

Implementation of Educational Computer Games in Malaysian Chemistry Classroom: Challenges for Game Designers

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Abstract:- Today, computer games are very popular and have big influence in the lifestyle of Malaysian students. However the implementation of computer games in educational setting in Malaysian classroom is still new and foreign. Previous researches had shown that computer game can be an effective tool in classroom teaching and learning process. Taken by the positive impact computer games can bring to classroom, there is a need for Malaysian researchers and game developers to explore this area. In this paper, the authors impart chemistry classroom as the case in point in discussing the topic. Nevertheless, in implementing educational computer game in Malaysian classroom, there are three crucial issues that need to be considered; viz. (i) the availability of educational computer games in the market that are suitable for Malaysian classroom context; (ii) the adaptation of the educational computer games within the Malaysian education system and; (iii) barriers in implementing educational computer games in Malaysian classroom. The paper examines the challenges faced by researchers and game designers in developing games for Malaysian chemistry classroom and concludes by encouraging local and international researchers and games designer to keep in mind the issues that related within a regional or community education system.

Key-Words:- Educational computer game, Malaysian education, Educational game

1 Introduction

Today, computer is not only the teaching aid but it is an important source of knowledge. The advanced technology of computer, for instances the internet and computer simulation are imperatively driving the changes in education, thus revolutionize the function of computer in the classroom. According to Collins and Halversont [1], “digital technologies such as computers, mobile devices, digital media creation and distribution tools, video games and social networking sites are transforming how we think about schooling and learning” (p.18). It is important for teachers and educators being able to adapt and imply the implementation of new technologies in teaching and learning process. Moreover, keeping head to head with the new generations of technology savvy students, the adaptation of the latest digital technologies in education system is essential to accommodate student’s interest and expectation. Computer as the dominant teaching aid instrument in school, play an

important role in this matter. Yet one thing that most of the student can relate to when they think about computer is not learning but playing computer games!

Computer game is a phenomenon that influences the lifestyle of most of the teenagers around the world. Now education researchers are in pursuit of exploring the pedagogical potential of computer games [2]. Many scholars believe that educational computer game can motivate and increase student focus in learning and simulate their higher order thinking [2], [3], [4] and [5]. New areas of research such as games and learning [6] and digital-game based learning [5] were born to investigate how games might be used in teaching and learning process. In facts there is significant increase in the research on educational computer games in recent years [7]. This may be in line with the boomed of computer game industry which valued at hundredth millions dollar per year [8], [9]. Research conducted has demonstrated that the implementation of

educational computer game in the classroom gave positive impact to student performances [10], [11] and [12]. However in implementing educational computer game in the classroom there are certain issues that need to be considered especially in term of the social and cultural conditions of the education system where the classroom stood in. Here, using chemistry classroom as the setting, the authors put forward an example of Malaysian condition, and the issues that arose from the idea of implementing educational computer game in Malaysian classroom.

2 Educational Game in Malaysia

In the context of Malaysia, a study by Rubijesmin [13] in 2007 investigated the experience of students in five schools in Malaysia found that 92% of respondent have experience playing computer game. The study shows most of the students in Malaysia are no strangers to computer gaming. The implementation of educational computer game in the classroom is seen as rather aberrant though. This is because the educational game industry in Malaysia is still new. As reported by Roslina and Azizah [14] in 2009; “an interview with several educational games developer in Malaysia indicated that the field of education is still relatively new in local scenarios; hence, many localized studies are needed in order to generate more knowledge in educational games in the areas of educational games design, development as well as its effectiveness among our (Malaysian) student” (p.296). For this reason, there is a need for the researchers and educators to fill in the gap.

3 Educational Computer Game for Chemistry Subject

Malaysian education system is based on the national curriculum which is custom throughout the primary and secondary level in public school. Teachers must teach according to the syllabus designed by the Ministry of Education, so that every student in public school will learn the same thing. This make the education system strongly dependant towards the national curriculum. Therefore, any intervention of pedagogical innovation in the classroom, in this case integrating an educational computer game, must take into account the necessity to follow the designated prospectus. Randel, et al. [15] supported this assertion by saying that “subject matter areas where very specific content can be targeted are more likely to show beneficial effect for gaming” (p. 261)

compared to other educational computer game that is not subject oriented.

