

Playing and Learning: How Dyslexic People Could Learn Better

Aurilla Aurelie Bechina Arntzen

Buskerud College University
Pb. 235, 3603, Kongsberg, Norway
E-mail Id: aurillaa@hihm.no

Christopher Stengrimsen

Buskerud College University
Pb. 235, 3603, Kongsberg, Norway
E-mail Id: cstengrimsen@hotmail.com

Abstract- Dyslexic people usually experience difficulties with word or number recognition or problem with short-term memory which limits their ability to read or remember. This problem is even more accurate when dyslexic people intend to pass the driving license. The theoretical background can be very hard to remember for people with Dyslexia. In order to cope with this learning problem, our project intends to investigate how the use of driving test Board game could foster their learning capability. This paper presents the problems and issues encountered by dyslexic people. The second part outlines how the usage of computer game should be considered as an efficient tool to enhance the cognitive ability of dyslexic people. The paper presents as well a prototype of an computer game board and discusses potential improvements.

Keywords- Dyslexia –Learning capability, Game Based Learning

I. INTRODUCTION

Dyslexia as a congenital neurological problem is a specific learning disability that is not yet completely understood [1]. The brain of a dyslexic person differs from a non-dyslexic brain [2]. It is believed that dyslexic's people use more their right side of the brain, which is associated with visual and creative thought processes [3]

Dyslexic people usually experience difficulties with word or number recognition, poor spelling and thus their reading capability is reduced. In consequence, Dyslexic people have problems in acquiring further vocabulary and some specific knowledge. Their capability to process visual information is often affected; thus resulting in a slow reading tempo. In addition, dyslexic people experience problem with short-term memory, which limits their ability to remember or grasp the meaning of long sentences.

Dyslexia is not a disease and can strike anyone regardless of social background or race [2]. The organization “Dysleksi Norge” (a nationwide interest group for everyone with reading or writing difficulties) estimates there are between five and ten percent with dyslexic tendencies in Norway. This implies there might be dyslexic students in almost every class with different forms of dyslexia.

Unfortunately, up to today there is no medical means to cure dyslexic people. In consequence, traditional classroom instruction might not be the most appropriate environment for dyslexic people that experience learning disabilities. The last decades, several research studies have been undertaken in order to better understand dyslexia issues. Thus, new teaching mechanisms to help people to learn more easily have been investigated [4]. Most of these approaches aims at improving the

verbal, reading, writing and memory skills of dyslexic people.

Under Norwegian law, dyslexic people are entitled to extra help from the public school system. Quite often they have specialized trained teachers that raise awareness of speech sounds in words and letter-sound correspondences defined as phonics. However, outside the school framework, people with dyslexia encounter different kind of challenges. For example, taking a driving license might represent a harsh task and a challenging process. For long time, dyslexics were considered as bad drivers as it could take them longer to develop automaticity in driving tasks. In addition, some of them were not able to talk with a passenger at the same time as driving. However, research done by Nicholson [5] suggests rather that with appropriate teaching methods, dyslexic learner can drive and pass their practical test with success. For example, his research work highlights the need to use multi sensory learning and to ensure that new information or skills are heavily embedded. For example, if someone has poor visual memory, then they can use their auditory or tactile memory to compensate [6]. Obviously, dyslexic people require lots of reinforcement to embed learning from the short term memory; fortunately most of them have excellent long term memories. So the learning process should focus on encouraging the long term memories and on the repeating phases in slower mood. Several initiatives based on recording an audio book in addition to the traditional driving book have emerged. In some case, this was enough to help dyslexic people to acquire the needed knowledge to pass the driving license. However, this approach seems to be not appropriate in some cases. Our research project aims to investigate how the use of a game can enhance the learning capability for people with dyslexia. An initial project in collaboration with the Norwegian Association of Dyslexics was to develop a serious board game aiming at facilitate the study of the theoretical part of the driving

process [7]. Based on this preliminary research, our project focuses on developing an computer board game that will enhance the learning capability in an entertaining way.

The second part of the paper, discusses the concepts and opportunities in using serious game as a means to enhance the learning capability. The third part presents the developed prototype and discusses potential improvements.

