A Framework for Adopting Educational Computer Games in the Undergraduate Courses in Thai Universities for Learning and Teaching

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I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

(Kowit Repeepisarn)

ABSTRACT

Computer and video games have been developed into effective tools for educational programmes. However, the question which follows is "Can computer games really become an effective educational tool in the classroom?" Debates and discussions regarding the best methodology for classroom education have gone on for decades. Researchers in many countries are slowly gaining acceptance to the use of educational games for educational purposes in schools and colleges. However the use of Educational Computer Games (ECG) is still not popular in schools and universities in Thailand. Thus, the research on the use of ECG for educational purposes in Thailand is scarce. This may be due to the negative impression of computer games from the community. Nevertheless, according to the Thailand Reform Education Act 1999, Thai universities should adopt student-centred learning as the main focus in teaching. It is therefore important to examine the possibilities of using ECG to support this type of learning environment. It is the purpose of this thesis to investigate the feasibility of adopting ECG in undergraduate courses in Thailand. The objectives of this thesis are: 1) to investigate the factors affecting the use of ECG in the classrooms by Thai lecturers and students, 2) to examine the learning and teaching styles that benefit the use of ECG, and 3) to determine the genre of computer games which are appropriate and effective as educational computer games. In order to study the adoption of ECG for teaching and learning in Thai undergraduate courses, three main theoretical frameworks have been investigated. There are technology acceptance theories, ECG concepts and pedagogical theories.

The research strategy for this study is survey research. Questionnaires and interviews are instruments used for data collections. The thesis combined both qualitative and quantitative research. A sample size of 400 students and 40 lecturers

were selected from four Thai universities. As for the interview survey, there were 18 interviewees participated voluntarily. The results from the literature review on the theoretical frameworks have the effect in formulating the five research propositions of the study and the 20 hypotheses.

The major findings from this study are as follows: 1) every ECG acceptance factor namely Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude towards Use (AU), Subjective Norms (SN), Perceived Entertainment (PE) and University Environment Support Factors (UESF) have positive influence on the behavioural intent to use ECG in teaching and learning; 2) nearly half of the Thai students have a Pragmatist Style of learning (43.5%) and a reasonable share of Thai lecturers have a Facilitators Style of teaching (41.4%); 3) when the learning style is used as a predictor of ECG adoption, every style of learning has a positive influence on the behavioural intent to use. After Analysis of Variance (ANOVA) testing, it was found that there is no statistical significant difference between each learning style. However, when using regression analysis with "enter" method to each learning style; it can be found that the Activist Style has the most positive influence on the behavioural intent to use ECG. In contrast, with ANOVA testing, different teaching styles have different intent to use ECG. By a comparison of teaching styles using Fisher's Least Significant Difference (LSD) method, it shows that there were two pairs of teaching styles that have a statistical significant difference at .011 and .013. The first pair is Facilitator and Personal, and the second pair is Facilitator and Delegator; 4) when the respondents were asked "What is Your Opinion If the University Has a Policy of Employing ECG into the Curriculum as a Learning Tool in the classrooms?", most respondents have positive comments on accepting this type of education technology. 82.4% of students and 65.4% of lecturers agreed with this policy; 5) there are a variety

of comments from the interviewees on the game genres they think could be appropriate for an education environment. Most of them think that all game genres can be applied to ECG (52.6%). 26.3% think that it depends on the content and subject areas. The rest recommended some other game genres such as adventure, puzzle, role-playing, simulation, and sport games. However, in order to support the research finding, further studies have been carried out based on previous research papers relating with game genre and learning theories. The papers have been reviewed, analyzed, matched, used to bridge the gap, synthesised and, subsequently the three new conceptual frameworks are proposed: 1) conceptual model of relationships between learning styles, learning activities and possible game genres; 2) conceptual model of relationships between game genre and three learning theories; and 3) three stages of adopting digital game platforms for learning in the classroom. This study provides some useful insights into the ECG adoption in the Thai undergraduate classroom

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Finally, I dedicate this thesis to my dad and mom who both have passed away and were hoping to see my Ph.D. graduation, but they never had the chance.

LIST OF PUBLICATIONS

The following papers contributed to the development of this thesis. There are nine papers, seven which were published in proceedings of international conferences. One book chapter and an article were published in an international journal. The papers are listed in ascending order of the publication year.

