Word Blaster: Improving Literacy with a Morphological Awareness Game

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Abstract

Many children with dyslexia and other disabilities have difficulty with reading large words because they have trouble breaking them down. Due to this, they often become stuck at a second grade reading level. In order to remedy this problem in a way that the children would enjoy, *Word Blaster*, a browser-based JavaScript game, was created. The game implements morphological awareness training to help children visualize the breakdown of words and familiarize them with the parts of words. Word Blaster is customizable so that the teacher or parent can input the words they want the child to practice with, allowing for flexibility to suit each child's reading level and weaknesses.

Introduction and Background

There are many children that struggle with reading. Dyslexic children, in particular, struggle with reading comprehension. Researchers have extensively studied the poor phonological awareness in dyslexic children, but the morphological awareness of dyslexic children has been studied much less comprehensively. Morphological awareness has been found to be an integral part of children's ability to read. A study of lower and upper elementary school students found that children read words with higher numbers of recognizable morphemes (or parts of a words—including common prefixes and suffixes) faster (1). The ability to read derived words is essential after children reach a second grade reading level. In order to improve their literacy after reaching the second grade, their ability to read derived words (which is dependent on both their morphological and phonological awareness) is significant. In a study done by Casalis, Cole, and Sopo in 2004, results revealed that dyslexic children do much worse than unimpaired children on morphological tests, but they also found evidence to suggest dyslexic children develop a certain type of morphological knowledge as a compensatory reading strategy (2). This might imply that dyslexic children have a greater affinity towards morphological strategies and may be able to use morphological awareness to read more effectively. In addition, it has been found that morphological instruction brings particular benefits to less able readers and can be effectively used on younger students (3). These traits make morphological instruction an ideal focus for a game that targets boosting literacy levels in language impaired children.

Video games—electronic games that involve a user interface with feedback on a video device (such as computer and handheld games)—are often thought by parents and teachers to be harmful for children. However, recent studies have shown that educational video games can often engage and encourage students in a way a traditional classroom environment can't. In fact, the use of video games has been proven to be effective in helping improve literacy and language perception in language

impaired dyslexic children. The results of a study in 2003 showed dyslexic children made significant gains in their reading and oral language skills after 8 weeks of playing a video game aimed to train oral language perception in language impaired children (4). Another study, published in 2010, proposed that educational video games are especially effective when used by those with dyslexia because video games take learning to a deeper level than short term memory (5). Many dyslexic people experience problems with their short term memory, but traditional teaching methods often only reach the short term memory level. This could explain why video games were found to be especially effective on people with dyslexia. Preliminary results and basic testing of the 2010 study concluded that the video game they tested contributed to faster learning capability in dyslexics (5).

In addition to their other benefits, video games may be helpful due to how accessible they are. Successful training with professionals may be more effective than a video game at improving the literacy of a child, but this takes resources that some families don't have. A study done in 2001 compared how a group of students using a video game designed to improve phonemic awareness in children did against a group of children receiving Orton Gillingham training (6). Orton Gillingham training is an instructional approach intended primarily for use with persons with dyslexia. The Orton Gillingham group ultimately did better overall, but the group of students using the video games made similar gains in phonemic awareness, which is what the game was designed to improve (6). However, though video games may not be as effective as professional training, they are much more widely accessible. Professional training can be hard to come by in some areas, and some families don't have the time or money to attend sessions. However, many more parents have access to computers and the internet. Browser-based games can be accessed by any computer with internet access in the word. This can give parents an easily accessible and fun way to help improve their children's literacy levels.

Video games may also be inherently helpful for those with dyslexia. Video games often involve matching movements to visual cues, which can help strengthen neural networks involved in reading and attention. Even video games that aren't educational can help do this. A study on the use of *Dance Dance Revolution (DDR)*, a commercial game with seemingly no educational purpose, by dyslexic and ADHD students revealed a positive trend between the number of sessions of *DDR* and the student's test scores (7).

There are not very many video games aimed at helping improve to the morphological awareness of children. The goal of *Word Blaster* is to implement morphological awareness training in a game environment that will encourage and engage children struggling with reading to improve their literacy.

Materials and Software

Word Blaster was written almost entirely in JavaScript, implementing the Dojo Toolkit and EaselJS libraries. The code was written using the Eclipse Indigo IDE using the JavaScript Perspective (an add-on to enable development in JavaScript). Debugging was done with Google Chrome Version 17.0.963.54 and Mozilla Firefox Version 10.0.2 utilizing the add-ons Firebug Lite 1.4.0 (for Google Chrome) and Firebug 1.9.1 (for Mozilla Firefox). The application nginx was used to create a local server to run the code on. Through the use of the Dojo and EaselJS libraries, Word Blaster has cross-browser support (though it has not been tested on Internet Explorer as of yet).