II. GAME BASED LEARNING APPROACH

The last decades, the use of personal computers, smart mobile device and the internet has changed the way people are living. The emergences of games and the players getting younger and younger have pushed the industry to develop more and more educational games. Recently the academic world started to investigate how serious game and computer games can facilitate the learning processes [8-10]. Recent research works have demonstrated that people tend to learn more easily when they are entertained and are engaged in the creativity process involving thinking and emotion [11, 12]. For example, the work done by Blunt concludes, the application of serious games significantly increases learning [13]. One reason that is often invoked is closely related to the concept of constructivist learning. In constructivism, the learner actively constructs knowledge and learning by integrating new information and experiences into what they have previously understood. The learner by building cognitive structure combine propositional Knowledge often referred as fact, concepts and procedural knowledge usually related to the techniques, skills and abilities [14]. In addition, it has been demonstrated that knowledge construction is best effective when taken place in social context, and in a setting in which new knowledge and skills are being used. Furthermore, people learn best through interaction with others [15].

Compared to the traditional computer based learning, computer game involves the learner actively in the learning environment. They are several factors in favors of using computer games to educational practices or to foster knowledge learning [9]. One of them is the recognition that play, constitutes an important part of human cognitive and social development. Gee reported in his study of video games as a learning tool that students are more likely to assimilate content by engaging themselves in a process of discovery [11].

In addition, people tend to construct knowledge in a best way when they are engaged personally; therefore computer game for learning purpose should involve content-based scenario or purpose. Furthermore, active participation in tasks is seen as a requirement for an active learning process; in fact, it is crucial to not separate the acquired knowledge from its everyday usage.

It is important to be aware as stated by Schnotz [16], that cognitive processing is not the only factor contributing to effective learning, but affective impacts and motivational should be taken into account as well. Moreover, if educational game are more engaging and appealing to learners interacting actively with these learning environment, it is worth to investigate further the use of these new game based learning approaches [17].

Therefore, games board could be considered as an educational environment that is rich in opportunities as they satisfy the people .competitive urges and the wish to master new skills and concepts [18].

Today, it is well recognised that board games for example are a very good means to encourage every player (learner) to take individual responsibilities, practices real-life simulated tasks and experience the outcomes of any decision making [9].

III. DRIVING TEST COMPUTER GAME BOARD

Living in today's modern society without using any form of transportation might be quite challenging. Norway is a large country with many small remote villages, therefore being able to drive is practically a big necessity. According to the Norwegian law, driving education consists requires that the driver student has to pass two exams, one theoretical and one practical [19]. Preparing for the theoretical exam is normally done by reading. For people with learning disabilities, this can be a cumbersome task, and in worst case might keep people from even trying. They tend usually to get discouraged by the difficulties they encountered while trying to gain adequate by reading books or attending lectures. In consequence, providing an enjoyable and efficient learning environment to pass successfully the driving license is crucial for people with dyslexia as they tend to learn better through visualizing the material, instead of only reading or hearing about it.

Our current project is based on an existing project done in collaboration with the Norwegian Association for Dyslexia. A board game called "Traffik Panik" has been developed. This game is inspired from the "Trivial Pursuit", but the questions are extracted from a driving book. The game board is composed with a cardboard playing board, question cards, dices and small plastic cars to represent the players on the board. The figure 1 illustrates the game board.



Fig. 1 "Traffik Panik" Game Board

This educational board game contributes to learn to drive safely and to educate people to the requirement of a driving test. The game board has a start space and several squares corresponding to different situations.

Based on this existing game, we have developed a computer game that allows one or several learners to play. A first prototype has been implemented with the goals to further engage the player (s) by being more interactive.

Each square on the game board is associated with a task the player has to conquer. From Marc Prensky's table "Types of Learning" the best way to communicate facts are either questions, association, memorization or repetition [21]. To comply with the table, the game will keep the original idea from the existing game, and every normal square will have a question task. The other squares on the game board will be associated with small sub games. Each sub game will extensively drill players on important facts.

Every time the player moves to a question square, a question dialog appears with a question suited for their level. The game is based on multiple choice answers. Each time the player gives the correct answer, the learner moves one step on the board toward the finish line. The interest of this game is the repeating aspect of the questions as it will help the player to learn through repetition. However, in order to keep the player engaged in the game, the questions are implemented in random way and therefore, starting new game will introduce each time a level of novelty in the questions. Each time, the player gives a wrong answer; he will stay in his position on the game board until he gives the correct answer to a new question.

