

Implementing Computer Games in Class – Issues and Recommendations for Improvement: Experimental Study in Malaysia

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ABSTRACT

Computer and video games are very popular among children, teenager as well as adults. These games could be easily accessed anytime and anywhere with the widespread availability of computers and games consoles especially in Malaysia. We believe with such popularity, these games especially computer games could and should be exploited as another medium of teaching and learning in Malaysian education systems. Therefore, from a bigger study, this paper looks at a smaller scope of the project; to identify the possibility of implementing computer games into a class session. A total eleven science-related games were evaluated by a total of 226 students (aged 10-11), along with 13 Science teachers at different stages of this study and different schools from Selangor Darul Ehsan and Perak Darul Ridzuan, Malaysia. The results presented focused on the issues and concerns identified and recognized as well as recommendations on improvements required so that computer games are possible to be used as instructional materials for Science learning.

KEYWORDS

Computer games, Online games, Implementation issues, Recommendations, Instructional materials

1 INTRODUCTION

This paper focuses on the findings of an experimental study on randomly selected students, conducted for investigation of their gaming experiences in classroom or laboratory settings with the aim of recognizing the possibilities of implementing computer games for Science learning.

2 LITERATURE REVIEWS

Video or computer games have been positively and highly accepted among users especially children and teenagers. Games provide fun and entertainment to players and certainly addictive among gamers to explore, play, win, lose, retry and completing tasks give [1]. It is believed that the success of engagement

and captivating players within games could benefit children in school especially in motivating them to learn [2,3]. The younger generations' positive acceptance towards video and computer games in their daily life has sparked the thought of adapting these games in learning.

Studies have shown that the values of digital games are most beneficial for players as they are capable of promoting and alleviating these functions and skills; visual development, motor development, cognitive skills and social development [4,5]. [6] mentioned that games can enhance the following functions; motor development, intellectual development, affective development and social development.

2.1 Visual Development

A group of researchers studied on the effects of computer games managed to enhance specific set of visual intelligence skills [6]. They found that computer games improved spatial skills i.e. ability to anticipate target and visualize spatial paths, increased people iconic (image representation) skills i.e. in reading images and enhanced significantly the visual attention skills i.e. in keeping track of several different items at the same time. This is then supported with a research done at University of Rochester, New York found that frequent gamers between the age of 10 and 23 were better monitoring what was happening around them than those who didn't play as often or didn't play at all. They could keep track of more objects at a time and they were faster at picking out objects from a clustered environment [7].

2.2 Motor Development

Results shown from a study done in 2003, at Beth Israel Medical Center and the Iowa State University, doctors who spent time at playing video games made 37% less mistakes in laparoscopic surgery and performed the task 27% faster than their counterpart who didn't play video games. The study focused on whether good video games skills translate into surgical prowess which involved motor skills,

reaction time and hand-eye coordination, and the result proven the curiosity [8]. [9] mentioned that scientific studies carried out over the past decade show gamers can be faster at visual recognition, can condition their brains to use less energy and can be more social, confident and comfortable in problem-solving than those who don't play.

2.3 Cognitive Skills and Social Development

The TEEM study concluded that simulation and adventure games such as Sim City and RollerCoaster Tycoon developed children's strategic thinking and planning skills. Teachers and parents involved noticed that their children's skills of negotiation and decision-making skill have improved. Besides that, students also improved in their skills when working as a team [10]. [11] reported that all the games used could be held to develop thinking skills (identified as information processing, reasoning, enquiry, creative thinking and evaluation skills). If the level of challenge was appropriate for the pupils, their engagement with the game involved problem solving and critical thinking skills such as devising strategies, considering options and taking rational decisions. Success with the games involved a requirement that the pupil should think logically, planning ahead and considering the interaction on outcomes of a range of factors of some complexity.

For this study, we had decided on focusing at one subject which is science. Malaysian government has identified science as a core subject in school curriculum for its educational system. At the primary levels, science is compulsory for all pupils.

