THE EFFECTS OF GAME-BASED LEARNING (GBL) ON PRE-SCHOOL STUDENTS' MOTIVATION IN MATHEMATICS LEARNING: A CASE STUDY AT TADIKA UNIMAS

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ABSTRACT

The Effects of Game-Based Learning (GBL) on Pre-School Students' Motivation in Mathematics Learning: A Case Study at Tadika Unimas

Chong Yung Yung

The growth of the use of communications technology has lead to the interest growth in leading the potential of games and computer games in modern education era (Whitton, 2007). One of the most popular modern learning methods is game-based learning (GBL). Generally, GBL is a learning method which uses game as the main instrument in teaching and learning process. In GBL there are elements of entertainment in a form of different games and education elements which are being combined to produce a more interesting learning environment for the targeted learners of a particular game. This study aim to observe the difference in students’ motivation in mathematics learning with the use of different learning method, which are conventional learning method and GBL. Besides, this study also designate to observe the effect of GBL towards students’ motivation in mathematics learning. Furthermore, this study also looked at the difference of students’ mathematics achievement with the use of different learning method and difference of motivation for male and female among the students who practices GBL. The main sample of this study is students from Tadika Unimas, all are from six years old class. The main instruments of the study that used to observe students’ motivation level are both conducted according to ARCS motivation model. The main instrument for experiment session are mathematics worksheet and computer game (Math Blaster Age 5 -7). The collected data will be analyzed using Statistical Package for Social Science software version 18 to compute the Independent-Samples T-test. Overall, three of the hypotheses fail to be reject and only one hypothesis sucessfully rejected.
ABSTRAK

Pengaruh Pembelajaran Berasaskan Permainan (GBL) Pada Motivasi Pelajar Pra-Disekolah Dalam Pembelajaran Matematik: Kajian Kes di Tadika Unimas

Chong Yung Yung

Pembangunan dalam sektor teknologi komunikasi telah membawa kepada peningkatan minat dalam menanah potensi permainan dan permainan komputer dalam era pendidikan moden (Whitton, 2007). Salah satu kaedah yang paling popular adalah belajar berdasarkan permainan (GBL). Secara umumnya, GBL adalah sebuah kaedah pembelajaran yang menggunakan permainan sebagai alat utama dalam proses pengajaran dan pembelajaran. Dalam GBL terdapat unsur hiburan dalam membentuk permainan yang berbeza dan unsur-unsur pendidikan yang digabungkan untuk menghasilkan persekitaran belajar yang lebih menarik bagi pelajar tertentu. Kajian ini bertujuan untuk mengetahui perbezaan motivasi pelajar dalam pembelajaran matematik dengan menggunakan kaedah pembelajaran yang berbeza, iaitu kaedah pembelajaran konvensional dan GBL. Selain itu, kajian ini juga menunjuk untuk mengamati pengaruh GBL terhadap motivasi pelajar dalam pembelajaran matematik. Selain itu, kajian ini juga melihat perbezaan prestasi matematik pelajar dengan menggunakan kaedah belajar yang berbeza dan perbezaan motivasi untuk lelaki dan perempuan di kalangan pelajar yang mengamal GBL. Sampel utama untuk kajian ini adalah pelajar dari Tadika Unimas, semua dari kelas enam tahun. Instrumen utama kajian yang digunakan untuk melihat tahap motivasi pelajar, kedua-duanya diasakan mengikut motivasi model ARCS. Alat utama untuk sesi eksperimen adalah, kertas kerja matematik dan permainan komputer (Math Blaster 5 - 7 years old). Data yang dikumpul akan dianalisis menggunakan program SPSS versi 18. Dari hasil dan penemuan kajian, tiga daripada hipotesis gagal ditolak dan hanya satu hipotesis berjaya ditolak.
CHAPTER 1
INTRODUCTION

1.0 Overview

This chapter presents a general introduction to the study and the main components of the study. These main components of the study include: an introduction to the study, the background of study, problem statement, purpose and objective of the study, research questions, conceptual framework, research hypothesis, significance of study, and definition of terms that relate to this study. This chapter ends with a brief summary about this chapter.