Book Chapter

B1. Rapeepisarn, K., Wong, K., Fung, C., & Khine, M. S. (2008). "The relationship between game genre, learning techniques and learning styles in educational computer games." In Z. Pan, et al (Ed.), *Techologies for E-learning and Digital Entertainment* (Vol. 5093/2008, pp. 497-508): Springer-Verlag Berlin Heidelbertg.

Refereed Journal Paper

J1. Rapeepisarn, K., Wong, K., Fung, C., & Khine, M. S. (2008). "Creating effective educational computer games for undergraduate classroom learning: A conceptual model." *i-Manager's Journal of Educational Technology, 5*(2), pp.22-31.

Refereed Conference Proceedings

P1. Rapeepisarn, K., Wong, K. K., & Fung, C. C. (2006). "Distinctions and generalities between "Learn through doing" and "Edutainment." In *Proceedings of the 7th Postgraduate Electrical Engineering and Computing Symposium, 7 November 2006.* (Murdoch University, Western Australia), 174-177.

P2. Rapeepisarn, K., Wong, K., Fung, C., & Cole, P. (2006). "Entertainment is a form of learn through doing?" In *Proceedings of the 4th Annual International*

Conference in Computer Game Design and Technology Workshop and Conference, 15-16 November 2006. (Liverpool Moores University), 116-120.

P3. Rapeepisarn, K., Wong, K., Fung, C., & Depickere, A. (2006). "Similarities and differences between 'learn through play' and 'edutainment'." In *Proceedings of the 3rd Australian Conference on Interactive Entertainment, 4-6 December 2006.* (Perth, Australia) V. 207, 28-32.

P4. Rapeepisarn, K., Wong, K., & Fung, C. (2007). "Issues for consideration to adopt educational computer games for learning and teaching." In *Proceedings of the 8th Postgraduate Electrical Engineering and Computing Symposium, 7 November 2007.* (Curtin University, Western Australia), 73-78.

P5. Rapeepisarn, K., Pongpankae, S., Wong, K., & Fung, C. (2008). "A comparative study of digital game platforms for educational purposes." In *Proceedings of the 9th Postgraduate Electrical Engineering and Computing Symposium, 4 November 2008,* (Western Australia University, Western Australia), 37-40.

P6. Rapeepisarn, K., Pongpankae, S., Wong, K., & Fung, C. (2008). "Educational use of handheld game consoles-PSP and NDS in Thai colleges." In *Proceedings of the 7th International Conference on e-Business, 6-7 November 2008.* (Bangkok, Thailand), 58-65.

P7. Rapeepisarn, K., Wong, K., Fung, C., & Khine, M. S. (2008). *"How teaching and learning styles affect adoption of educational computer games in classroom?"* In *Proceedigns of the 6th Internation Conference in Game Design and Technology Workshop and Conference, 12-13 November 2008.* (Liverpool John Moores University, UK), 37-42.

CONTRIBUTIONS OF THE THESIS

The scholastic contributions in this thesis have been published and reported and they are described in the following perspectives:

The first part provided a review of the literature and research on educational computer games (ECG) for teaching and learning focused on the comparison between edutainment and 3 types of learning: "learning through play", "learning through doing" and "learning through simulation". Two main ideas of learning through play and learning through doing have been published in paper P1, P2, and P3 which are described in Sections 2.1, Chapter 2. These are papers on the state-of-the-art development of the discipline. The papers present the reason why play is so important, providing the significance of learning through doing, and providing the reasons for setting edutainment games a criteria for learning.

The conceptualization of computer games, ECG including Thai computer game industry has been investigated. Game genre classification in this thesis was selected and investigated from the standard genre categories (Bate, 2004; Burn & Carr, 2006; Wolf, 2002). The classification is also based on the research finding of Thai student game players (as mentioned in Paper J1). Game platforms and their potential use for teaching and learning are presented including the IT and digital game markets in Thailand. These studies have been published in paper J1 and P5 which have been described in Sections 2.2.1, 2.2.2 and 2.4 in Chapter 2.