The Program

Word Blaster consists of two interfaces. These are the Input Interface and the Game Interface. The Input Interface is shown in **Figure 1**. The Input Page welcomes the user and gives instructions on how to customize the game. Below the instructions is the input tool which the user uses to input the words that the game will be played with. The game can be started with the "Go!" button. An alternative default button is in place so that a user may try the game with a default list of words before deciding to input a custom list. Words can be added using the "+" button and fields other than the first field may be deleted with "x" buttons.

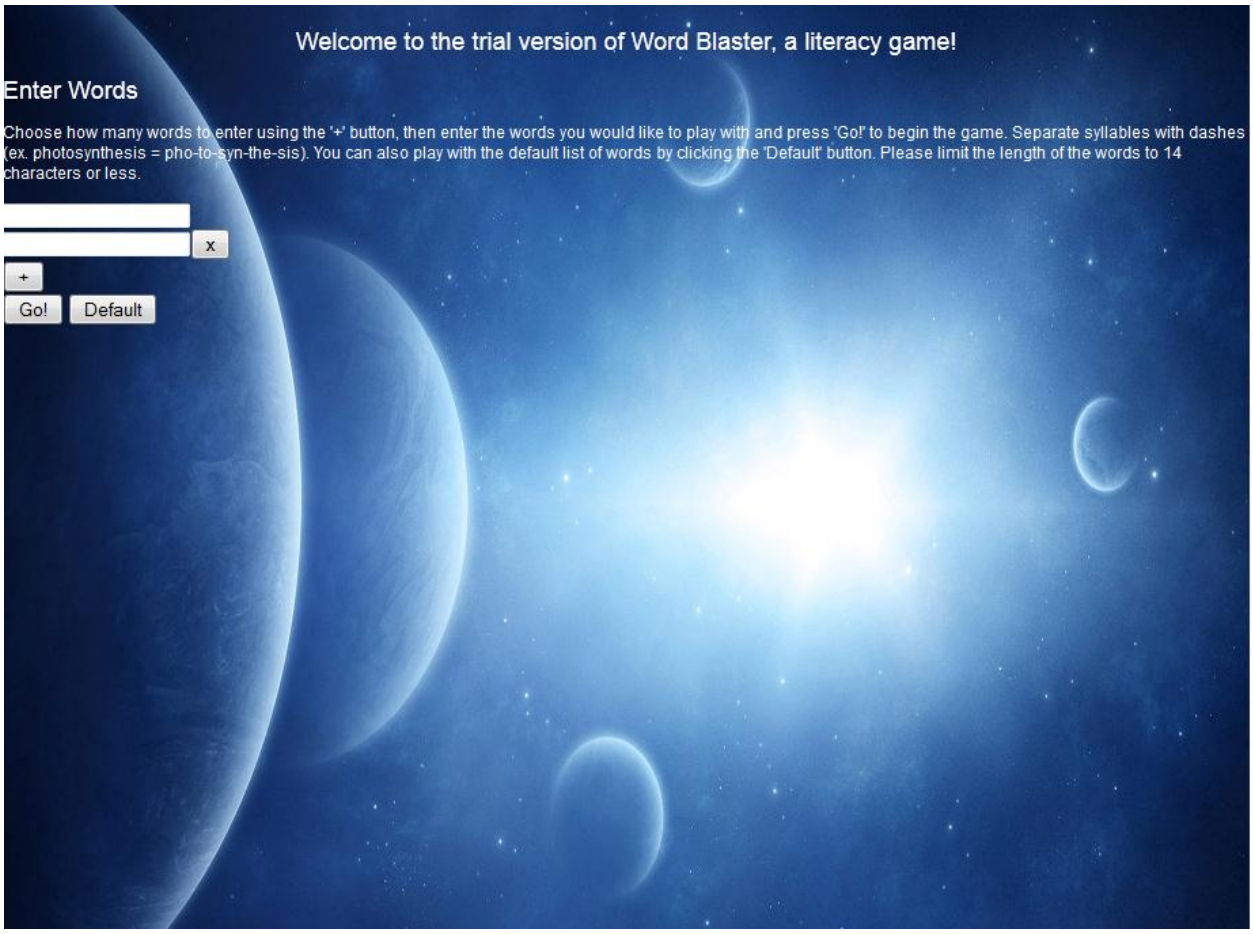

FIGURE 1 – INPUT INTERFACE

The Game Interface, displayed in **Figure 2**, shows what the page looks like after the "Default" button is pressed. If the user inputted a custom word list, the game would display the first word in the list instead of "CHEMISTRY" (the first word in the default list).

