

UKM Teaching and Learning Congress 2011

## Computer games: implementation into teaching and learning

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### Abstract

It is well known that a computer game other than video games is a current trend among the younger generation. Studies have shown that the use of computer games not only played by children as young as two years even up to adulthood. Integration and implementation of computer games into the classroom is also seen to help students learn with more fun and effective. The purpose of this paper is to discuss the principles of learning to be embedded in a computer game-based learning as well as aspects that can be considered when designing a computer game that will be used as the application of teaching and student learning.

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*Keywords:* Computer games; games-based learning; games design

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### 1. Introduction

Research has proven the effectiveness of information technology through the use of computer games via various applications and mediums (Syamsul Bahrin & Norshuhada, 2009). The computer game industry is successful in attracting young users. According to Johannes Fromme (2003), technically, this electronic game has become easier to start off with for the last two decades. Users need not acquire specific knowledge on the use of consoles such as Game Boy or other electronic game consoles.

Computer game has become popular among children as free time activity, be it in the form of video, mobile application or computer. Research by Feierabend and Klingler (2001) in Johannes Fromme (2003) shows that in a week, users of between 6 to 13 years of age are more prone to doing things using computer games (be it individually or in groups). Studies have been conducted on the use of computer games in the field of education. Studies on its effectiveness have been done to ensure that efficient, effective and quality learning takes place (Moser, 2000; Syamsul Bahrin & Norshuhada, 2009). Computer games also have the potential to create an entertaining learning environment as games have the potential to motivate students (Bokyeong Kim, Hyungsung Park & Youngkyun Baek, 2009). Besides, computer games too contain competitive activities which conform to rules, aims, feedback, interaction and result. Bokyeong Kim et al., (2009), posits that computer game-based learning supports a few aspects of the learning process as follows:

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- Encourage students to gather ideas from different fields so as to solve or decide on a solution.
- Encourage students deter their learning outcome using the game based on the outcome and action taken.
- Encourage students to interact with other group members and discuss the steps to upgrade learning skills.

The important aspects of the games include: seeking information, choosing suitable and required information, developing discussion strategy, settling conflicts and problem solving.

According to Fenggeng Ke (2008), educational researchers have recommended computer games as a potential learning tool. Their findings are based on the following arguments:

- Students can strongly associate themselves with the computer games.
- Computer games encourage active learning (learning by doing).
- There is empirical evidence which proves that games can be an effective tool to improve understanding during learning.
- Computer games can encourage collaboration between students.

## 2. Games and Learning

Gariss et al., (2002) introduced a game-based learning model to show how the integration between computer games and education is implemented. According to Pivec et al., (2003), game-based learning model has been carried out successfully in formal education e.g. in the military, medicine, physical training etc.

Based on Figure 1, let us see how and when learning takes place in a games-interacted education. According to Pivec et al., (2003), the main characteristics of an educational game are that the lesson content correlates with the features of the game. The main characteristic is that the game must motivate the students so that they are eager to repeat the cycle. During repetition, students are expected to exhibit emotional or cognitive behavioral changes through interactions shown during the game.

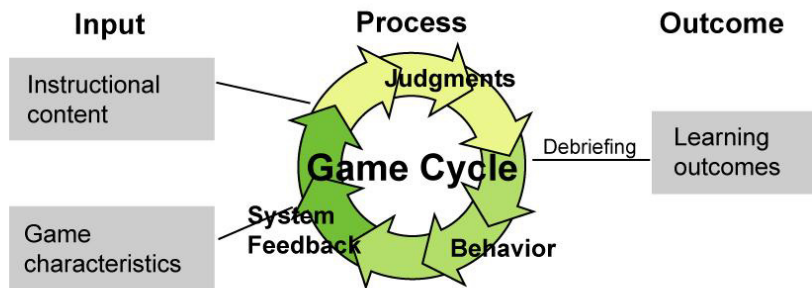


Figure 1. Model Game-Based learning (Garris et al., 2002)

According to Garris et al., (2002), Figure 1 describe a correlation between the game cycle and learning outcome. The model provides a link between simulation-based activities and the real world as well as associate events in the game with real-world events. According to Pivec et al., (2003), as well as by Kolb et al., (1971), this model describes what had been committed, and reflected, understood in the application of the learning process.

