

Game Based Learning for Autism in Learning Mathematics

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Abstract

In the 21st century, research related to a game-based learning (GBL) have attracted many researchers and practitioners in researching more on the matters. Due to the positive effects of game-based learning, numerous studies have led more researchers to create educational games in supporting the teaching and learning development in schools especially for the need of the 21st century students. Moreover, students also realize the benefits gained while dealing with a game-based learning as well as the acquisition of 21st-century skills. Therefore, the purpose of this study is to develop a game-based learning for autistic children in learning basic mathematics. Through this game, the autistic children will learn mathematic in a structured and easier way. Some simple notes will be provided for them. The notes will act as a manual or guide before they attempt the games. For this study, the quantitative methods have been employed. Meanwhile, the ADDIE model has been embedded in developing this game-based learning. The respondents chose were primary school students aged 5 to 8 years old. The testing was conducted among autism students from Melaka Autism Education Centre. The expected outcome of GBL is to attract autism children to learn and focus during learning process. Besides that, GBL has also been found to be able to motivate students in learning and, it has been agreed by all that using GBL is the most effective teaching strategy to promote learning.

Keywords: *Autism, Game Based Learning, Multimedia, Mathematics, 21st Century Skill, Technology*

1. Introduction

This project is a game-based learning in which conducted for the purpose to learn basic mathematic for autistic children. According to The National Autism Society of Malaysia (NASOM) websites, Autism is defined as “a lifelong developmental impairment that blocks a child's learning, language communication, emotional and social development.” Autism is a brain disorder that distracts communicating, socializing, and maintaining what is considered a normal relationship with others. Children with autism may have a varied level of skills and capacities and behaviors. Thus, their parent and

teacher need to give a full attention for their learning process. An autistic need to learn gradually so that they can catch up what are being taught by their teacher.

Some general characteristic of children with autism disorder is cognitive, social skills, communication, and self-direction. There are many ways to assist autistic child in order for them to learn in easier ways. They need more special education other than normal children. So, the study will establish a game-based learning process that allow autistic children to learn in a structured and interestingly. Within this project, some notes will be prepared for them before attempting or playing with the game. When then they understand what they should do, they will start playing the games. By playing the games, it will make them understand more. The repetition technique will be used to increase their understanding.

Nowadays, there are not many products or tools in the market that targeted for autistic children. As a result, more products need to be produced to help this children in building their cognitive, social skills, communication, and self-direction.

2. Game-Based Learning

Learning has become ever more attracted to the level and preferences of learners and game-based learning [32]. Education is one of the main fields of application where successful implementation of digital games will bring about many creative and positive changes as interactive online environments constitute a key feature of the new generation of students [27]. GBL offers students immersive experiences as an active learning methodology [1]. Nowadays, students are very interested in computers. Gaming is one of the most entertaining and satisfying activities in daily life [12]. The scientific and public interest in serious-purpose games has dramatically increased over recent years [5];[8];[17];[25] as is increasing evidence of positive promotion of earnest games in various scenarios [10]; [20];[31]. More specifically, multiple studies have shown that more and more scientists are engaging in educational games in order to promote the teaching of essential skills of the 21st century [4]; [9]. Critical thinking, imagination, collaboration and communication are described as the learning and innovation in the 21st century [6]. According to Li and Tsai [18], the example of constructivism the sociocultural theory of learning is one of the major theoretical foundations employed by GBL science education researchers. The study analyzes the theories used in GBL relating to the development of skills in the 21st century. Establishing such educational practices requires understanding new principles for learning and content-based curricula, collaborative learning processes for students and the development of new projects based on learning knowledge [11].

Game oriented learning with the goal of improving learning practices in the educational process [28]. Throughout recent years, numerous studies have been widely accepted to recognize and demonstrate the advantages of this method. Digital Game-Based Learning has also been widely used as a form of education. The effects of game-based training on conceptual intelligence of rational number knowledge are recently examined in [16]. A game-based training group is playing a digital game while a daily maths course is attended by the control group. The results have showed that the game-based training group has significantly improved conceptual rational number of knowledge. Meanwhile, [15] has found a significant promotion in students learning computer game-based mathematics. The effects of computer games on high school pupils has been studied by Rastegar and Marashi [26] and they found that gaming has an important role to play to learn through excitement and joy.