1.1 Introduction of Study

In today’s educational field, the method and instrument used is not only fully dependent on the conventional methods and instrument only, but also by using many other technology to make the learning process more meaningful, interesting, and more effective for the learners. There are various type of technologies used in teaching and learning process, for examples; educational CD-ROMs which are produce according to the content of a particular subjects, E-Learning, educational software and Game-Based Learning (GBL). The design of the technology, ways of implementation, principle of the technology, and
instrument used for these teaching technologies are mostly different with each other, with one similarity which they all involve the use of digital instrument, for example a computer. In this study, the main focus on the type of teaching and learning technology is GBL. As claims by Tan, Wilder and Neill (2008), GBL is a form of learner-centered learning tools that uses games for educational purpose.

GBL is one of the new learning ways in today’s educational field. Simple explanation on GBL is using games to learn a particular subject or for other educational purpose. In GBL, game being used as a tool to transfer knowledge of a particular subject that being focus on that game to the target users of the game. In GBL the main instruemnt is games, which more specifically known as educational games. Generally a game is a type of competitive activities where people play and complete with other players, and they play according to the rules of the games (Oxford Advanced Learner’s Dictionary, 2010). Therefore in GBL there are elements of entertainment in a form of different games and education elements which are being combined to produce a more interesting learning environment for the targeted learners of a particular game. Based on the resource found by Whitton (2007), the starting time for GBL inception was at 1950s, the process was integrated with war-gaming, computer science and operational research, besides that the inception process also coupled with the emergence of constructivist educational theories that emphasize active, experiential learning and reflection. There are five main elements of GBL games; types of games (edutainment games versus educational games), motivation elements in the games, narrative context of the games, goals and rules of the games, and interactivity and multisensory cues of the games (Donlinger, 2007). These five main elements of games for GBL determine the quality and effectiveness of the games for teaching and learning purpose, besides the quality of these elements also affect the outcome of the game play. Besides that, these elements are importance components which significant to determine the potential of the games to be an educational games and uses for teaching and learning purpose.
According to Donlinger (2007), there are two types of game which involve the elements of effective games design for teaching and learning purpose: edutainment games and educational games. Both types of games involve learning process, but the difference is at the requirement aspect in playing the games. For edutainment games, it’s more to skill and drill format where the player of the game practice repetitive skills over and over again until he or she masters the skill and win the game (Donlinger, 2007). While for educational games, it is more concerned with the educational aspect that includes entertainment aspects to make it more interesting for learner to learn the knowledge through the game. Learners are required to have high order of thinking which involve more cognition and cognitive skills; higher order of thinking are problem solving, strategizing, hypothesis testing, or logical thinking (Donlinger, 2007). Tuzun, Soylu, Karakus, Inal, and Kizilkaya (2009) state that, educational game software was more motivational and educationally effective compare to other educational software without any game characteristics.

In educational games, it can be categories into three main categories; non-digital games like card game and board game; second is digital game like computer games; and digital games that are played by a group of player, which also known as collaborative games like online game (2010 Horizon Report, 2010). In this study, the game category that is being focused on is digital games. Digital games for example computer games, is a software artifact which combines multimedia and other computer technologies such as 3D modeling and networking which enable the game player to experience goal-based play in a virtual environment (Tang & El-Rhalibi, 2007). Digital games is said to be importance for three most recent cohorts of children who are born in the early 1980s, early 1990s, and early 2000s, this is because they are born and growing up in a world where digital games have been an important part of their life (2010 Horizon Report, 2010).

One of the significances feature of GBL is it involves a gaming behavior. As stated by Chen, Wang, Chang, Chao, and Shih (2009), gaming behavior is one
of the learning modes in human's learning mode. When people start to play, they need to learn the rules of the game in order to master the game; they experience the simulation situation or world that mimic real world problem in game environment. This helps to give personal and meaningful experience in achieving the goal of the educational games towards the player. Many research and study related to the GBL claims that it helps in motivate the students and its positive effects on students learning skills, cognitive skills like memory, logical thinking, concentration and understanding for particular related subject. Students can have their own personal experience on the subject that the game focuses on.