Role-Playing Game (RPG) genre illustrates the relationship between game-based learning model and the game itself. The objective of RPG is to entertain to student and can be classified an educational entertainment where it is more of the problem-solving approach where each player picks a character that he likes. RPG games are mostly high-levelled and have many solutions. However, help in the form of equipment, weapons, mini maps etc. are provided so as to allow players to think and face challenges that they endure. Awarding points and rewards in the form of medals and certificates provides motivational support for the players.

In developing a computer game application, designers should take into account the features of the game. There are several opinions on the features of a game, for example Thornton et al., (1990) and Pivec et al., (2003) claim that

interactivity is an important aspect in a game. Johnston and Felix (1993) on the other hand propose visual dynamic, rule, objective and interaction as important features. Baranauskas et al., (1999) states that a game should be challenging and risky. According to Malone (1981), the four elements that must be in a computer game are fantasy, curiosity, challenges and the ability to control.

Druckman (1995) posits that games are able to raise the motivational level and student's interest in education. Besides, several studies reveal importance on learning retention. Eight out of eleven researches claim that learning retention is better in game-based learning, while other three studies show no significant difference. Seven out of eight studies on students' learning interest show that students are in favour of games. However, Pivec et al., (2003) clarifies that the relationship between learning interest and game-based learning is still unclear.

### 3. Computer Games Design For Learning

According to Roslina and Nazli (2008), the production of computer games requires a distinctive learning principle. Gee (2006) in Roslina and Nazli (2008)'s states that the production of a good computer game integrates up to 16 learning principles.

- *Introduction*: Pupils need to role-play characters to fulfill the given task. This means the player should represent the their own characters.
- *Interaction*: Pupils must interact to the optimum so that they can fully experience the learning process.
- *Production*: Actions carried out by pupils must be in accordance to the storyline that depict the learning process that will take place.
- *Risks taking*: Games must encourage pupils to be brave in making decision and prepare them in risks taking.
- *Specialization*: Games must be of different levels so as to enable pupils of different levels to play according to their capability
- *Agent*: Pupils are able to feel the roles that they have chosen and control, in order to be themselves with what they do.
- *Problems prepared in orderly manner*: Problems that arise in a game ought to be solved by pupils in an orderly manner
- *Challenges and reinforcement*: A good game offers a set of problems and allows pupils to solve them. In schools, weaker students are often deprived of reinforcement activities while good students face limited challenges in solving problems
- *Suitable time and demands*: Gee (2006) believes that textbooks are not very efficient and some people face problems dealing with them. On the other hand, during games, information is available when needed
- *Meaningful situation*: Games often provide meaningful situations in terms of action, image and dialogue
- *Loosing but entertaining*: Loosing in a game is a choice. It is challenging for pupils to overcome it by improving on the skills to win back the game
- *System for thinking*: Games should encourage pupils to think of the relationships between facts, happenings and skills.
- *Exploring, lateral thinking and thinking of the objective*: Through games, players are encouraged to explore based on their choices, move at an average pace, think laterally to achieve an objective.
- *Smart equipment and spreading of knowledge*: Equipment used in the games is considered smart equipment, e.g. avatar which is smartly programmed for movements and actions.
- *Multitask groups*: Multiplayer games require players who play different roles to fulfil given tasks. Players should be competent in the games in order to achieve the goals no matter who the other players are. This will encourage teamwork as well as problem-solving ability among the team members.
- *Pre competent achievements*: The games allow players to participate using the smart tools even if they are not competent in that particular subject matter.

According to Pivec et al., (2003), from the constructivist point of view, students need to be involved actively in acquiring knowledge, and this knowledge is used in restructuring information, manipulating, recreating, and testing the knowledge so that it is more meaningful, well-planned and well-remembered. According to Pivec et al., (2003),

the design in constructive methodology differs from task-based methodology in terms of the design of the systematic teaching approach.

Designers who use constructive methodology create learning environments that are less focused, answering the question 'how' or implementing the process approach but stressing on elements that facilitate learning.