[12] summarized some of the difficulty of teaching Science and as well suggestions to improve the teaching process at school. Substantial studies had shown that teaching science can be a stressful experience. Therefore, they recommended that overcoming the issue, using multimedia resources might be a solution to the problem. Since in Malaysia, teachers have the opportunity to teach using multimedia resources (i.e. courseware and Internet), teachers still face difficulty of teaching Science, especially when it comes to the activities provided. However, responses gained from teachers showed that although those multimedia CDs are able to assist them in teaching, amendments should also be done for improving the existing technology. Among suggestions given are adding more elements of games as well as designing materials which enables students to use according to their acceptance levels or intelligence and to engage them in class equally [13].

As mentioned earlier, games have potential for teaching and learning purposes, which naturally, in this study, we are looking at the possibility of

incorporating existing computer games available in the market or in the internet at Malaysian public schools focusing at the theme of Environment - Recycling in classroom environment. We hope by recording the experiences and by testing all these games in classrooms and laboratory settings, computer games will be given a higher respect and be used undoubtedly in schools.

3 OBJECTIVE OF STUDY

This is a report on a study aimed to investigate actual gaming experiences among Malaysian students in either classroom surroundings (learning with incorporating computer games in class) or at specialized laboratory setting.

The following are the **research questions** of the study.

- to identify the issues and concerns that might occurred for the implementation of computer games as instructional materials for Science learning in Malaysia.
- to highlight improvements that should be done for computer games be another instruction materials for Science learning in Malaysia

4 SCOPE OF STUDY

A total of eight computer games were used in this study (Table 1). These games were pre-selected by referring to the Malaysia's Science curriculum structure Year 4 & Year 5 (Primary level) which were then tested by the Science teachers involved in this study to reconfirm the relevancy and appropriateness of the games to be applied during the period of the study (i.e. whether these games are relevant with the current topics taught in the term). All of selected games were identified related to the science syllabus under these themes;

1. Year 4: Investigating Living Things and Knowing the importance of Reuse, Reduce and Recycle materials
2. Year 5: Appreciating the Importance of Water Resources and Survival of Species

Table 1: List of Computer Games used for Primary School

<i>Computer Game Title</i>	<i>Available at</i>	<i>Platform</i>
Wild Wetlands	http://www.engagingscience.org/games/onlinegames/games.html	Online
Recycle Game	http://www.primarygames.com/holiday/earth_day/games/recycle/index.htm	Online
Wasted	http://www.sciencemuseum.org.uk/onlinestuff/games/wasted.aspx	Online
Errand Run	http://www.ecokids.ca/pub/eco_info/to_pics/environmental/errandRun/play_err	Online

	andrun.cfm	
Yard Sale	http://www.ecokids.ca/pub/eco_info/to pics/waste/yard_sale/popup.cfm	Online
Clean Room	http://www.ecokids.ca/pub/eco_info/to pics/waste/clean_room/ main.swf	Online
Trash Troopers	http://www.ecokids.ca/pub/eco_info/to pics/waste/trashtroopers/index.cfm	Online
Great Journey: Mr. Penguin's Letter	Games stores	CD

5 METHODOLOGY

The study collected primary data, by implementing experimental-based research design with the population of primary schools in Selangor Darul Ehsan and Perak Darul Ridzuan, Malaysia. This study applied an experiment (play session) study using tools such as interviews, questionnaires, pre-and post-testing, and observation sessions. However, for this paper, it will only review the data analysis made from interviews and observation sessions.

On a pre-selected date, a play session was conducted at different stages with the students at either at their own computer laboratories at schools or a specialized multimedia computer laboratory.

Stage one was done among 192 students at their own schools (refer Table 2), in their schools' computer laboratories, with the researcher acting as moderator, along with two assistances; meanwhile stage two was done among 34 students at a specialized multimedia computer laboratory in UPSI, Malaysia (refer Table 3) with the researcher acting as moderator, along with five assistances to help and assist students whenever needed. Each student was allocated (free seating, not pre-determined seating) their own PCs, in the laboratory. All eleven games were tested and played by the students during both stages.