In the context of chemistry subject, Osborne and Miller [16] argued that the lack of variation in classroom activity during teaching and learning process is one of the main issues in current science curriculum. Moreover, the traditional and out-dated teaching approaches and methodology that strongly embraced by Malaysian chemistry teacher worsen the situation [17]. Abu Hassan [17] stressed that more interesting and attractive teaching aids need to be invented in order to assist student learning and boost their performances. Feasey [18] supported this and believed that a creative science classroom was depended at teacher’s and student’s expectation on new and interesting learning experience. Educational computer game can be a practical material to achieve a creative chemistry classroom. According to Ward et al. [19], “games can offer many opportunities for pupils to learn both the knowledge of science and its associated vocabulary in an interesting way” (p.256).

Chemistry curriculum usually been seen as difficult subject by students [20]. Habraken [20] described that student perception towards the chemistry subject (as being difficult) was due to the traditional conceptual structure of chemistry curriculum. To change the situation, it is essentials for teachers to change their traditional way of teaching. Habraken [20] stressed the need of interesting new approaches in chemistry teaching and learning process to attract and engage students therefore changed their negative perception. Many researchers [21], [22], [23], [24], [25] had proven that chemistry can be taught in various methods of teaching to increase student performance and interest in the subject. Educational computer game could be an addition to the methods of teaching.

Focusing on the idea to implement educational computer game in Malaysian chemistry classroom, the main references that available for the researchers and educators are the present literatures on educational game. However almost all of the researches on educational computer games discussed in literatures were done and implemented in developed countries where the education system and cultures were very different from Malaysian.

To further understand the topic of educational computer game, the authors look at how the educational computer games were implemented in the overseas classroom and how it can be implemented in Malaysian classroom. The discussion raises issues of the challenges faced by researchers and game designers in developing games for Malaysian classroom

4 The Availability of Educational Computer Game in the Market and its Suitability for Malaysian Classroom

Undoubtedly, there are plenty of educational computer games in the market. In fact, many scholarly reports had supported the positive impact of such games towards students learning and how the implementation of educational computer games should be incorporated in the classroom. For example, McLester [26] and Squire and Jenkins [2], reported on how educational computer game such as *Sim City* and *Civilization III* has successfully been integrated in classroom activities. In *Sim City*, students are given the chance of role playing [26], where they learn about social hierarchy, economic and politic of a population (a city - where they themselves built). While *Civilization III* allows students to lead a civilization from 4000BC to the present, where they learn about how to “seek geographical resources, manage economies, plan the growth of their civilization and engage in diplomacy with other nation- states” [2] (p.12). But, the question arises here is; can these computer games be implemented in Malaysian classroom?

Although student can learn a lot from games such as *Sim City* and *Civilisation III*, these games are not suitable in the context of Malaysian classroom. This is simply due to the social and cultural differences of the games with Malaysian. Being a multicultural country which still strongly embraced the traditions and customs of its multiple ethnicities backgrounds, it is essential for the game to be Malaysian oriented. Perrone [27] emphasised that “to draw students into depth and complexity of a subject, we must look for topics that relate to students’ lives”. Hence it is important to present to the students material which they can relate in order to engage them in teaching and learning process. Educational computer game currently in the market were designed and produced by international gaming company which designed a game in favour of the main targeted customer social and cultural characteristics (for example *Sim City* - pictures the lifestyle of Americans/Westerners; and *Civilisation III* – pictures the civilisation process of the western world).

On another stand, most of the games in the market are made primarily for entertainment purpose, therefore sometimes the product “convey misinformation or foster misconceptions” [2] (p.12). According to Squire and Jenkins [2], “*Sim City*, for example, exaggerates the mayor’s power and ignores issues of race” (p.12). Having such disadvantages it is inappropriate to implement the

available educational computer games in the market in Malaysian classroom. The situation challenges researchers and game designers to develop educational computer game that socially and culturally suitable for Malaysian classroom.

