motivational barriers to learning.

5. Design Critique of Furious Frogs

Papert describes "edutainment" as the "offspring that keep the bad features of each parent and lose the good ones" (Papert, 1998). This effect of 'edutainment' is understandable as game design is an in-depth field of study and educational theories can be hard to implement properly within the principles of game design. Lack of experience in either field can result in a game that is not enjoyable or that fails to teach the player effectively.

However, *Furious Frogs* is more than 'edutainment' title. It is an enjoyable and well-made game that seeks to teach language. A critical look at the design of the game can reveal certain game design principles that could be improved upon and new e-learning concepts which could be implemented in order to make a good game even better. Claims of academic improvement would require statistically significant results and were not investigated in the course of this study.

5.1 Assumption of Knowledge

The main problem with *Furious Frogs* is the assumption of knowledge. Before the students were allowed to play the game, they had to be pre-taught the antonyms that were contained within *Furious Frogs* at the start of the lesson. This is not so much an issue when using the game in class, but it becomes a problem when you look at it through the lens of game design.

Players visiting the website and playing *Furious Frogs* for the first time may not even know what the word 'antonym' means, causing confusion as to what the goal of the game is.

This is the most fundamental principle of game design; never assume that the player knows how to play your game. In the case of *Furious Frogs* it assumes that the player already has previous knowledge of the specific antonyms contained within the game. This simple oversight in game design can lead to players rejecting the game outright within the first few minutes of gameplay.

Since knowledge of the antonyms contained in *Furious Frogs* is required in order to compete fairly, the game itself should teach the player about this concept. In order to solve this issue an extra game mode could have been implemented where players learn what the term 'antonym' actually means. This could have been achieved through a simple multiple-choice game with pictures, cycling through the forty or so antonyms contained within the multiplayer game.

5.2 Multiplayer and Beginners

Furious Frogs has only one game mode: multiplayer. Due to the lack of a 'tutorial level' not all players will come to the game with an equal chance to compete.

The teaching and testing of antonyms should be handled within the game but outside the arena of competitive multiplayer. Any game, whether learning or mainstream, should give the player a 'safe space' in order to practice their skills in a consequence free environment. Gee quotes the psychologist Eric Erickson in describing this 'safe space' as a 'psychosocial moratorium' within games; a learning space in which the learner can take risks and where real-world consequences are lowered (Gee, 2003).

Beginners need this 'safe space' in order to make mistakes and to not feel too frustrated while learning how to play the game for the first time. The competitive environment of multiplayer is not the atmosphere for learning, but for testing skills that the players have already mastered. Putting beginners in direct competition with superior players could lead to beginners quitting prematurely and never returning to the game.

It should be noted that this is a criticism of the game design. The lack of the games introduction to the antonym concept should have been covered in the game itself. However during class this concept was introduced by the teacher before the game was played.

5.3 Negative Scoring

Another issue is that the game scores the players negatively; for every wrong answer the players score drops by one point. This may seem like a common sense game mechanic but in practice when the player realises that they are no longer within a chance of winning they may 'rage quit' and go for the lowest score possible within the time remaining.

Negative scoring should only be used when players have passed a certain skill level, increasing the difficulty of the game in tandem with their level of skill so that they remain challenged. Negatively scoring players with low skill levels can result in new players becoming frustrated with the game and giving up.

Brown et al. discuss the importance of learners discovering principles and concepts for themselves, and encouraging guesswork (Brown, Collins and Duguid, 1989). The mechanic of negative scoring discourages guesswork by punishing the player for guessing incorrectly. During gameplay negative scores can also be disproportionately unfair. For example if a player has built up a score of six points by getting six antonyms correct, they could lose up to five points by using guesswork if they honestly did not know the answer for the next antonym.

For beginners, the game could be designed so that you could get three chances before you are penalised for your choice, thus keeping the game mechanic intact while allowing for the player to guess. Or, there could be a 'cool down' period where the frog would refuse to eat flies instead of negatively affecting the players score.

The idea of negative scoring must be used with great care as not to aggravate the player. This mechanic is common place in many mainstream computer games but with educational games we should not punish the player for being 'bad' at the game. This is especially true if the player has not yet built up the skill set required to compete against others in the game.

5.5 Monitoring Players

Although it can be hard to tell without looking into the underlying code base, *Furious Frogs* seemed to lack any persistent function to monitor the player's performance over a period of time, allowing for the game to learn about the player's learning requirements.

Game based learning should build specific learning profiles for each player and then monitor their progress during the game. Using this information the game could dynamically change the difficulty level to suit the skill level of specific players.

One of the problems with the game was that the multiplayer lobby was not ranked and the players were allocated randomly. This meant that the players who were poor at the game would be in the same virtual room as players who were very good at the game. This increased the poor player's dissatisfaction as the competition became completely one-sided.

This profiling information could also create an 'illusion of competition' even without game ranking. For instance if someone is too far in the lead, the game could start giving them antonyms that it knows that they have had trouble with in the past. In cases where the gap is quite large the game could simultaneously give easier questions to the lower scoring player and give harder questions to the leader. This management of profile information could create an experience where the game doesn't become too difficult or too easy for anyone playing the game. Kirriemuir and McFarlane discussed this difficulty concept as a requirement for players to be able to enjoy the game (2004).

Implementing profile management in this way would ensure that everyone playing is evenly levelled, without any of the players knowing that the game is being managed from behind the scenes. Of course, implementing this idea would require some balance, as even the leader could 'rage quit' after a series of wrong answers

Implementing DGBL in a live classroom environment takes a lot of preparation but the results in attention and motivation of the students are worth it in my opinion. *Furious Frogs* walks the line between education and entertainment and is enjoyable for the students. There have been far too many 'edutainment' titles that have been poorly

designed with repetitive tasks that are boring (Kirriemuir and McFarlane, 2004) and would have failed to motivate the students. However, *Furious Frogs* is fast paced and fun while simultaneously testing the player's vocabulary in order to progress. Although there are improvements that could be made I believe that *Furious Frogs* has the right mix to make e-learning games within the classroom enjoyable.

Further research needs to be undertaken to investigate whether or not competitive based games have an impact on academic performance. In order to accomplish this much more time needs to be invested in creating a game which monitors the students' performance data. At the moment I am currently studying 3D authoring suites and game engines in order to create this type of learning game. If we have access to the performance data we could create a more challenging game and even suggest a link between DGBL and actual performance gains if the data supports it. Given the nature of DGBL any subject which requires elements of rote learning could benefit from using this technique.

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