Table 2 and 3 show the distribution of students involved. The schools were invited by the researcher through formal invitations (with clearance from respective District Department). Only students with parents' or guardians' permissions were involved and depending on the class teachers, the whole class or randomly selected students participated.

Table 2: Distribution of Students involved at their own schools

		Age		Total
Gender		10	11	
	Boys	48	38	86
	Girls	54	52	106
School	n=10			
Teachers	n=10			
Total		102	90	192

Table 3: Distribution of Students involved at the specialized laboratory, Universiti Perguruan Sultan Idris (UPSI)

		Age		Total
Gender		10	11	
	Boys	8	8	16
	Girls	9	9	18
School	n=2			
Teachers	n=4			
Total		17	17	34

As mentioned earlier, for this paper, it will highlight the results collected from the interviews and observations made during all experiments conducted. The researcher interviewed all teachers involved (after the experiments) for collecting their perceptions and thoughts based on their own experiences with using games for teaching Science. These interview sessions used semi-structured questions, mostly all were noted in a specialized answering sheet and when possible, the conversations were audio-taped.

Meanwhile, the researcher and observers (assistants) took note for all sessions conducted. Each observer was given specific instructions of what needed to be observed. They wrote down all information on a standard check-list form provided. All forms were filled immediately after the play session ended, and collected once completed on the spot.

6 RESULT OF STUDY

This section explains about the results gathered from the observation notes made of all experiments conducted.

6.1 Stage One

In this section, it outlines the various potentials and challenges for the integration of game in class, which teachers and students faced while operating the games given for Science teaching and learning in classes. The aim of this section is to provide rich content of actual factors which impacted upon the process of introducing and using games for teaching and learning in schools.

Out of ten schools visited, eight experiments were conducted at the schools' own computer laboratory. Two experiments were done in a normal classroom, with a notebook and a projector used. Majority (n=7) of these laboratories consists of between 35 – 45 desktops, meanwhile one had less than 35 (between 20– 34). Seating arrangements for students were based on first come, first served or free seating. No arrangement was set in all experiments. Ideally, seating should be 1:1 (i.e. one computer per student).

However, for all experiments done, unfortunately we couldn't abide to that due to technical problems that occurred. Depending on the number of functioning computers, students were either playing individually, in pairs or in a group of between three-four members per computer.

Since the experiments were done at their own surroundings, students were seen of not having any difficulties in familiarizing with the computers especially in browsing the internet versions of games. Depending on the speed and access of the network available, overall, the experiments were completed.

However, during these experiments, issues and concerns were able to be recorded (observation notes and interviews). Among the problems that regularly appeared during the experiments were insufficient computers per students and electrical, technical as well as internet connection (network) problem.

- **Insufficient Computer Supply**

As mentioned earlier, there were cases of not enough computers available, especially those in perfect working order in the schools' computer laboratories. Most likely, the computer labs could not cater for the students of one class; normally in less than 45 students. The computers ratios for students were most likely not enough. In our observations, many computers were not regularly serviced or no proper maintenance was done. These computers were having problems (e.g., monitors could not display; missing peripherals – mouse, keyboards, CPUs, cables; CPU not functioning). Thus, students had to resolve by sharing computers when necessary.

In one of the school attended, even though the school was established in 2004, within an urban area, however, the facilities within the school's computer laboratory were simply poor. This school has 40 computers, but more than half were not functioning, most were waiting to be repaired. In fact, many of the computers' gadgets, especially the headphones were not functioning. Therefore, many of the students were playing games without hearing any instruction, background music or sound effects. This did caused problem in the session, as students were reckless due to their inability to hear. Students did make efforts of sharing the headphones, but, up to some point, they totally ignored such need, and many expressed their frustrations to the writer.

As for the one school with no laboratory, problem of insufficient supply of computers especially for teachers' usage is a big problem. Teachers need to book a computer and queue up for a turn, which tend to let down teachers' motivations in the end. In one case, teachers couldn't get direct usage of computers at office for training or other stuffs. Computers available

might be in the school's offices which were used for clerical staffs, not for teachers.