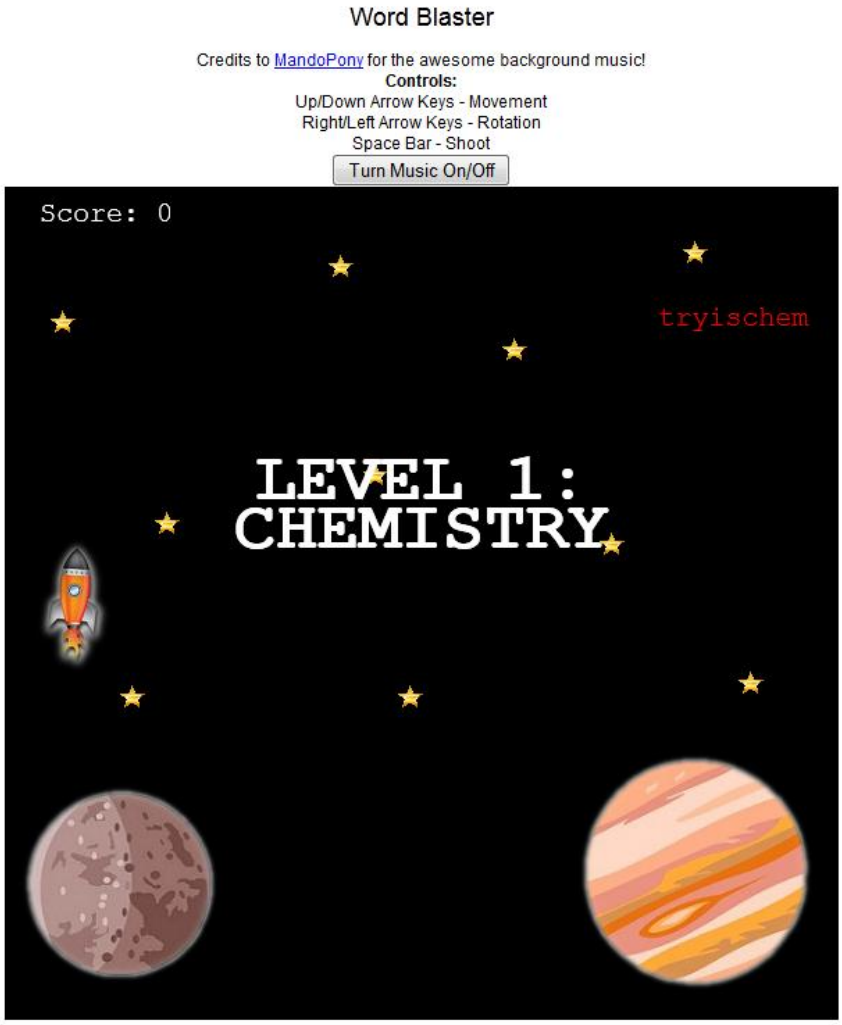

FIGURE 2 – BEGINNING OF LEVEL

The title of the game is displayed at the top of the page, along with credits for the background music and instructions for how to control the ship. A music toggle is provided so that the background music can be turned off if it becomes too distracting for the player. Once the "Go!" or "Default" buttons are pressed, the game begins running (starting at level 1 with the first word entered). At the beginning of each level, the level and word are read aloud once for the player to hear. In this case, "Level

1…Chemistry” is what would be heard by the user. Then, the user can start the game be pressing any key on the keyboard or clicking with the mouse.

After this, level and word text in the center of the screen disappear and the red text (which is a scrambled version of the word) on the screen begins moving. The player is then to maneuver and shoot the scrambled red text to break it up into its constituent parts. This is shown in **Figure 3**.

