THE USAGE OF DIGITAL GAMES IN LEARNING BIOLOGY AMONG FORM FOUR STUDENTS IN MALAYSIA

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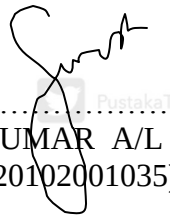
DECLARATION

I hereby declare that the work in this project paper is my own except for quotations and summaries which have been duly acknowledged.



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ABSTRACT

This study investigated the usage of Digital Games (DG) in learning Biology among Form Four students in Malaysia. It is aimed at identifying general overview of the students' interest in using DG in learning of Biology. It also explored the effectiveness as well as the problems faced by students' while using DG in the learning process. This study was conducted in a sub-urban secondary school in Kinta District, Perak. Six Form 4, consisted of four males and two females students participated in this study. A qualitative research design was utilized to answer the research questions. Individual in-depth interviews and also laboratory observations were carried out to collect the data needed for this study. The data was analysed using coding. 'Verbatim Transcripts' were used to describe the data. Analysis of the data reveals that DG arouses students' interest as well as motivates them in learning Biology. In addition, the results also indicate that students gain benefits in the learning process by using DG. On the whole, the findings of this study show that students have positive perception towards the usage of DG in learning Biology.

ABSTRAK

Kajian ini mengkaji penggunaan permainan digital (DG) dalam pembelajaran Biologi dalam kalangan pelajar Tingkatan 4 di Malaysia. Ia bertujuan untuk mendapatkan pandangan keseluruhan terhadap minat pelajar dalam penggunaan DG dalam pembelajaran Biologi. Ia juga menyiasat keberkesanan dan masalah yang dihadapi oleh pelajar semasa menggunakan DG dalam proses pembelajaran. Kajian ini telah dijalankan di sebuah sekolah menengah di pinggir bandar di Daerah Kinta, Perak. Enam pelajar Tingkatan 4, terdiri daripada empat pelajar lelaki dan dua pelajar perempuan telah mengambil bahagian dalam kajian ini. Satu kajian kualitatif digunakan untuk menjawab persoalan-persoalan kajian. Temu bual secara individu dan pemerhatian di makmal telah digunakan untuk mengumpul data. Data tersebut telah dianalisis menggunakan 'pengkodan'. 'Verbatim Transcript' telah digunakan untuk menggambarkan huraian data tersebut. Dapatan kajian menunjukkan bahawa penggunaan DG merangsang minat para pelajar serta memotivasikan mereka dalam pembelajaran Biologi. Di samping itu, dapatan kajian turut menunjukkan para pelajar memperoleh manfaat menerusi penggunaan DG dalam proses pembelajaran. Secara keseluruhannya, dapatan kajian ini menunjukkan para pelajar mempunyai persepsi yang positif terhadap penggunaan DG dalam pembelajaran Biologi.

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LIST OF ABBREVIATIONS

DG - Digital Games

GBL - Game Based Learning

DGBL - Digital Game Based Learning

CDC - Curriculum Development Center

T&L - Teaching & Learning

MBMMBI - Uphold Bahasa Malaysia and Strengthen the English Language

ICT - Information and Communication Technology

LMS - Learning Management System

ITSs - Intelligent Tutoring Systems

RTS - Real Time Strategy

RDGs - Role Playing Games

FPS - First person Shooters

QR - Qualitative Research

MMORPGs - Massively Multiple Online Role Playing Games

TAM - Technology Acceptance Model

TAR - Theory of Reasoned Action

PMR - Penilaian Menengah Rendah

MRSM - Maktab Rendah Sains MARA

USM - Universiti Sains Malaysia

CHAPTER 1

INTRODUCTION

1.0 Introduction

The use of games in learning and instruction, have been publicized by many researchers. Games are hypothesized to address both the cognitive and affective dimensions of learning (O'Neil, Wainess, & Baker, 2005), to enable learners to adapt learning to their cognitive needs and to provide motivation for learning (Malone, 1981). Digital Game Based Learning (DGBL) is a term and concept that has been under discussion and debate in recent years. Much of what has been written is based on the work and opinions of Prensky (2001) and Gee (2003), who are heavy proponents for the adoption of DGBL.

Games aim at specific learning goals and consequently for specific learning outcomes as well. Therefore it seems obvious to conduct the review from this perspective. Many studies on games have focused particularly on cognitive learning outcomes: learning of knowledge and problem solving skills. A taxonomy of learning outcomes will not only reveal in which situations games improve learning, but also uncover dimensions of learning that have been neglected thus far in reviews. This research basically focuses on Digital Games (DG).