There are twelve characteristics identified by Prensky (2007): enjoyment and pleasure, intense and passionate involvement, structure, motivation, doing, learning, flow, ego gratification, adrenaline, social groups, emotion and spark learners' creativity (cited by Tan, Wilder, & Neill, 2008). Motivation also present in the list of computer application to initiate and sustain learners' attention and interest over a period of time in O'Brien and Toms (2008) study. Tuzun (2004) is one of the researchers who involve in the GBL research; he found that there are thirteen motivational elements in the research using Quest Atlantis, an educational online computer game (cited by Ucgul, 2006). The thirteen motivational elements are: identity presentation, social interaction, playing, learning, ownership and control, fantasy, immersive context, curiosity, creativity, achievement, rewards, uniqueness, and context of support. These elements and characteristics of the educational games support and increase the potential of the use of GBL teaching and learning process.
1.2 Background of Study

In the findings of sufficient teaching and learning methods and instruments, there are several important key aspects that related to successful learning and one of the importance ones is sustain students’ motivation in learning. According to the Encyclopedia (1981, p.720), “Psychologies and educators also recognize that learning is best when the learner is motivated to learn.” There is also a statement which states that, adequate motivation is an important condition for efficient learning, and the stronger the motivation level is; the more effective the student will learn (New Standard Encyclopedia, n.d., p.M-579a). GBL and its instrument is one of the methods that in the list of investigate its motivation value in motivate students in learning process (Ucgul, 2006). GBL is significantly related to learning aspect, while motivation is the main key of success learning; therefore, motivation is an important element for GBL. Huitt (2001) claims that, many motivation theorist assume that motivation involve in the performance of learners responds; “a learned behavior will not occur unless it is energized”. As mention by Teed (2010), the feature of GBL are able to motivate student in learning, the uses of competitive exercises, which either get the students against each other or getting them to challenge themselves in order to motivate them to learn better.

Tuzun, Soylu, Karakus, Inal, and Kizilkaya (2009) state that, educational game software is more motivational and educationally effective compare to other educational software without any game characteristics. Furthermore, there is a statement which state that, people who play games have a more developed intellectual skills than those people who don’t play games (Estallo, 1995) (cited by Milovanović, Minović, Kovačević, Minović, & Starčević 2009).
1.3 Problem Statement

Mathematics is one of the subjects that educators use GBL instrument in teaching and learning process. Mathematics being categorized into the group of subject that is not an easy subject to be learned or teach (Human Capital Working Group, 2008). Some students might think that mathematics is a difficult, complicated and confusing subject because it includes formulae and calculations; others having negatives idea where learning mathematics is boring because the content is not related to their real life (Wan Fatimah, Afza & Mohd Hezri Amir, 2009). Besides, negative experience in solving mathematics problems and the negative thinking of the students cause the students to have negative attitudes which lead to mathematics anxiety problem. Motivation is one of the ways which can help in coping mathematics anxiety problems (Kesici & Erdogan, 2009). Motivation plays an important role in students’ performance and responses towards learning a particular subject (Huitt, 2001). According to Kesici and Erdogan (2009), positive level of motivation beliefs and self-regulated learning can help in coping mathematics anxiety problems and success in mathematics learning.

The use of conventional instrument also one of the factor which affect the effectives in mathematics teaching and learning process. As stated by Wan Fatimah, Afza and Mohd Hezri Amir (2009), conventional learning instruments like text books, revision book, lecture notes and courseware are not effective in ensuring success in master the subject. In conventional learning, students only have a limited freedom for them to manage the content and apply their skills or knowledge in dynamic context (Squire, 2000). Lack of motivation is one of the limitations of using conventional learning instrument (Wan Fatimah, Afza & Mohd Hezri Amir, 2009). Therefore other research and investigation on the other teaching and learning method is require to find another method to helps in maintain and sustain learning motivation among the learners. GBL had been stated to be one of the methods studied by many educators or researchers in the world today. There are various issues studied on GBL, for example: instrument layout
design, learning values of the games, effects on the academic achievement of the students with the uses, motivation values, issues on the pro and cons of the uses and the effects of the uses of GBL instrument on learners' learning motivations. In this study, majorly is study on the effects of GBL instruments on the learners’ motivation level in learning Mathematics.