ECG, as an edutainment game, is considered as a learning through doing activity. ECG also creates a student learning centre (SCL). The students can have control over

when they go and what they try within the game. SCL was introduced in Thai educational system. Hence, it makes sense to propose ECG as an educational tool for teaching and learning. As a result, the comparison of SCL features and learning through doing properties was presented. This comparison supports the idea of proposing ECG for learning in Thai classrooms. This study has been published as a conceptual model in paper P6 and it is described in Section 2.6.5, Chapter 2.

The idea of investigating the factors that impact Thai lecturers and students in their use of educational computer games in the classroom according to objective 1 of this thesis was considered in the adoption of ECG for teaching and learning. Subsequently, the theoretical use in the thesis employed the technology acceptant theories. This includes the Technology Acceptant Model (TAM), Theory of Reasoned Action (TRA) and the concept of Beliefs about Teaching with Technology (BATT). Meanwhile, according to objective 2 of the thesis, VARK Learning Style, Honey & Mumford Learning Style and Grasha & Riechmann Teaching Style were explored. This study was published in paper P4 and it is described in Chapter 3 of the thesis.

Some parts of the results of this thesis such as ECG acceptance factors and learning styles affecting the behavioral intent to use ECG were published in paper P7. These results are also described in Sections 5.2.2.1, 5.2.2.3, 5.2.2.4, and 5.3.1 of Chapter 5.

The further studies apart from the survey results of this thesis were proposed as conceptual framework propositions. These propositions were analyzed, developed, synthesized and finally published in four papers. One paper was published as a book chapter, one paper as a journal article and the other two papers as conference

proceedings (B1, J1, P6, P7). These conceptual framework propositions are described in Chapter 5 in the following Sections: 5.4.1, 5.4.2 and 5.4.3.

Summary of the contributions of the thesis is illustrated in Table 1.1

Table 1.1: Summary of the Contributions of the Thesis

CHAPTER	CONTRIBUTIONS	PAPER NO
2 (2.1)	Literature survey on Edutainment, Learn through Play and Learn through Doing	P1, P2, P3
2 (2.2.2, 2.2.3, 2.4)	Conceptualization of Computer Game, ECG and Thai Computer Game Industry	J1, P5
2 (2.6.5)	Comparison of SCL features and Learn through Doing properties	P6
4	Theoretical Framework (Issues for Consideration to Adopt ECG for Learning and Teaching)	P4
5 (5.2.2.1, 5.2.2.3, 5.2.2.4, 5.3.1)	The survey results from Thai students according to ECG Acceptance Factors and Learning Style Affecting the Behavioral Intent to Use ECG	P7
5 (5.4.1, 5.4.2, 5.4.3)	Conceptual Framework Propositions: • Conceptual Model of Relationships between Learning Styles, Learning Activities and possible game genre. • Conceptual Model of Relationships between Game Genre and Three Learning Theories. • Three Stages of Adopting Digital Game Platforms for Teaching and Learning	B1, J1, P6,

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ACRONYMS

ANOVA	Analysis of Variance
ATCI	Association of Thai Computer Industry
ATSI	Association of Thai Software Industry
AU	Attitude Towards Use
BATT	Belief about Teaching with Technology
BI	Behavioural Intent to Use
CAI	Computer Assisted Instruction
DGL	Digital Game-based Learning
ECG	Educational Computer Games
EDU	New Oriental Educational Technology Group
FPS	First Person Shooter
HEI	Higher Education Institutes
ICT	Information and Communication Technology
IGDA	International Game Development Association
LSAY	Longitudinal Survey of Australian Youth
LSD	Least Significant Difference
LSI	Learning Style Inventory
LSQ	Learning Style Questionnaire
NDS	Nintendo Duel Screen
NECTEC	National Electronics and Computer Technology Centre
NII	National Information Infrastructure
NITC	National Information Technology Committee
ONEC	Office of the National Education Commission
PCLS	Perceptual Learning Styles
PE	Perceived Enjoyment

PEOU	Perceived Ease of Use
PFLS	Preferred Learning Styles
PSP	Play Station Portable
PU	Perceived Usefulness
RPG	Role Playing Game
RTS	Real-Time Simulation
SCL	"Student-Centred Learning" or "Centre for Student Learning"
SIPA	Software Industry Promotion Agency
SN	Subjective Norms
TAM	Technology Acceptance Model
TPS	Third Person Shooter
TRA	Theory of Reasoned Action
TS	Teaching Styles
VASK	Four types of learning style (Visual, Auditory, Write/Read, Kinesthetic)
UESF	University Environment Support Factors
UKCGO	The Children Go Online Survey, UK
UL	University Type
UT	University Location