1.1 What Are Digital Games?

A digital game is a computer based game with a primary purpose other than entertainment, ranging from anywhere between advertisements to military training exercises (Michael & Chen, 2005). This research focuses mainly on digital games that aim at the mentioned learning outcomes. Many definitions exist that describe a digital game (Garris, Ahlers, & Driskell, 2002; Vogel et al., 2006), but mostly a definition along the following lines is chosen: that it is goal-directed, a competitive activity (against the computer, another player, or oneself) and conducted within a framework of agreed rules (Lindley, 2004). In addition, digital games constantly provide feedback to enable players to monitor their progress towards the goal (Prensky, 2001).

While there is no set definition of what DGBL is, there are several theories to define constitutes and engaging game. Malone (1981), stated that the three key features that created an engaging game were challenging, fantasy, and curiosity. He argued that in order for an environment to be challenging, it must provide goals whose attainment is uncertain.

According to Prensky (2001), who drew upon Malone, the key characteristics of an engaging game are as follows:

i. Rules
ii. Goals and objectives
iii. Outcomes and feedback
iv. Conflict/competition/challenge/opposition
v. Interaction
vi. Representation or story

Jones (1998) however argues that the following characteristics are essential to the design of engaging games:

i. Task that we can complete
ii. Ability to concentrate on task
iii. Task has clear goals
iv. Task provide immediate feedback
v. Deep but effortless involvement (losing awareness of worry and frustration of everyday activity)
vi. Exercising a sense of control over our actions.
vii. Concern for self disappears during flow, but sense of self is stronger after activity
viii. Sense of duration of time is altered.

Prensky (2001) also believed that a very careful balance between what he called as “eye candy” and “game play” must be achieved in order for the game to be engaging. “Eye candy” refers to the graphic and visual appeal of the game. “Game play” refers to the controls and events of the game itself. In other games, the controls are very easy to use and the game has a solid plot line with engaging events, but there is no visual appeal. The truly successful games are those that manage to achieve both.

The key to developing a good game and also a good learning experience is an engaging storyline (Klaila, 2001). He stated, gaming shows us that long, traditionally tedious, and difficult tasks can be engaging and fun when they are part of an engaging learning experience. A strong story line is the key to the success of e-learning interaction.

DGBL also creates a learner- centered, learner-guided environment. The student has control over where he or she goes and what he or she does within the game. The game also allows the freedom to freely explore and experiment within the environment. As the student plays the game, he or she may adapt to the environment, picks up the game vocabulary, undertakes tasks, and finds treasures and bonus items so he/she can progress to more complex levels. As the student continues to play, he or she must constantly relate expectations and interactions based on the courses and consequences of each interaction (Gee, 2003).

Even if only recently it has become a hot topic, games have always been parts of teachers’ collection of teaching techniques. Education is often the first bench mark for exploring the potential of new technologies and video games can be considered as a type of educational technologies. (Cantoni & di Blas, 2006)

1.2 A Taxonomy of Learning Outcomes in Digital Games

There are many classifications of learning outcomes. Traditionally, researchers have focused on the cognitive dimension of learning outcomes (Bloom, 1956; Gagné, 1977). Others have included affect-oriented objectives such as appreciation (Krathwohl, Bloom, & Massai, 1964). More recent, other classifications have emerged identifying factors such as collaboration/teamwork, communication and self-regulation as potential outcomes of learning (Baker & Mayer, 1999).

An interesting classification of learning outcomes has been provided by Kraiger, Ford and Salas (1993), who distinguished between cognitive outcomes (e.g., problem solving), skill-based outcomes concerning the development of technical or motor skills, and affective outcomes including attitude and motivation. Drawing from the two latter classification schemes, the researcher propose a taxonomy consisting of four categories of learning outcomes: cognitive, motor skills, affective and communicative. Research into using games for learning to support these claims has been carried out over the past 20 years, but with very mixed results. However, the choice of game along with the situated environment and the teachers role as moderator, are vital if the desired learning outcomes are to be achieved.

Cognitive learning outcomes can be divided into knowledge and cognitive skills. Knowledge refers to encoded knowledge reflecting text oriented example verbal knowledge and non text oriented knowledge, example knowledge in the form of an image. Several types of encoded knowledge can be determined such as declarative and procedural knowledge of how to perform a task. A cognitive skill pertains to more complex cognitive processes. In problem solving, for example,

learners have to apply knowledge and rules to solve new problems. In complex and dynamic situations, people are sometimes forced to make decisions under time pressure. Such decision making skills require situational awareness, that is, the ability to attend to and perceive the relevant information in a situation, comprehend this information and predict how the situation may develop (O' Brien & O' Hare, 2007).