1.4 Purpose of Study

This research is to study the GBL as a tool to enhance learners' motivation in learning mathematics, among primary school students. Many research were done regarding GBL in learning, mostly about what learners can learned from the game and seldom about which element in GBL can helps the learners in their learning, and how it can enchance learners learning modes (Dondlinger, 2007). Therefore in this study, it studies about GBL motivation element, and aims to explain the motivation value of GBL using educational games in mathematics learning. Ucgul (2006) claims that, “The best educational software will not make sense if students are not ready to learn. In order words, it is necessary to motivate students to learn in order for making best use of educational software.” This study also aims to observe the effects on the students’ motivation in mathematics learning after practice GBL. Besides observing the effects of GBL on students’ motivation, this study also aims to observe their mathematics achievement with and without the use of GBL. Lastly, this study also aims to observe the potential of the use of GBL in mathematics learning and to indicate the difference of different gender in using GBL method.
1.5 Objective of the Study

1.5.1 General Objective:

To study the effects of GBL to enhance pre-school students' motivation in Mathematics learning.

1.5.2 Specific Objectives:

1. To identify whether there is differences in students’ motivation in mathematics learning based on the uses of different types of learning methods (GBL and conventional learning method).

2. To identify whether there is differences in students’ motivation in mathematics learning after the use of GBL learning method.

3. To identify whether there is differences in students’ mathematics achievement based on the uses of different types of learning methods (GBL and conventional learning method).

4. To identify whether there is differences between male and female students’ motivation for using GBL method in mathematics learning.

1.6 Research Questions

1. Is there any differences in students’ motivation in learning mathematics based on the uses of different types of learning methods (GBL and conventional instrument)?

2. Is there any differences in students’ motivation in mathematics learning after the use of GBL learning method?
3. Is there any differences in students’ mathematics achievement based on the uses of different types of learning methods (GBL and conventional learning method)?

4. Is there any differences between male and female students’ motivation for using GBL in learning mathematics?

1.7 Conceptual Framework of Study

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Dependent Variable</th>
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<tbody>
<tr>
<td>Type of learning environment</td>
<td>Motivation Level in Mathematics Learning</td>
</tr>
<tr>
<td>(Game-based learning and Conventional learning methods)</td>
<td>(High motivation and Low motivation)</td>
</tr>
<tr>
<td>Different gender</td>
<td>Mathematics achievement</td>
</tr>
<tr>
<td>(Game-based learning method)</td>
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1.8 Research Hypothesis

$H_{01}$ There is no significant difference in students’ motivation in mathematics learning base on the type of learning methods.

$H_{02}$ There is no significance effect of GBL on students’ motivation in mathematics learning.

$H_{03}$ There is no significant difference in mathematics achievement in mathematics learning base on the type of learning methods.
There is no significant difference in different gender towards motivation level in learning mathematics using GBL.

1.9 Significance of Study

There are various researches done for each of the learning methods, including GBL learning method. Even though there are many research done on GBL but the number of research done about GBL for Malaysia learning cultural is very little. Therefore, this research is to help in further investigation about GBL in Malaysia learning cultural. Besides that, this research also important in observing the effects of GBL in preschool students’ motivation in learning mathematics. This observation is mean to be used to study whether GBL able to be a tool to enhance learners motivation in mathematics learning. Furthermore, this research also studies the potential of uses of GBL in mathematics learning for preschool. Even though there are various researchers found that GBL is a good tool in learners learning process, but these researches mostly about primary school’s students, high school’s students or colleges’ students.

1.10 Definition of Terms

1.10.1 Game-Based Learning

**Conceptual Definition**

Game-based learning is the used of educational game or known as serious game in learning a particular knowledge, where it deals with the applications that define learning outcomes (Wikipedia, 2010).
Operational Definition
In this study, game-based learning is refer as learning method which using games as the main instrument in Mathematics teaching and learning process.

1.10.2 Conventional Learning Methods

Conceptual Definition
Conventional learning method is a method which more to a situation where teacher deliver knowledge by explanation and regurgitate the knowledge on pencil and paper tests, students seldom have the opportunity to applying their knowledge learned in any dynamic context (Squire, 2000).