Designers apply this methodology in the seven pedagogical goals:

- Provide experience through knowledge-building process
- Provide experience to encourage experience add values in various perspectives
- Apply what is taught in realistic and relevant contexts
- Encourage ownership in the learning process
- Apply what is taught in the social contexts
- Encourage the use of various representation styles
- Encourage self-awareness towards the process of gaining experience through working.

With the existence of elements that have been mentioned, educational computer game designers should take into account the pedagogical and psychological element. Although not all the elements are used in a game, the usage of these elements as a basis for the creation of the educational games is hoped to create a great impact in today's educational field.

#### 4. Conclusion

Computer game, an example of a system of application, needs to provide ideal environments for research in artificial intelligence where complex stimulus and various dynamic agents are used. In addition, computer games provide basic interactive cognitive models. However, the integration of computer games in the learning process need to be viewed from a positive angle. Designing computer games embedded with learning elements is not an easy task but is an approach perceived to help pupils understand their tasks easily. Besides enjoyment, pupils are able to gain cognitive and affective elements through problem solving, making decisions, making conclusions and working collaboratively with their friends. Pupils not only learn about the subject matter but they also build up their own personality.

#### References

- Baranauskas, M., Neto, N., & Borges, M. (1999). Learning at work through a multi-user synchronous simulation game. Proceeding of the PEG'99 Conference. Exeter. UK.
- Bokyeong Kim, Hyungsung Park, Youngkyun Baek. (2009). Notjust fun, but serious strategies: Using meta-cognitive strategies in game-based learning. *Computer & Education Journal Bil* 52. 800-810
- Druckman, D. (1995). The Educational Effectiveness of Interactive Games Simulation and gaming across disciplines and cultures: ISAGA at a watershed, Thousand Oaks: Sage, 178-187
- Fenggeng Ke (2008). A case study of computer gaming for math: Engaged Learning from gameplay. *Computer & Education Journal Bil* 51. 1609-1620.
- Garris, R., Ahlers, R. and Driskell, J.E. (2002). Games, motivation and learning, simulation & gaming: An Interdisciplinary Journal Practice and Research. Vol 33, No. 4. Dec 2002.
- Gee J.P. (2006) Good Video Games and Good Learning. [http://www.academiccolab.org/resources/documents/Good\\_Learning.pdf](http://www.academiccolab.org/resources/documents/Good_Learning.pdf), muat turun pada 30 September 2011
- Johannes Fromme. (2003). Computer Games as a Part of Children's Culture. *The International Journal of Computer Game Research*. <http://www.gamestudies.org/0301/fromme/> muat turun pada 30 September 2011
- Johnston, R.T. de Felix, W. (1993). Learning from video games. *Computer in schools*, 1999-233
- Kolb, D.A., Rubin, I.M. & McInTyre, J. (1971). *Organizational Psychology: An experimental approach*. Englewood Cliffs, NJ: Prentice Hall.
- Malone, T.W. 1981. What makes computer game fun? *Byte* 6(12). 258-277
- Pivec, M., Dziabenko, O., Schinnerl, I. (2003). Aspects of game-based learning. In *Proceedings of I-KNOW '03*, 2003, pp. 216-225
- Roslina Ibrahim & Azizah Jaafar. (2010). Using Educational Games in Learning Introductory Programming: A Pilot study on students' perceptions. *Proceedings 2010 International Symposium on Information Technology - Visual Informatics, ITSIm'10* 1, art. no. 5561414

- Roslina Ibrahim & Nazli Yahya. (2008). Educational Computer Games (ECG) for Malaysia Educational Settings? A Review and Prospect .  
Prosiding 2nd International Malaysian Educational Technology Convention. Kuantan, Pahang
- Syamsul Bahrin & Nurshuhada. (2009). Analisis Teri Pembelajaran Dalam Permainan Mudah Alih. Prosiding Seminar Kebangsaan Teknologi dan Inovasi Pengajaran- Pembelajaran 2009. Putrajaya. Malaysia
- Thornton, G.C. & Cleveland, J.N. (1990). Developing managerial talent through simulation, *American Psychologist*, 190-199