The second type of learning outcome, learning motor skills, involves several stages. Initially a learner has to acquire the skill by making a transition from declarative knowledge to procedural knowledge. In subsequent stages, the learner practices the motor behavior and in this way compiles the behavior, that is, make the motor behavior faster, less error prone and independent verbal rehearsal.

With affective learning outcomes, we can differentiate two subtypes. To start with, learning may focus on a change in the attitude of the learner. Attitudes refer to internal state that influences the choices or actions of an individual (Gagne, 1977). This may pertain to a change from a negative to positive learning attitudes towards subjects at school, but also to a change in behavior that is exhibited in daily life. The subtype, motivation, is a prerequisite for learning to commence. Motivation reflects the willingness to pay attention to the learning material and to spend cognitive resources to process information.

The last type contains communicative learning outcomes. Although collaborative learning is claimed to lead to deeper level of understanding and long term retention of the learnt material, it also emphasizes the opportunities for developing social and communication skills, and building social relationships.

Video games can supplement traditional learning but cannot replace it. The majority of today's teachers are not aware of Game Based Learning (GBL) and the importance of incorporating into their lesson plans.

The knowledge and skill level required to implement this technology successfully is lacking. For GBL to be included in the academic curriculum, the issue of teacher support needs to be addressed on a wide scale.

Many of today's students do not see the value of game based learning. The younger students will enjoy the interaction without categorizing it as learning and the older students will often view games as a non-serious activity within the classroom.

1.3 How can a Digital Game for Learning be defined?

Although digital video games for learning or with a learning value were already employed in the 1970's (example, Plato: Programmed Logic for Automated Teaching Operations), the term DGBL was made popular by Gee (2007) and Prensky (2001). Prensky (2001) argued that the digital natives who were born after 1970's, have been exposed to digital devices from a very young age, and have developed skills that need to be acknowledge in schools and universities, notably by engaging and teaching them through video games. According to Prensky (2001), the digital natives' process information significantly differently compared to previous generation. In contrast, the digital immigrants may not have embraced 21'st century literacy, and therefore it may be difficult to find this new generation of students who speak a rather different language. Prensky (2001) stated that there is a gap between these two generations that

ought to be bridged. As a result, instructional settings should be modified and include a non-linear format, instructions based on discoveries, student-centered classes and pedagogical methodologies that encourages the development of meta-cognitive skills.

1.4 Background of the Study

This study is done to investigate the usage of Digital Games (DG) among the Form 4 students in the learning of Biology. There are varieties of activities conducted in the teaching and learning process of Biology. The existing activities which are normally conducted in the classroom are teaching using text books and reference books, using ICT and hands on practical experiments. In spite of all those activities, the formal usage of DG is not practiced in the schools yet. The teaching and learning process that is mainly focused nowadays is the using of ICT in the lesson. In order to have an advanced teaching and learning process using ICT, the DG plays a main role here to boost the student's interest in the lesson.

Biology is taught in Form 4, 5 and 6, and basically the students only use the school textbooks, reference books, workbooks and software recommended by the teachers, Curriculum Development Center and Ministry of Education. By using the latest technology, DG is one of the best techniques to teach students so that they will be very interested in knowing the learning outcomes of the chapters that they are studying in a more advanced way. Over the last decade, the genre of digital games has exploded to include numerous platforms and designs.

Digital games, whether computer game or handheld-based, are characterized by rules, goals & objectives, outcomes & feedback, conflict/competition/challenge/opposition, interaction, and representation of story (Prenksy, 2001) or more simply, "Purposeful, goal-oriented, rule-based activity that the players perceive as fun" (Klopfer, 2008). They are distinguished by two key elements: (1) an interactive virtual playing environment, and (2) the struggle of the player against some kind of opposition.

Digital games can develop cognitive, spatial and motor skills and help improve ICT skills. They can be used to teach facts (e.g. knowledge, recall, rote learning or memorization), principles (e.g. cause and effect relationship) and complex problem solving, to increase creativity or to provide practical examples of concepts and rules that would be difficult to illustrate in the real world. DG possesses intrinsic learning qualities that challenge and foster learners' challenging environments, where they can make mistakes and learn by doing. These types of environments might be particularly suited to pupils who are pragmatically minded. These pupils might prefer to go through the process of experimenting, instead of regurgitating information. Such an experience could help them to better understand some concepts that they might otherwise perceive as complicated or boring (Felicia, 2009).