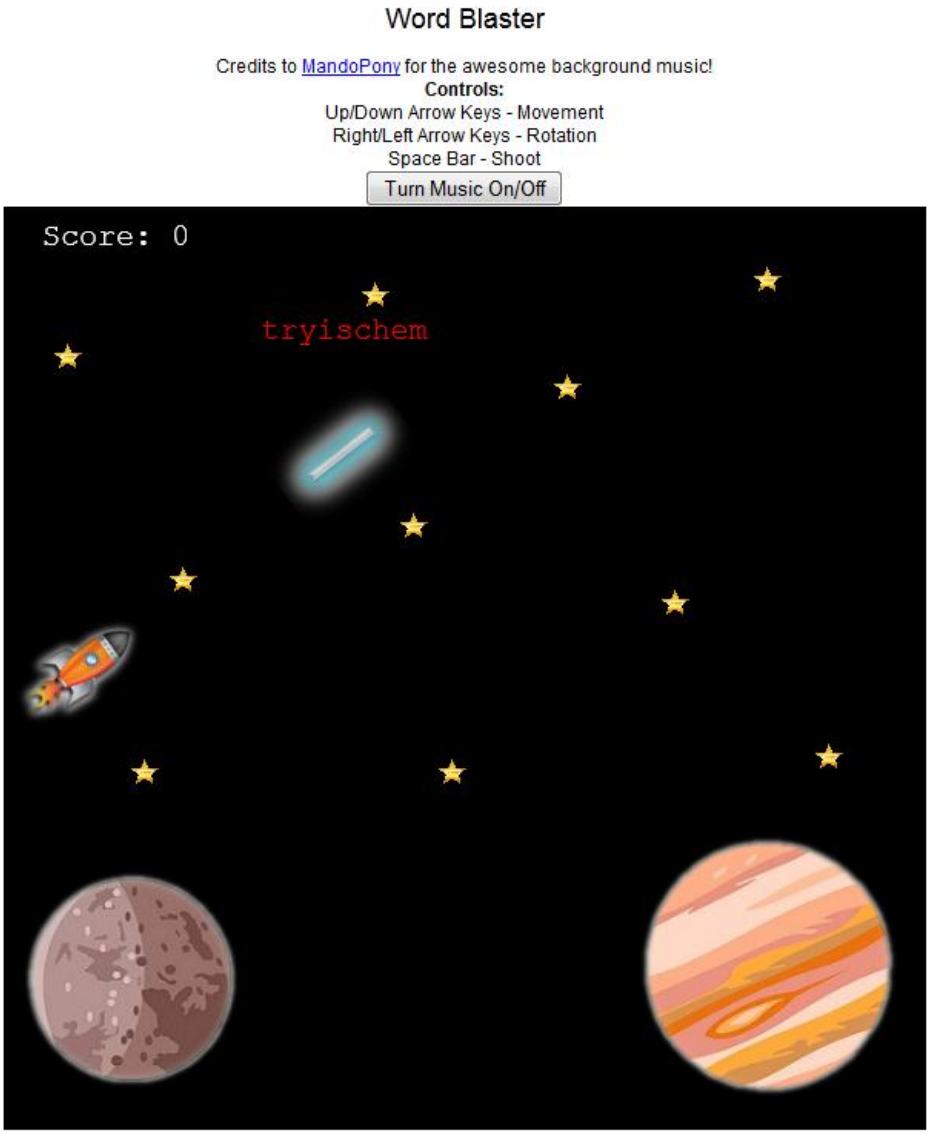

FIGURE 3 – ATTACKING THE WORD

After the user successfully shoots the red word, it will break up into white parts, which will all begin moving in random directions. This is shown in **Figure 4**.