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

In the recent decades, edutainment - which merges entertainment and education - has been successfully used by many educational programmes around the world (Addis, 2006a; Amory, Naicker, Vincent, & Adams, 1999; Bredemeier & Greenblatt, 1981; de Freitas & Maharg, 2010; Egenfeldt-Nielsen, 2005; Krotoski, 2005; Oyan & Bebko, 1996; Papastergiou, 2009; Randel, Morris, Singhal et al, 2008; Watzel, & Whitehill, 1992; Shelly, 2006; Yu et al, 2010). Computer games, one form of entertainment, has also been developed into effective tools for educational programmes.

The question which therefore follows is "Can computer games become an effective educational tool used in the classroom?" Debates and discussions regarding the best methodology for using computer games in the classroom have gone on for decades. The traditional teaching tools such as using overhead transparencies or Power Point slides may soon be obsolete. Today young people all over the world have grown up playing digital games in their daily lives. The newer educational programmes that have been developed from computer games, which include concepts of edutainment, may gain more attention for classroom teaching in the future.

There are a number of reasons for computer games being employed for educational purposes (Addis, 2006a; Amory, et al., 1999; Bredemeier & Greenblatt, 1981; Gikas & van Eck, 2004; Kirriemuir & McFarlane, 2003; Randel, et al., 1992; Shelly, 2006). Two of the main reasons are their interactivity and engagement with the players. A computer game allows each learner to manage at his/her own pace. Therefore, learners may be allowed as much time as needed to practice and master their skills. The attraction of rich visual images, the aesthetics, sound effects and the

pleasure that a computer can provide engages a learner's attention and enhances their learning. Computer games motivate learners and sustain their interest with fun, challenges, competition, feedback and interaction. Instant feedback to learners during playing or learning is crucial for effective teaching (Mitchell & Savill-Smith, 2004).

Given its popularity, motivating nature, interactivity and capacity to assist in skills development, computer games have much potential to be used for educational purposes (Green & McNeese, 2007). The freedom in sophisticated games compels players to explore options. An exploration game fosters discovery of a virtual world. Games compel players to explore and experiment, offering challenges and rewards. Games may also be used for tests (MacDonald, 2008; Ochoa, 2007). A student is likely to perform better because a game tends to lower a learner's stress level. Unlike traditional teaching methods, games provide an opportunity for students to organise their resources, test their knowledge and interact with course materials (Baranich & Currie, 2004).

The idea of using computer games in the classroom has become widely accepted across school curricula in many countries including USA, UK, most European countries and Australia (Bradford, 2006; Egenfeldt-Nielsen, 2006; ELSPA, 2006; Kirriemuir & McFarlane, 2005; Prensky, 2005a; Squire, 2004). However, the application of this media as an education tool in schools and colleges in Thailand is rare.

All universities in Thailand have been interested in developing Computer-Assisted Instruction (CAI), the World Wide Web and multimedia into undergraduate programmes (Miller, 1999). Most faculties have adopted a policy to implement CAI in most of their faculty discipline areas. Recent publications on learning theories support the efficacy of constructivist-learning approaches (Foote, Vermette, & Battaglia, 2001; Y. B. Kafai, 2006; Lambert, 2002; Pivec, 2010; Wellhousen & Kieff, 2000; Whitton,

2009; Wilson, 1996). Computer games can support this method of learning. In addition, leading reformers on education in Thailand support student centred learning (SCL) as the preferred approach for teaching and learning by students. SCL approaches are also considered to have better practical outcomes. Computer games may better enable skills learning and therefore are considered as a student-centred learning approach. Computer games may combine a number of motivating factors which are not found in other mediums. They offer fun with a passionate involvement. They operate with rules, provide goals, yield varied outcomes and allow for feedback. Computer games also offer problem solving opportunities which spark a player's creativity. Interactive programmes offer social networks and involve players to learn by doing (Prensky, 2005a).

The reasons given above provide ample support for the case that computer games be used as learning tools in Thailand. There could also be significant educational value form computer game being incorporated in the undergraduate curriculum in Thailand. This is the idea of using computer games for education.