1.5 Significance of study

Students nowadays are very much interested in using modern online gadgets such as Facebook, Twitter, Skype, etc. The findings of the study will be beneficial to the students as they could apply DG in their learning process and will make them more

interested in the subject of Biology. Students can use variety of DG related to chapters in Biology to enhance their understanding of the particular topic and make development in the subject matter. To the Biology teachers, this is an advanced teaching method whereby students learn by themselves and teachers facilitate. The DG is accessible through internet which is available in most schools nationwide and there will be more advanced tools which will be and are being used in the classroom as now students have their own laptops. Teachers can make this as an advantage to let the students play the DG in the classroom and later get the feedback at the end of the lesson.

The Ministry of Education will benefit from this as they can introduce the DG in the revised Biology curriculum. Apart from that the manufacturers and course ware developers would also benefit because they can produce variety of DG for the use of students in schools. The current multimedia courseware which is being used for teaching and learning Biology, given by the Ministry of Education since 2003, is less effective as there is lesser participation of the students during the teaching and learning process.

According to Pandian & Ramiah (2004), the multimedia courseware was said to be unsuitable for Low English Proficiency students, as they were not able to understand the language used to deliver the content. DG is student friendly as students play and learns as well during the teaching and learning process.

The Curriculum Development Center (CDC) will be benefiting from this research as they have more materials to be included in their syllabus. The officers from the CDC can in-cooperate with the schools to implement the DG as it benefits both the students as well as the teachers.

1.6 Statement of the Problem

The researcher has been teaching Biology for the past 13 years to the Form four and five students. In the process of teaching Biology, the researcher is always and has been very much attached to the classic way of teaching the subject. As what normal teaching procedures are, the other teachers as well as the researcher use same old method by bringing text books into the lab or classroom, do the experiments, discuss experiments, and write down the results. These methods are very much in practice from those days where there is no availability of modern technology and gadgets.

In this 21st century many modern tools are in usage and yet there are still teachers who are more into the classical teaching methods. Advanced technologies such as DG are not used broadly to improve the quality of teaching. Students nowadays are prone to games and more to video games. Social networks such as Facebook, Twitters, Skype and Yahoo Messengers are widely used by students. Therefore, they are exposed to current and latest technologies.

1.7 Objectives of the Study

This study aims to gain a general overview of the student's interest in using DG in the learning of Biology. This study is:

1. to evaluate the effectiveness of using DG in learning Biology among Form 4 Science students.
2. to diagnose the problems faced by the Form 4 Science students in using DG.
3. to show cause and effect of using DG among Form 4 Science students in learning Biology.

1.8 Research Questions

1. How effective is the DG in the learning of Biology among Form 4 Science students?
2. What are the factors that influence the usage of DG in the learning of Biology among Form 4 Science students?
3. What are the advantages in using the DG in the learning of Biology among Form 4 Science students?

1.9 Definition of Terms

1.9.1 DG - Digital Games – A digital game is a computer based game with a primary purpose other than entertainment ranging from anywhere between advertisements to military training exercises (Michael & Chen, 2005).

1.9.2 GBL - Game Based Learning - "Game-based learning" refers to teaching-learning actions carried out in formal and/or informal educational settings by adopting games. It encompasses the use of both games designed expressly for fulfilling learning objectives (educational games) and "mainstream games" i.e. those games that are developed for fun when used to pursue learning objectives (Kirriemuir & McFarlane, 2004).

1.9.3 DGBL - Digital Game Based Learning - Digital game-based learning (DGBL) is an instructional method that incorporates educational content or learning principles into video games with the goal of engaging learners (Coffey, 2009).

1.10 Limitations of the Study

This study is limited to Form Four Science Stream students from a sub - urban school in a selected district in Perak state. The respondents in this particular class are of average and good, and their ability in playing computer games is well known. The researcher classified students as good, if they score above 50% in their mid-term examination and average if they score less than 50%. Some respondents do not have access to the internet at home so they have to come to school and use the school's internet access. To overcome this problem, the researcher conducts DG only during the school hours. This will be fair to every respondent.

Other than that, the researcher would have to introduce the DG before hand in the classroom because some respondents are not aware of the existence of such a programme. The researcher intends to use the DG for only two months to observe the respondents' progress in their Year End Examination (2012).

The findings of the research can be applied to any levels in general either in pre-school, primary, secondary or even higher education institutions. DGBL can also be used in other subjects as well. The authorities and committees involved in designing the DGBL will benefit from the research findings as they can study the outcomes and come up to a general concept in laying out another syllabus which is more user friendly to all students in general and particularly rural students.

1.11 Conclusion

Chapter One has presented a general introduction and rationale for this study. The problem of the study, which consists of a concise discussion of the background and statement of the problem, has been highlighted. In addition, the purposes, significance, limitations, and the definition of specific terms used in the study have been stated. In the next chapter, the literature review on DGBL will be discussed further.