Operational Definition
In this study, conventional learning method is teachers teach the students through explanation and students require doing some mathematics worksheet either in form of pencil-paper based or technology based which involve the use of computer.

1.10.3 Educational Games

Conceptual Definition
Educational game is a type of game which concerns more about the educational aspect than entertainment aspect, where the players of the game need to acquire higher order of thinking and involve more cognitive skills (Dondlinger, 2007).

Operational Definition
In This study, the educational game refer to the Mathematics games; Math Blaster, which can be use for the children to learn basic Mathematics skills.
1.10.4 Motivation:

*Conceptual Definition*

Motivation is an important condition for efficient learning, and the stronger the motivation level is; the more effective the student will learn (New Standard Encyclopedia, n.d., p.M-579a).

*Operational Definition*

In this study, motivation refers to the activation of belief and interest in learning Mathematics.

1.10.5 Mathematics Anxiety

*Conceptual Definition*

Mathematics anxiety also known as mathematics phobic which can be relate to negative experiences with mathematics skills and mathematical concepts like formulas and equations (Kesici & Erdogan, 2009).

*Operational Definition*

In this study, mathematics anxiety is refer to the feeling of fears of using and applying mathematics skills which cause the students to fail in mastering mathematics skills.
1.11 Summary

Overall in this chapter discussed about what is this study about and explain about the main aspect of the study. It can be summarized that, this study is to investigate the effects of using game-based learning in formal education in terms of numeracy. The level of cognitive skills and motivation of students towards numeracy will be the result of this investigation. The outcome that predicts to be gain from this study also includes students’ opinion on the game-based learning, pros and cons of the game-based learning.
Chapter 2
Literature Review

2.0 Overview

In this chapter, it presents more information about modern and conventional learning methods, about the game-based learning (GBL), about motivation and ARCS motivation mode, and about mathematics and mathematics anxiety. Examples of previous researches and example for the explanation is given for more understanding.

2.1 Modern and Conventional Learning Methods

Conventional learning method is the most common method used in educational teaching and learning process all over the world. In conventional learning method, the instruments are text book, note book, revision book, and paper and pencil base exercise. Abdul-Fattah (2006) stated in conventional learning, teacher and book as the main sources of knowledge and the learning process is mostly teacher and book centered. Students attend prescheduled classes where learning takes place, and their achievement usually evaluated by written and less frequently oral exams given at specified date and times (Abdul-Fattah, 2006). According to Squire (2000), students acquire knowledge from teachers'
teaching, then regurgitate the knowledge on pencil and paper tests, and are given very little freedom to manage the content and applying it in dynamic context. According to Wan Fatimah, Afza, and Mohd Hezri (2009), there are several problems associated with the conventional learning instrument; lack of motivation, not very interesting or boring, little encouragement for self-learning, less meaningful and no continuity (Table 2.1).

<table>
<thead>
<tr>
<th>Lack of motivation</th>
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<tr>
<td>Most students do not study because they want to study, but more like they were asked by others. They did not realize the benefits of studying due to no direct rewards or consequences from the action.</td>
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<table>
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<tr>
<th>Not very interesting / Boring</th>
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<tr>
<td>Most of conventional learning instruments are just merely text and full of exercise. With linear learning models, students can only accept and digest all the inputs without being able to respond and interacts to it.</td>
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<tr>
<th>Little encouragement for self-learning</th>
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<tr>
<td>It does not provide enough stimulation for students to initiate learning on their own and restrict the students' freedom to find the answer of their inquiries and also to explore their world in their own way.</td>
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<th>Less meaningful</th>
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<td>Weak relationship between what the students have learnt so far from their study to what they have experienced in their everyday life.</td>
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<th>No continuity</th>
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<td>It takes some time to gain enough concentration and focus on their study from conventional learning instruments. By stopping for a while, all the motivation is gone and they will need to regain focus from beginning if they wanted to continue their study at other time.</td>
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</tr>
</tbody>
</table>

Table 2.1: Problems associated with conventional learning instrument (Wan Fatimah, Afza, & Mohd Hezri, 2009).