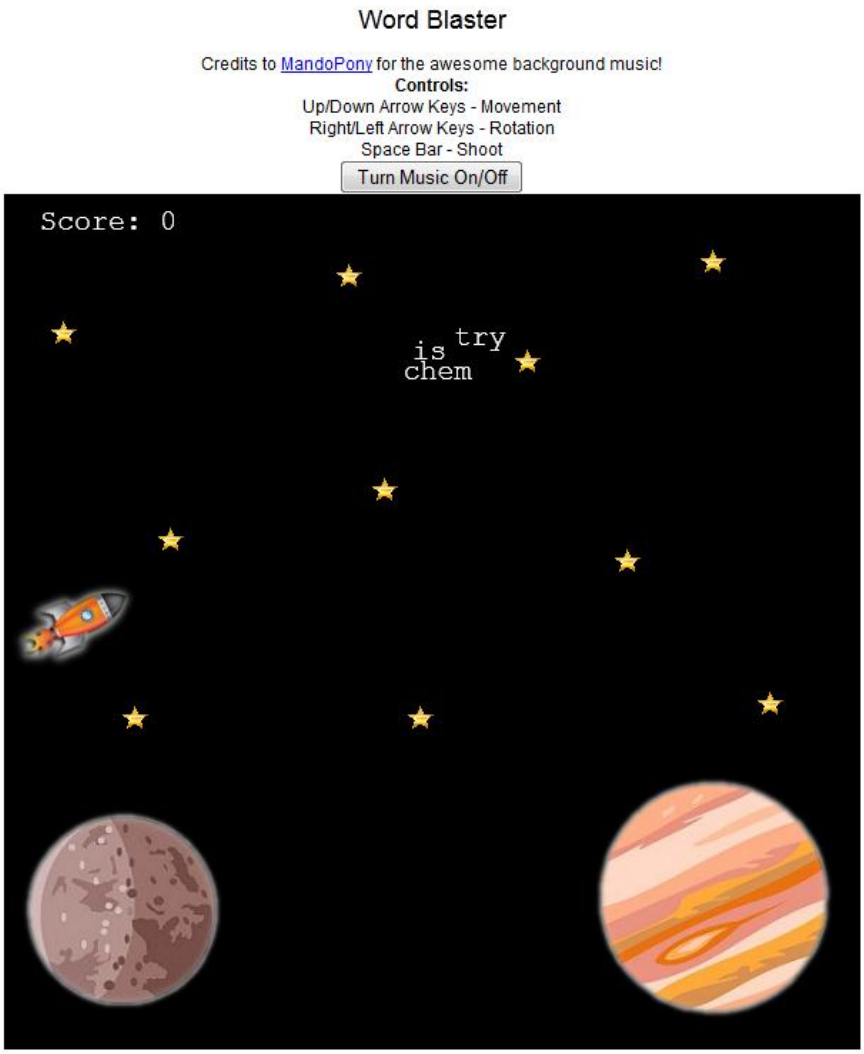

FIGURE 4 – BREAKING UP THE WORD

After the word is broken up, the pieces of the word are to be collected in order until the word is completed. If a piece is collected out of order, the game will show the word in the center of the screen with the collected part highlighted. It will also read the word aloud again to the player. This can be seen in **Figure 5**. Though not shown in the figure, if the player has more than fifteen points, fifteen points will be deducted from the total score.