- **Electrical Shortage**

Electrical problem was another frequent problem teachers faced at the older schools. Many schools existed in Malaysia were built way back before the Computerisation Program being introduced in the education system. These older schools have limited electrical capacities to support the usage of computer demands for electricity. Therefore, electrical shortage was a big obstacle. This was the case for two teachers from two different schools who had to write report about the electricity problems on weekly basis. In one particular school, their computer labs (two computer labs to be exact; each with 30 personal computers) had long been closed as a result of a shortage of electricity problem. Because of the shortage of electricity, it had caused a burnout for all the computers in the school labs.

During the play session, for one of the school mentioned above, the writer was taken and given a tour to the school's new established computer laboratory (less than two years). All 30 computers available in were considered new (under two years), all completed with necessary gadgets such as microphones, speakers and video cameras. Due to electrical connectivity problem, all of those computers were not used which was so unfortunate for the school since it was built during the Computerisation Program timeframe. By the time the writer revisited the school, the problem had existed for more than four months, which the school's IT coordinator was still waiting for the next step from the relevant units (District, State Unit of Education and Ministry Of Education - MOE) as the school had requested for electrical faulty check as well as appropriate resolution.

Besides that particular school, another school visited had the same problem but this was understood because of the school was built since the early eighties. According to the IT Coordinator, two classes were transformed as the school's computer laboratory, but due to low power supplies, the computer laboratory was often closed due to its incapable in tolerating the power usages of computers versus the electrical power supplies available. The Science teacher who is also the IT coordinator had informed us that it had been closed for more than six months. In fact, for this particular school, the computer-based program had not been running since the closure of the computer laboratory, as many of its computers had been burnt out due to the power conflict.

- **Technical Problem**

Teachers who were 'lucky' in getting to access and use computers for teaching-learning purposes had to

encounter many technical problems. These might include hardware and peripherals breakdowns, installations' errors, bugs or viruses creeping during their presentations, limited memory or operating systems capacities; which all requires technical knowledge to mend and fix such problems. The technical matters involving computers were definitely not within the capability of any normal Science teacher or even any subject matter teacher as well as the schools' IT coordinator. Teachers need technical assistance during the session either before or after class sessions.

Since the writer acted out as the facilitator for the play sessions, the writer had also experienced these problems. Since teachers' presences were as assistances, the writer controlled the main computer (or teacher's computer). There were a few cases where technical problems existed during the play sessions, often involving installations' errors, existence of bugs and viruses, and not forgetting hardware or gadget breakdowns. The writer was left alone to solve the problem, without any assistance from the technical people and that did caused waste of precious time in solving those problems. Besides problem with the teacher's computers, there were many more experiences of technical difficulties which the writer had encountered with the students' computers; similar problems. Of all ten schools the writer attended for the play sessions, no technical assistant was available for any of the primary schools visited.

- **Software, Operating Systems and Peripherals Upgrade**

Another technical problem existed within the computer-based system in Malaysia was the poor upgrading systems of the computers especially involving the operating systems and software. According to one of the teachers (who also acts as IT Coordinator), that particular school was not allowed for upgrading from Windows to the latest version because there was a ruling under MOE which said that primary schools' computer programs would only be able to use the older version of operating systems; Windows 95. These operating systems were outdated and should have long been replaced with the newer version. According to this teacher, some schools were able to upgrade their operating systems by using other means such as school parents-teachers associations' budgets or donations from private companies.

Unfortunately for this school, the only means of upgrading the computer laboratory was by the changing of ruling from the MOE. Besides the outdated software and operating systems used, there were also cases which the memory cards' memory capabilities and processing power were extremely low, unable to cope with the latest software requirements. Once again, it seemed that there is a restriction for any

upgrading for these school computers' needs.

The writer personally encountered difficulty in installing many games especially for the three primary schools as the games required a minimal operating system of Windows 98. The writer was surprised to encounter such problem as these schools were considered newly built (established since 2000).

- **School Management and Policy Makers Support**
School Management comprises from the Heads in the school, leads by the school's principal or headmaster/mistress. These are the people responsible in ensuring the smooth running of each school with the assistance of other members of the people involved in managing the daily operations of school. Other than them, there is another higher unit which determines the success of running any schools' programs. This unit might comprise of the District, State Department of Education and MOE. Combining all these entity, all programs or policy making pertaining to the school must be aligned and agreed upon one or many of these entities.