Game design and development

Designing a serious game is challenging and need a structured process design. The first step aimed at gathering the users,

technical requirements. Several scenarios have been developed in order to understand how the game can be played. The second phase focused on translating these requirements into functional specifications. A technical architecture encompassing various components has been delineated. The third phase focuses on selecting the right technologies in order to implement in best possible way the various defined functions. The phase 4 focuses on developing the prototype. A preliminary test and validation of the software game have been conducted.

We have developed a simple character creator, allowing new players to set up new character. This editor is not used to create avatars or other character appearance modifications. In this game, the character is used to connect vital information and achievements to a distinct player. This feature allows the sharing of one game installation among several users and will keep track of the achievement of every player (character). Achievements are stored and therefore, it is easier to keep record of the performance.

Amongst the user requirements, we focused on programming a user interface with a panel of colors that suits best dyslexic people. "Scotopic sensitivity syndrome" also known as "Irlen syndrome" is categorized as a form of dyslexia [22]. People suffering from Irlen Syndrome have extreme problems focusing or seeing the text clearly, this can also be due to the color contrasts used in the text. Therefore changing to another background color might help considerably. Text and background color can be configured in the character settings, so the player always will get his selected color set in every dialog, menu and text shown in the game.

Another requirement that has been implemented into the game is the audio feature. Since reading can be a frustrating activity, for each card, an audio file has been associated. Therefore, when needed, the player can just press a button and listen to the question instead of reading it.

Game engine

Game engines are software libraries with the sole purpose of being used in game development. There are no specific rules for which features and support a game engine must have. Game engines are often targeted for a specific use, platform, and programming language. Almost every platform, Windows, Linux, Xbox, PS3, PSP etc. have several 2D or 3D game engines available.

Primary requirements for a game engine have been identified such as for instance:

- *Use of Open GL* or Direct 3D supporting for most graphics cards for desktops, laptops and even some game consoles and cell phones. By developing a prototype dependent on either of these 3D engines, our prototype can be versatile and run a wide variety of hardware.
- *Support a scene graph structure:* as a data structure for representing a graphical scene. Objects can very easy be connected to each other making scenes easier and faster to develop. This technology is vital for making a prototype. Grouped objects can be moved correct and fast around on the scene with very little programming.
- *Bindings available for Java:* The game engine must be enabled for the Java programming language. Java is a versatile programming language with multiplatform support. Java also has the ability for web deployment in a browser.
- *Sound support:* Adding sound to the game in form of background music, sound effects and voice is an important part of most games. To make the game focus on the information and understanding instead, of the reading, every question can be stored as an audio file giving the option to the player to read the question or play its related audio sound file.
- ...

Based on the above requirement, we select jMonkey Engine. The engine is developed with Java and will only run on computers with Java technology available. The game engine is build on top of other free libraries that communicate with both sound- and graphics cards. OpenGL is the graphics library used through the open source LWJGL (Lightweight Java Game Library) [22].

The current version of JMonkey Engine does not have a Graphical User Interface (GUI) bundled therefore we had to select Nifty-GUI as the most suitable solution for our project to design menus. Nifty has a detached style system, so it's easy to use different styles. This can be very practical when making game menus for dyslexic people. Several color schemes or contrast can be created to suit better dyslexic people needs.

The project is still an ongoing work. A first version of the prototype has been implemented based on open source and is subject to further improvement and development. Testing is always a part of software development. To ensure the prototype is behaving correctly and no unexpected crashes appear, the game has been through considerable testing during the development, this also ensures the quality of the game. However, the game has not been yet tested by dyslexic people: The next phase of this project is conducting an assessment of the potential of fostering learning capability by playing with the game.

Currently the version is a stand alone application; however, with some modifications the prototype can be available through a regular browser with Java support and an internet connection

IV. CONCLUSION

Recent research studies have demonstrated the positive role of using games. In this paper we present a prototype of a test driving computer game board. The paper discusses the potential of helping dyslexic people in learning the driving rules

by providing a new way to acquire new knowledge. The project is still under development therefore a large scale evaluation is not yet done. However, the preliminary results and basic test lead us to believe that using game board can contribute to foster learning capability for dyslexic people.

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