Nonetheless, up to now it is difficult to find underlying mechanisms for the success of playing games. Emotional engagement is hypothesized to play a crucial role among other factors [13]; [23] in observing emotional responses to learning materials for the purpose of learning [21]; [22]; [29]; [30]. Consequently, we have experimentally tested whether a game-based learning can significantly increase emotional engagement. It is argued that games are well suited to promote emotionally engaging interactions [23] and thus become increasingly popular in learning-enhancing education [5]; [13]; [23]. Though the idea of using games in educational settings has been around for decades, as a research field it is still in its early stages. As such, there is still unclear underlying mechanism by which games or game elements involve learners and promote learning [19].

In addition to compete with peers, the game behaviors of students may include how they interact with their peers or in groups, how they move through the environments, their on- and off-task actions during tasks, and how they engage with specific game elements such as goal, characters, and story [2]; [7]; [24]. Students' game behaviors contribute to the interaction and communication qualities of the game which are considered to have important consequences for game-based learning.

3. Problem Statements

In this country, the number of autistic children is increasing. Once thought to be a rare disorder, the number of this 'disease' is increased and it has been diagnosed mostly amongst young children. However, many have mistakenly understood about autism due to the greater understanding and recognition of its complexities. According to a report carried out by the National Center on Birth Defects and Developmental Disabilities, a group of psychological conditions that include autism has been diagnosed with autism spectrum disorder, about one in eight years of age. After examining records of a total of 2,757 children, researchers came to the conclusion, that in a four-year period beginning in 2002, the results disturbed the number of autistic children by 57%. An alarming trend is whether the rise is due to better diagnosis or whether the number of cases of autism spectrum disorder is growing. An autistic children need to learn slowly and systematically. They need a special education that can teach and assist them how to overcome their weakness. There are not many product of 2D game-based learning for autistic children on the market. An autistic is the same as other children, they will attract more on playing games rather than learning on notes or by hearing to the teacher. If they interested to the game, the children will immerse in the game play. They will try to solve the problem and their curiosity will make them try to finish the game until the end to know the result of the game.

4. Objective

The study presented in this paper has been designed to develop GBL for autism students to learn Mathematics. This study had three research objectives:

- i. To develop courseware using game based learning for autistic children to learn mathematic.
- ii. To measure usability, functionality and User Acceptance of this courseware.
- iii. To apply "point and click" game techniques in this courseware.

5. Scope

The target user for this particular project is autistic children. This product is a game- based learning to learn basic mathematic for autistic children. The basic math operation of number will be taught in the notes provided. Therefore, the game will be the simplest way for autistic children to learn, and the subjects are related to subtract, add,

multiply and divide number. This game-based learning is a one type of Point and click games. All the players have to do is to click the right sea creature that shows the right answer to the question given. A Short animation will be included before the game start to attract the children. Some quizzes also will be included. Attractive graphic and sound effect will be used to make the game more interesting. The children will be interested and excited to learn and play the game. The game will not be tedious for them, so they will have more focus on the game until it finishes.

This project is a stand-alone 2 Dimensional game that will give an education and entertain values as well as combine all multimedia elements like short animation and attractive graphic for autistic children. The program that is used along with is the 3.0 action file. Adobe Flash is a multimedia application that has been used to create animation, video, and interactivity and often used for advertising and games. Action script is the language of object-oriented programming (OOP) used for interactivity in an application with the flash movies. Action script has its very own grammar and punctuation rules that define which characters and words can be used to create meaning.

6. Methodology

The method of analysis is a quantitative with respect to the basic strategy. ADDIE methodology is applied to achieve the goal of this project. It involves the instructional design, learning theories and learning technique. Nevertheless, games are interdisciplinary, since they involve a thorough understanding of game design theory, theoretical experience, and a basis in applicable theory of the learning [4]. The aim is to create games for different educational purposes. Figure 1 indicates that the ADDIE model consists of five stages.