5 Adaptation of Educational Computer Game in Malaysian Education System

In 1992, Randel, et al. [15] did a literatures review on 68 researches of educational computer game that were done from 1984 to 1991. In the review Randel, et al. [15] explained that although that there are variations in the researches result where some (i) favour traditional instruction over educational games and some (ii) claimed that there are no differences between traditional instruction and educational games on student performances, but yet Randel, et al. [15] concluded that implementation of educational games in the classroom are consistently perceived as more interesting than traditional instruction. The contradict results were conceivably due to factors such as students gender [28], students background [29], game design [28], teachers competence in implementing the educational computer game as teaching and learning aid [30] etc.

Jean et al. [28] discussed how different gender reacted differently towards a game and how this affects the student’s performances while playing the educational game. According to Jean, et al. [28] “the findings provided evidence that PQ (Phoenix Quest – the game) appealed to girls because the protagonist was of their age and gender, and because the puzzles and searches were engaging throughout the game” (p.207). On the other hand, a research done by Hong and Liu [129] rationalized the effect of student background and game design towards the overall student’s performances while playing the game. According to Hong and Liu [29], students who are considered experts gamers are doing better compared to novices gamers. Besides that, the difficulty and complexity of the game also influenced student’s performances. On another issue, Rubijesmin and Sheard [30] through their research on students social skill while playing computer games in class reported that; “the important issues is not the object or technology used in teaching and learning, but how it is applied and diffused” (p.177) by the teachers. This shows the importance of teacher’s competence in implementing the educational computer game as teaching and learning aid in the classroom.

It can be concluded here, that in order to design an educational computer game specifically for Malaysian classroom, there are many factors that need thorough deliberation on part of researchers and game designers.

6 Barriers in Implementing Educational Computer Game in Malaysian Classroom.

Rice [31] in implementing educational computer game in the classroom and summarized six major barriers in implementing educational computer game in classroom. According to Rice [31] the barriers are “negative perceptions toward video games as educational components; the difficulty of providing state of the art graphics in educational video games, a lack of adequate computing hardware in the classrooms to run advanced video games; a school day divided by short class periods which hindered long term engagement in complex games; a real lack of real world affordances; and a lack of alignment to state standards” (p.249). Although the background of Rice [31] work was based from the United State of America (USA), the author’s found it relevant with situation in Malaysian. Further below, the author’s briefly discussed the six major barriers in the context of Malaysian classroom.

6.1 Perceptions on computer games

Although many researches have proven that educational computer games can in fact have positive impact on teaching and learning process, yet there are always the other side that oppose the claim. In Malaysia computer game has long (and still) been perceived as the medium of entertainment rather than learning. And perhaps due to this, it is considered “too good to be true” and even impossible for some people (especially parents and teachers) to accept the educational part of computer gaming. Rice [31] asserted that “perceptions hampering acceptance of even the best educational games for classroom use include a lack of understanding concerning the differences between arcade-style games... and cognitively viable modern games” (p.251). In the stance where parents always dissent their children from playing computer game and teachers’ are considered effective if their class is quite and their students concentrate on what being written on the blackboard and what been said by them (chalk and talk); researchers and game

designers are confronted with great challenges in selling their point of view.

6.2 Unimpressive educational computer game

Quoting a student point of view on computer games “Games are made for one purpose: fun” [32] (p.614), it’s clearly point out the essence of game in motivating and engaging its player. However in uniting the element of play and learning in a game, it is not an easy task. With competition from the state of the art commercial games in the market, usually educational computer game will always lost to the sophistication of the big budget and popular games. Rice [30] exposed a situation when a class was informed that they were going to play a game; the students were very enthusiast at first, but upon realising that the game was no close to the sophistication standard that they usually play at home, the students were disappointed. They claimed that the game was lame and boring. In designing and creating an educational computer game from scratch with demand of such higher level production process are immensely challenging for local researchers and game developers (due to lack of sources, budget, skills etc.)