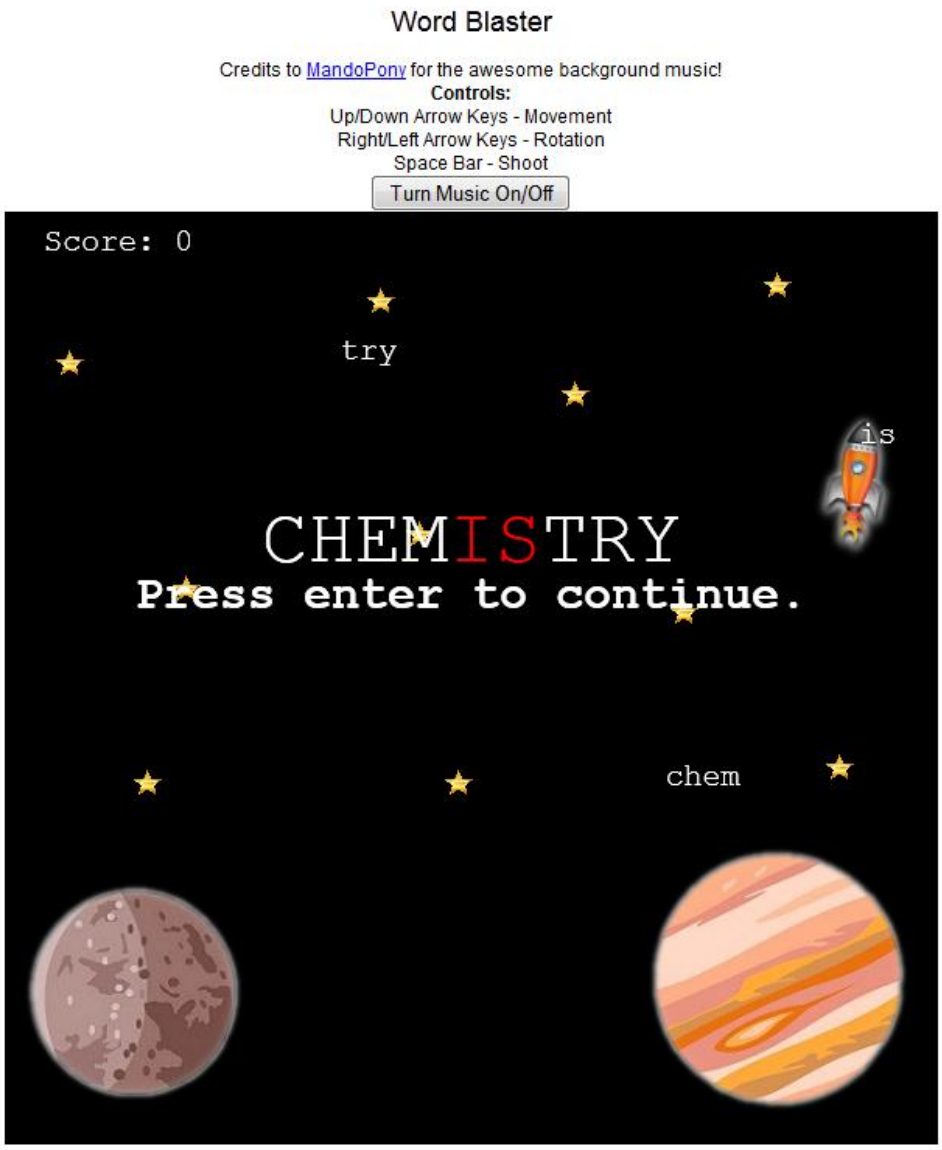

FIGURE 5 – GETTING PARTS IN THE WRONG ORDER

After the player hits enter to resume the game, the player will then be invincible for 5 seconds, during which collecting things out of order does not prompt the response. This invincibility is indicated by a flashing transparency (the player will be flashing between opaque and partial transparency during the 5 seconds). The transparent stage and invincibility of the player is shown in **Figure 6**.

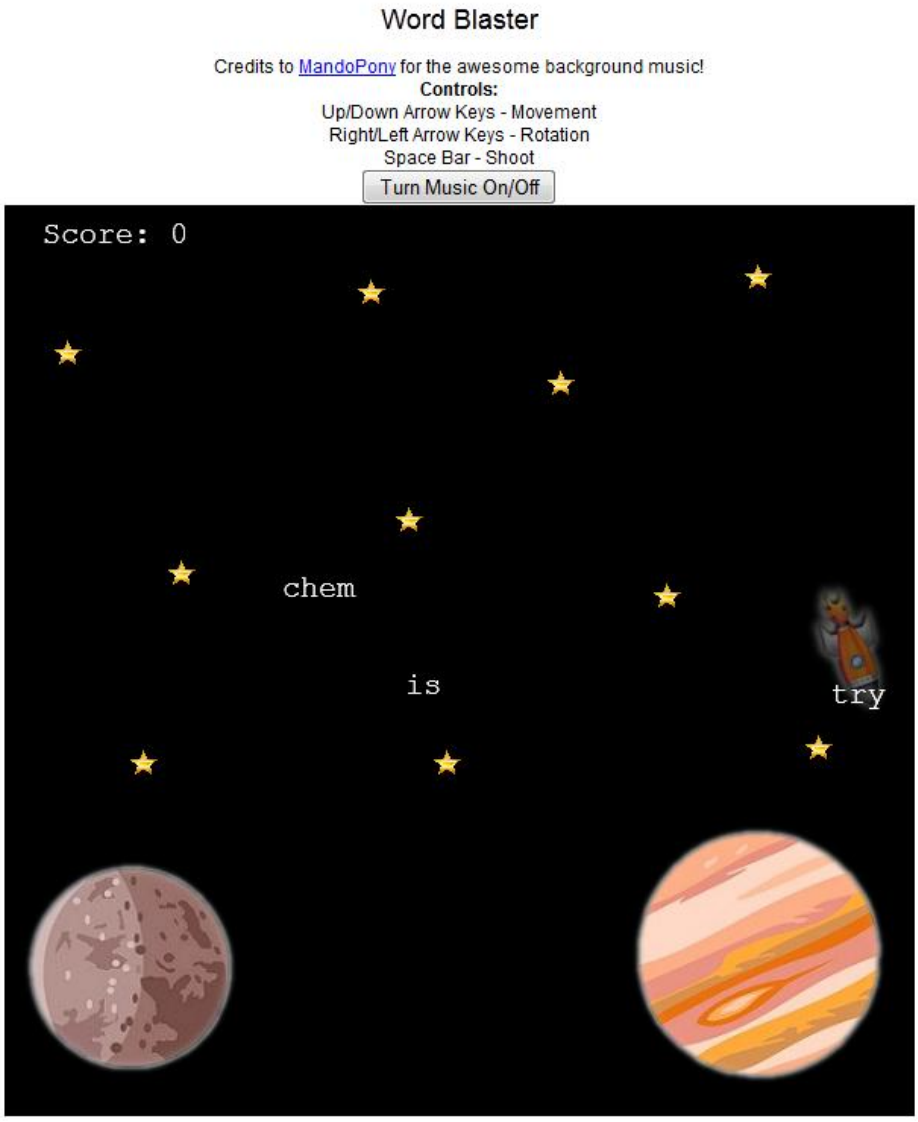

FIGURE 6 - INVINCIBILITY

After a correct part of the word has been collected, it will show up at the bottom of the screen. This can be seen in **Figure 7**.