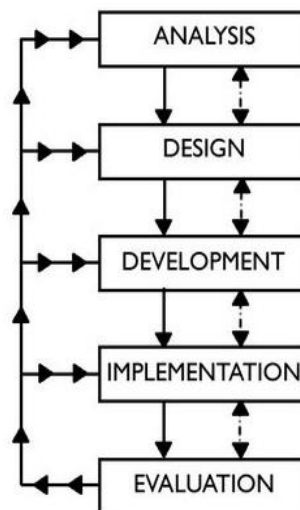


Figure 1. ADDIE Model

6.1. Analysis

Analysis phase is the process to find the needs and constraints of the product. In this phase the target audience needs to be identified. The target audience for this project is Autistic children. The purpose of this product is to help the autistic children to learn basic mathematic in a structured and easier ways. This project is also conducted to deliver a message to the public that the autistic children can also be an excellent people like normal children. As we know that children are our leader in the future, therefore it is important to focus on their needs and shows our concern for them.

6.2. Design

We have to define learning tasks, analyze and pick methods and resources to be used in the design process. We need to choose the web-based setting most suitable by evaluating the types of cognitive skills required to achieve teachers' objectives. Write down the training targets and pick the project's overall approach. The theme "under the water" will be used for this project. The character of sea creatures will be illustrated in each module to attract the autistic learner. The learning activity need to be simple so that it is easy for the autistic children to learn. All the notes are standardized to avoid the autistic children being confuse with too many interface.

6.3. Development

The process of development is to begin production, formational evaluation and revise. We need to get the necessary media or construct them in this process. Use the capabilities of the internet to present information in different multimedia formats so that the needs of the learners can be met. Then determine the appropriate interactions. We need to be creative and innovative in motivating learners to further explore when using the goods. In this GBL, suitable multimedia elements were produced from the design phase. All multimedia elements that are created from design phase will be integrate in development phase as a prototype.

6.4. Implementation

Implementation processes is to put the plan into action. It refers to the actual delivery of the instruction, whether it's classroom-based, lab-based, or computer-based. The purpose of this phase is to deliver instruction effectively and efficiently. This phase should encourage learners to understand the material, support the mastery of the goals and ensure that learners transfer their knowledge from the educational environment to the workplace. Computer-based instructions are used for this project as actual delivery.

6.5. Evaluation

Evaluation process is the framework for further implementation from all stages. The test process evaluates the instruction's efficacy and effectiveness. It should take place in all phases, between stages and after implementation throughout the entire instructional design process. During and between phases the formative assessment is still ongoing. The purpose is to strengthen the instructions prior to implementing the final version. After the final version of the instruction has been applied, summative review will take place. The general usefulness of the instruction is assessed by this method of evaluation. In this experiment, based on the preceding example, we determine whether autistic children is fully learned or vice versa.

7. Expected Results

GBL especially point and mouse click games technique will help the autistic children to learn basic mathematic. This game-based learning acts as an edutainment for the children. The students not only able to learn yet being entertain during learning. In order to keep them interested and immersed in learning process, edutainment is designed to make learning process more entertaining. To provide some valuable knowledge to the autistic children by keeping them immerse with entertaining material is the goal of an edutainment product. Autistic children tend to accept educational material that is presented in interesting way rather than straightforward lesson. Students indicated that after playing the game they were more interested in the subject and that they knew better about the game than before [14].

8. CONCLUSION

As far as theory is concerned, this investigation enhances the understanding of the effects of real competition and virtual competition on learning by offering empirical evidence. In this study, however, the sample size was not significant. However, more studies are necessary to provide additional evidence with a larger sample. Usually, autistic children like to play game rather than learning in class. Therefore, researchers need to be decisive on how to attract autistic children in their learning process, and one of it to combine learning with game. Through this way, the learning process will be more interesting. The children will have more concentration on the notes provided during the game. The attractive multimedia element, graphic and short animation could be employed in the game and as such will make them interested to learn.

This is a win-win situation where the autistic children can benefit from the game and their parents or teacher also can educate them simultaneously through notes and game. On the last notes, it could be said that the contribution from this project can benefit autistic children to learn in a structured and easier way. The systematic and repetition technique in the game will make them learn in their own pace and time.

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