"Computer Games for Education" and "Educational Computer Games" are terms most people use alternatively. Generally, there are some differences. Computer games for education are games that are designed for game-play and are not found to contain intended educational values. Educational computer games are games that are designed for educational purposes in the form of computer games. In terms of computer game genre pedagogy, game experts and game developers also classify education games as one genre of computer games. The particular purpose of educational computer games is designed to teach or train with explicit educational goals based on actual curriculum. The emphasis is on teaching a specific body of knowledge. Rather than being structured as a straightforward set of lessons or exercises, these programmes are

structured like games, in which such elements as scoring, timed performances, or incentives are given for correct answers.

The focus of this thesis is on the use of Educational Computer Games in the undergraduate curriculum in Thailand. Therefore, lecturers and students' beliefs and attitudes toward incorporating educational computer games into their curriculum for teaching and learning are critical factors in determining what could happen in the classroom (Krotoski, 2005).

The question is "Which forms of teaching and learning are appropriate for incorporating games into Thai classrooms?" Most importantly the incorporation of computer games into classrooms necessitates consideration of their genre and character.

The main objective of this research is to investigate the feasibility of adopting educational computer games into undergraduate courses in Thailand.

The following aspects need to be investigated: (1) acceptance of the technology, (2) lecturers' attitudes, (3) students' willingness to learn, and (4) the genre of available and appropriate educational computer games relevant to educational environments. Figure 1.1 illustrates the model of ECG adoption for teaching and learning in Thai undergraduate courses.

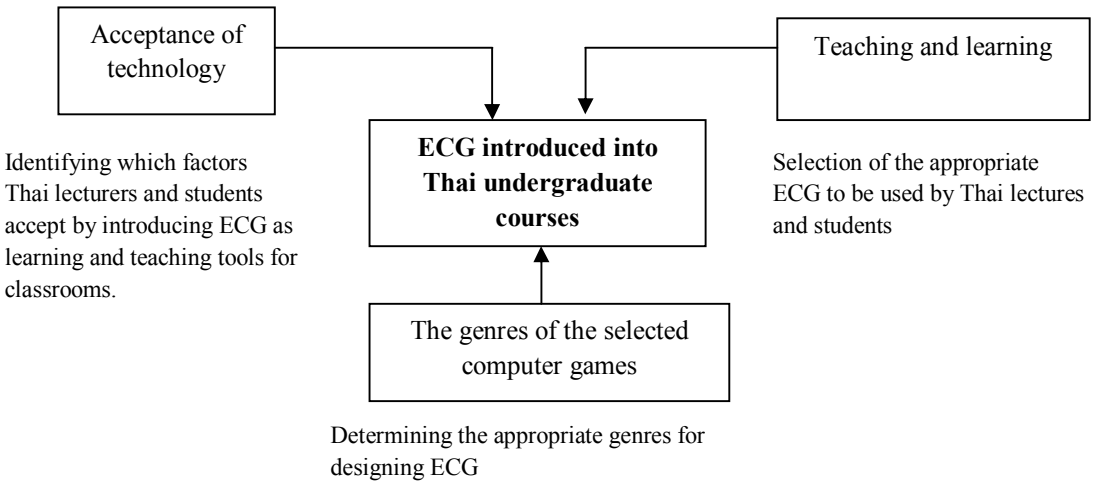

Figure 1.1: A Model of ECG Adoption for Learning and Teaching in Thai Undergraduate Courses

1.2 PURPOSE OF THE THESIS

The objective of this thesis is to investigate the feasibility of adopting ECG for teaching and learning in Thai undergraduate courses. The aims of this study are:

1. To investigate the factors that impact Thai lecturers and students in their use of educational computer games in the classroom.
2. To identify the various learning and teaching styles that may make best use of educational computer games.
3. To determine the genres of computer games which are most appropriate for development as effective and educational computer games.

1.3 RESEARCH QUESTIONS

1 Which factors will influence the successful introduction of educational computer games into the classroom by Thai lecturers and students?

2. Which learning styles will derive benefits from the use of educational computer games in Thailand?
3. Which teaching styles will derive benefits from the use of educational computer games in Thailand?
4. Which computer game genres will be more appropriate to be used to develop educational computer games for the different educational environments found in Thai undergraduate courses?
5. Are there any relationships between learning and teaching styles with computer game play behaviour in Thailand?
6. Are there any relationships between gender and computer game play behaviour in Thailand?