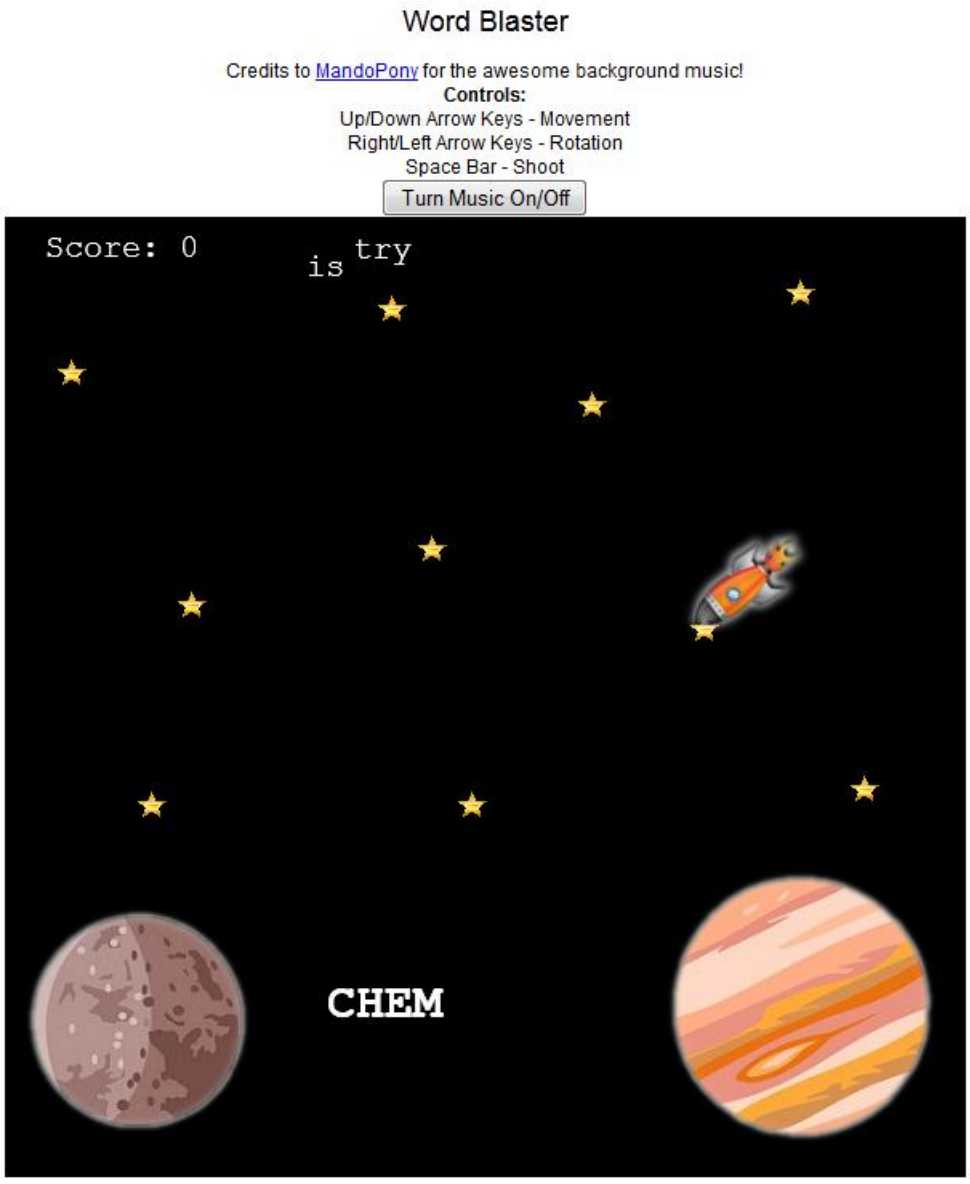

FIGURE 7 – COLLECTION MECHANISM

After all of the parts of the word have been collected, the player will be taken to a congratulations screen, and the game will say “Good Job!” to the player. Sixty points will be added to the player’s total score. The congratulations screen can be seen in **Figure 8**. After you press enter at the congratulations screen, you are taken to the next level, where you will go through the same process

again. On the last level, however, there isn't a "Press enter to continue." prompt. The game will instead say "Congratulations! You got ___ points!" where the ___ represents the number of points the player earned.