Three teachers who were also the school's IT Coordinator shared justifications about what they believed hindered the success of computer-based programs in schools. Based on their own experiences in handling the schools' computer-based programs, many of the matters arise due to the lack of support received from the immediate parties. They mentioned that it was normal for problems to occur, but they believed that the problems could be resolved. However, supports from the upper management were minimal, in fact were not positive. Even if they received supports from the school management, but the process need to undergo levels of entities especially from the policy makers which normally would take quite a number of days, even months in processing matters.

The lack of positive support especially from the school management was one of the biggest hinder in ensuring effective practice of computer-based programs, especially if it involves computer laboratory. Without the support from these individuals, not much can be expected from the higher level of operational units.

6.2 Stage Two

The setup of the seating arrangement during stage two was done based on the recommendations made in stage one. Since it was conducted at a fully functional, well-equipped multimedia laboratory, this study was able to eliminate all the issues faced in stage one. Students were given seating of one pc per student (as recommended by the teachers). However, it's free seating which means students were allowed to sit at

any place of interest, next to whom they preferred to be. Other problems such as electrical, network or technical problems were not of concern, as the laboratory used has its own technical assistants who take care of the lab.

7 DISCUSSION

From the two stages of experiments conducted, it is acknowledged that with fully functional working facilities, adequate numbers of computers per student and less or no technical problems encountered; computer games can be used in class as another instructional material for Science learning. Many positive outcomes especially on the matter of students' intellectual and social skills were identified during the experiments done [4,5]. A summary of recommendations was able to be derived from the two stages of experiments conducted based on the interviews and observations performed. These recommendations can be divided into three main stages for the games-based sessions in class; before, during and after.

7.1 Stage One: Before Play Session

In this stage, three important actions need to be carried out by teachers.

- Familiarizing with Games

In order for maximizing the benefits of using games in class, teachers must familiarize themselves with the games.

The teachers have to actually play the game upfront to;

1. Understand the goals and objectives of the game played
2. Understand the rules and challenges for each task
3. Know the steps required to overcome any problems which might exist during playtime; gameplay or technical
4. Know how to relate the goals and challenges given with the topic being taught
5. Lay out instructions, guidelines and objectives of the playtime
6. Develop continuation activity after playtime

Without doing these, the games might not be fully utilized for teaching and learning process intended.

- Concept, Theory or Information Made Known

Before games being incorporated in class, students should be taught of the topic. The delivery of information, concept or theory intended within the topic is much better be known by the students before playing any game. These information could be either basic or introduction concepts or even in depth.

The reasons are;

1. Students could easily understand the goals and objectives of the games, by relating the information known by them.
2. Since all students were given the same information before the play session, assumption could be made that all students are equally similar with the level of information existed among them. Therefore, teachers could focus on students who might encounter problems with non-related with knowledge such as technical problem, rather than needing to explain the information to the students. With that, using limited play session time could maximize to the fullest.
3. Besides that, by ensuring students' level of information are equal, teachers could be assured that students are using their knowledge based on a validate source, rather than picking up from their own experience or knowledge gained elsewhere which might not be accurate.
4. Even if with basic information, students could at least use those limited information and further exercise their critical and creative thinking skills if needed. This is much better than no information at all.

With basic information of topic, teachers could ensure that the students' levels of information are equally the same and they will have less to worry. All they might need to focus during the playtime would be any technical problem or focusing and assisting certain needing students (weak in academic).

- Basic Computer Skill

Since the introduction of Smart School Program (SSP) in 1996, students should be familiar with the concept of using computer in class. Even though that doesn't necessary mean that students are well-versed using computers at school, but at least they had undergone the computer-based class experience since their first year of school – Year One, Primary School.

Teachers from the urban schools admitted that their students are well-versed and more advanced in IT skills as compared to them. But, for those students from rural schools, teachers admitted the only access of computers for these students would be at school. Therefore, these students might be least skillful as compared to those owning their own computers. Schools are their venue to enhance their skills in computers.