1.4 THE SCOPT AND LIMITATION OF WORK

The scope and limitation of work in this thesis are:

1. The factor that impact Thai lecturers and students on educational computer games will focus mainly on the Technology Acceptance Theory.
2. Pedagogical theories that impact Thai lecturers and students will focus on learning and teaching style.
3. The experience on educational computer game of Thai lecturers and students can be any type of game.
4. The sampling of four selected universities are school of Information Technology which the lecturers and students mainly have experience on educational computer game.

1.5 THEORETICAL FRAMEWORK

In order to study the adoption of ECG for teaching and learning in Thai undergraduate courses, three main concepts need to be investigated, namely, adoption, ECG, and teaching and learning styles.

Adoption refers to the acceptance of ECG for teaching and learning in the classroom. There are theories related to technology acceptance such as the Theory of Reasoned Action (TRA) (Verkatech & Davis, 2000), and the Technology Acceptance Model (TAM)(Davis, 1986). There is also one theory used for measuring a lecturers' belief concerning support factors that affect technology integration in the classroom: Belief about Teaching with Technology (BATT)(Ford, 1992). Consequently these theories were examined in this research.

In this research the significant factors were derived from TAM, TRA and BATT. Factors used as ECG acceptance factors were: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Towards Use (AU), Subjective Norms (SN), Behavioural Intent to Use (BI), Perceived Enjoyment (PE) and University Environment Support Factors (UESF).

ECG refers to one genre of computer game. ECG is a game which has been designed to teach learners about certain subject or help them to learn skills as they play. Some literature (Green & McNeese, 2007; Hussain, 2001) refers to this type of game as "Edutainment" because it integrates education with entertainment. Hence, theories and concepts underlying this are edutainment, and computer game theories which include characteristics of computer games, computer game genres, digital game platforms, and factors affecting on game preference.

Learning and teaching styles come under pedagogical theory. This thesis focuses on two main concepts which are *learning* and *teaching styles*. However, other pedagogical theories were also investigated including Bloom's taxonomy (learning objective) (Bloom, 2006), Gagné intellectual skills of learning capabilities (Gagné, Briggs & Wager, 1992) and Prensky's learning content and learning activities (Prensky, 2005a).

1.6 NATURE OF STUDY

The research strategy used in this thesis was survey research. Questionnaires and interviews were the main data collection methods. The thesis combined both qualitative and quantitative research. The questionnaire and interview questions were constructed based on the purpose of the thesis. The results from literature and reviewing the theories from a theoretical framework are used for formulating five propositions of the study and consequently 20 hypotheses were formulated. The five propositions are:

Proposition 1: "Student's and Lecturer's Behavioural Intent to Use Are Predicted as ECG Acceptance Factors: PU, PEOU, AU, SN, PE, and UESF (referred to 1.4 for ECG Acceptance Factors).

Proposition 2: "The Different University Type and University Location of Respondents in Thailand Will Affect the Acceptance and Use of ECG in the Classroom".

Proposition 3: "Student's Different Learning Styles and Lecturer's Different Teaching Styles Affect Their Behaviour on the Intent to Use of ECG in the Classroom".

Proposition 4: "Different Learning Styles and Teaching Styles Impact Different Educational Computer Game Play Behaviour".

Proposition 5: "Gender Differences Affect Educational Computer Game Play Behaviour".

The key findings from hypothesis testing will answer the research questions. Some of the research questions could be further studied by documentation. By analysing, comparing, synthesising the related documents and pedagogical theories, the conceptual framework has been modelled and proposed.

1.7 VARIABLES USED IN THE STUDY

Variables used in this study were categorised into four groups: Demographic Variables, ECG Acceptance Factors Variables, Pedagogy Variables, and Computer Games Play Behaviour Variables. The lists of variables and the definitions of variables are illustrated in Figure 1.2 and Table 1.1.