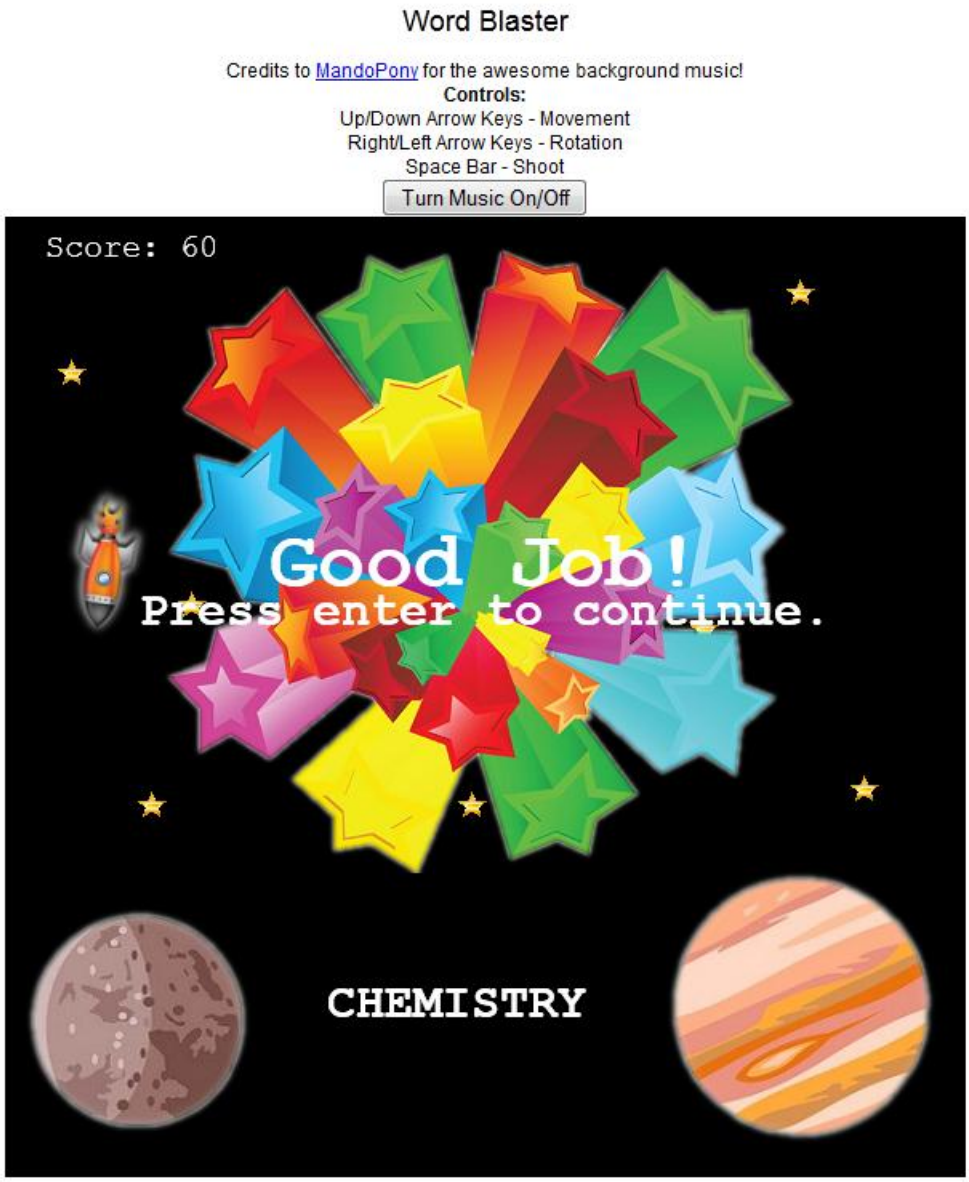

FIGURE 8 – CONGRATULATIONS SCREEN

Conclusion

Word Blaster is probably not the most effective morphological awareness training based game in the world, but it does its job. Once hosted on UNC's website, *Word Blaster* will be freely accessed by parents and teachers of disabled children all over the world. Though no formal studies have been conducted to test the efficacy of *Word Blaster*, Dr. Karen Erickson, Director of UNC's Center for Literacy and Disability Studies believes the program does work and will be beneficial to children around the world.

Acknowledgement

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