Students need to be skillful in their hand-and-eye coordination which is a skill in coordinating the use of hand (i.e. to type – keyboard or to move – mouse) and eye (i.e. viewing the monitor at the same time with hand action) at a same time. The familiarity of using computers will assist students while playing games with computers.

With that in hand, students are more comfortable and confident while playing the games and totally engaged themselves with the play session. Again, teachers need not to waste time guiding them on these skills.

7.2 Stage Two: During Play Session

A few precautions need be taken care of and dealt with during any play session.

- **Class Structure**

The best option of a class structure would be those with a ratio of 1:1, which means that one student using a computer/game. However, this depends if the school has such infrastructure.

Among the reasons why this ratio is much preferred are;

1. It allows students to learn on their own paces.
2. It allows students to exercise their own self-reflections.
3. It stimulates more challenging activities according to the level of expertise and needs among students. The challenges provided within the games could cater to individual needs' of the challenges degree of difficulties.

However, based on the current scenario for computer facilities existed in Malaysian public schools, the next best option would be 2:1, i.e. working in a pair or in partners. 2:1 means two students sharing one computer and game at a time. This ratio is considered the best option in reality to maximize games-based session.

Among the reasons why 2:1 ratio should be considered for class structure are;

1. It allows and encourages discussion sessions among students. Students paired with each other have a better chance to discuss options or answers than if played individually. Students could communicate by discussing each own ideas and work out ways to accept each other idea in solving the game played.
2. It allows and encourages collaboration work or teamwork. Students learn to play with each other, helping each other out in more sensible manner. Working in a pair allows collaborating with less disastrous moments and less chaotic sessions if compared to work in a bigger number of people in a team.
3. To ensure that this practice being exercise successfully, teachers could pair students by either pairing students according to their academic performances or pairing students with whom they are comfortable to work with (i.e. letting the students choosing their own partner or members).

- **Duration**

If games were to be used in class, it should be done during a two-class period. In Primary school level, it means a class of 90 minutes. The games-based learning session should not be conducted in anything less than that amount of time, as the concern is that anything less that the two-class period might not be useful at all. This is because normally students need time adjusting to the games-based setting as well as familiarizing towards the game itself (gameplay, instructions).

The strategies that needed to be applied are in the beginning of all PC games-based class session, allocate at least 10 minutes for introduction purpose of what the activity of the day might be. Within this allocated time, teachers should be giving guideline to all students. Then, leave the rest to the students to explore and complete the tasks given to them by letting them play freely. Then finally, before the end of the class (i.e. 10 minutes before class ends), teachers should wrap up the session by reminding the students of their tasks given which was supposed to be done.

7.3 Stage Three: After Play Session

Under stage three (after play session), there are a few activities highly recommended to be acted on which reinforces the learning activities done earlier. These activities are known as reinforcement activities and should be conducted after stage two.

- **Reinforcement Activities**

Reinforcing any topic covered is necessary as stated in the Science curriculum.

There are three strategies of reinforcement activities conducted at the post-play session in games-based classes which could be put into practice by teachers.

1. Short report or summary: A short report or summary written by students about their experiences with the games, based on teachers' specific goal or reason behind the use of games in class.
2. Class or Group Discussion: A short session of discussion could be conducted after any games-based class sessions which should be always moderated by teachers, ensuring the discussion reflects the objectives of the topics taught
3. Quiz or Short Test: This quiz or short test is not about recalling the topics, but about identifying and recognizing the games activities relevancy with the topics taught.

7.4 Schools Management' and Policy Makers' Commitments

Support from the School Management comprises from the Heads in the school, leads by the school's principal or headmaster/mistress is highly sought by teachers as they are positive in the idea of implementing games as instructional materials in Science classes. These are the people who are responsible in ensuring the running of each school. It is hoped that the higher unit comprised of the District, State Department of Education and MOE would be positive and have conducive mindsets so that quicker actions in ensuring a better and engaging learning environment for our children – the future generations can be attended to.

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