6.3 Lack of infrastructure capability

Another problem which concerned researchers and game developers is the lack of infrastructure capability in Malaysian classroom. Although there are probably no problems for all teachers to have computer access at school, however it is highly doubtful for every student to have access to a computer every period [30]. Perhaps the teaching and learning process could be done in special space likewise computer lab, but still, the resources are limited for one or two class at a time. Moreover, with advanced standard of computer game nowadays, the capabilities of the machines to run the game sufficiently are also unpromising [30]. As a result, researchers and game developers must take into considerations the type of game that they intended to create, whether it can be play by many student in one time (one computer-many players) or individual players (one computer-one player), and how will the game be incorporated in teaching and learning process in term of its pedagogical and instructional aspects?

6.4 Inflexible school hours

Rice [30] noted the complex and challenging natures of good games that constantly motivate and intrigue players to fully engage in the game play. However one aspect of the game that could be disadvantage for the use in the classroom is the time taken to finish the game. Typically, it takes hours and even days to complete one game. Taking into account the learning time provided during schools hours; between 30-45 minutes per period, it is impracticable to implement the time consuming game in the classroom. Perhaps researchers can design a game that specifically aimed “so that learning objectives can typically achieved within 30-45 minutes” [31] (p.255). But, will the game be as complex and challenging for the student to be motivated and engaged?

6.5 Reality versus virtual

Rice [31] presented an Affordance Theory proposed by Gibson in 1977 to explain the relationship between an entity and its environment. In the case of implementing educational computer game in the classroom, Rice described that “within three-dimensional electronic environments, upon which many game instructional efforts are based, the current level sophistication is insufficient for highly advanced affordances” (p.256). Undeniably, virtual worlds created by educational computer game perhaps can simulate experiences that could benefits student but until what point should virtual world replaced reality? The pro and cons of implementing the educational computer game in the classroom need to be weighed by researchers and game developers in the course of decision making insofar game as instructional medium for the teaching and learning process.

6.6 Aligning game to educational standard

The issue of aligning game to educational standard, as being discussed previously, is important in requirement for the teachers to follow the national curriculum (see section 4). In order for teachers to use educational computer game in the classroom, it is crucial for the game to be grounded around the specific instructional content (syllabuses) and at the same time is able to entertain and challenge student like conventional commercial game.

7 Conclusion

So far in this paper, three key issues that challenge researchers and game designers in developing an educational computer game for Malaysian Classroom have been discussed. The issues are (i) the Malaysian education system issue, (ii) the student’s and teacher’s competency and game design issues and (iii) the barriers in implementing educational game in Malaysian classroom issue. In developing educational computer game for Malaysian classroom, there are heaps of issues that researchers and game developers need to consider especially in terms of issues that related within a specific regional or community.

An annotated bibliografi by Russel [33] listed chemistry educational game published and marketed (majority in the USA) to be used by chemistry instructor and educator. There are 52 games listed by Russel [33]. From that amount, half of it (26) are computer game while the other are board, card or chemistry kit games. This shows the significant efforts towards the implementation of chemistry educational computer game in teaching and learning process. However, all of the games listed by Russel [33] are targeted for student at tertiary level and not suitable of school’s chemistry classroom. Other literatures on the same topic (chemistry educational game), for example ‘Periodic Table Games’ by Martin [34], ‘FactGAME’ by Ramette [35], ‘PLATO’ by Smith & Chabay [36], ‘Egame’ by Edmanson and Lewis [37], ‘Kinetics and Mechanism – A Game Approach’ by Harsch [38], ‘CHeMoVER’ by Russel [39] and ‘The Old Prof Card Game’ by Granath and Russel [40] also show the incline for chemistry education researchers to invent educational game for tertiary level chemistry students. This highlighted the need for researchers and game developers to develop chemistry educational computer game that suitable (i) for Malaysian classroom and (ii) for students at secondary school level.

In spite of these facts, there is a huge gap of information that needs to be filled by researchers and educators, especially in the context of chemistry education. Research should be done to explore chemistry education under more diverse scope of educational computer game niche. Extra effort by the local, Malaysian researchers and educators are essentials in order to generate more knowledge in educational games in the area of educational games in the country.

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