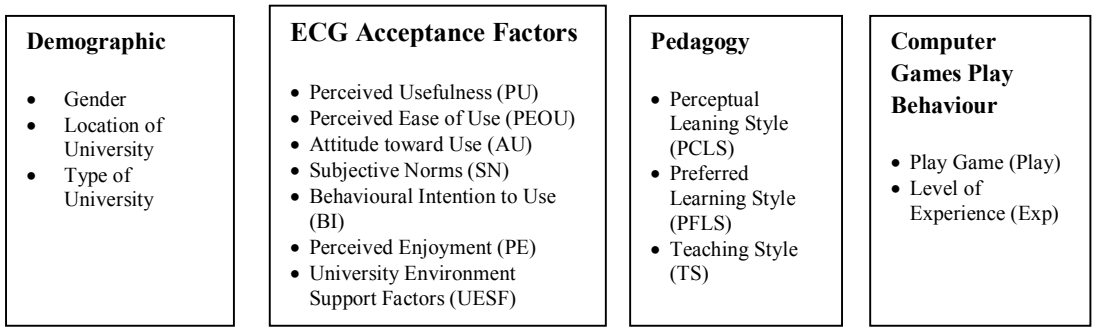

Figure 1.2: List of Variables

Table 1.1: Definitions of Variables

The Acceptance of Educational Computer Games

Variables	Conceptual Definition	Working Definition
Perceived Usefulness (PU) (Davis 1989)	The degree to which a person believes that ECG in classrooms would be advantageous and provide positive, expected outcomes	ECG may increase, support and enhance the effectiveness of learning & teaching, engage students during learning, allow students to progress at their own pace
Perceived Ease of Use (PEOU) (Davis 1989)	The degree to which a person believes that the use of ECG would take less effort	It is simple to learn to operate ECG in a classrooms
Attitude towards Use (AU) (Davis 1989)	An individual feels positive or negative about using ECG in the classrooms	Learners have confidence, find ECG useful and enjoy using them in the classrooms
Subjective Norms (SN) (Davis 1989; Thomson et al. 2003)	The perception that most people who are important to him/her think he/she should or should not use ECG in the classrooms	Positive influence from their colleagues, friends, supervisors and superiors regarding the use of ECG in the classrooms by students and lecturers .
Perceived Entertainment (PE) (adapted from Pikkarainen et al. 2004)	The degree to which the use of ECG is perceived to be enjoyable in its own right. (adopted and modified from Davis et al, 1992)	The degree of enjoyment, amusement, pleasure, gratification, excitement, stimulation, challenge and competition experienced in playing with ECG in the classrooms.
University Environment Support Factors (UESF) (Ford 1992: BATT instrument)	Elements which influence lecturers' beliefs and their support for technology integration into classrooms. Likewise for technology integration into universities.	A supportive environment for lecturers which will help them to effectively use ECG in the classrooms. This includes resources, professional development, lecturers, students, parents, administrators, buildings and equipment.
Behavioural Intention to Use (BI) (Venkatesh et al. 2003)	An indication of how hard people are willing to try and of how much effort they are willing to exert.	The degree to which lecturers and students are willing to use ECG in classrooms.

Pedagogy

Perceptual Learning Style (adapted from Flemming, 2001)	An individual's unique way of processing information. It is the manner in which an individual learns by involving his senses e.g. feelings.	The way people interpret and understand what they see and observe. It may be categorised into visual, aural, reading/writing and kinaesthetic (VARK Learning Style)
Preferred Learning Style (adapted from Honey & Mumford, 1992)	The unique preferences and behaviours individuals use in learning situations.	The attitudes and behaviours which determine an individual's preferred way of learning. It is categorised into 4 types of learners: Activist, Pragmatist, Reflectors and Theorist (Honey & Mumford)
Teaching style (Grasha, 2002)	Different methods of teaching based upon an individual instructor's beliefs about what constitutes good teaching practice, his personal preferences, abilities, and the norms of his particular discipline.	One of the teaching styles from the 5 categories Expert, Formal Authority, Personal Model, Facilitator and Delegator (Grasha-Riechman)

Attitude towards Playing Computer Games

Play games	The attitude of a student towards playing computer games.	The student does play or does not play computer games (Yes or No)
Levels of experience	The degrees of skill required for playing computer games.	Categorise the levels of skill required for playing computer games ie. beginner, intermediate and advanced.

Demographic

Gender	Male or female	Male or Female
Location of University	Location	University locations classified into metropolitan or regional
Type of University	University Purpose	Type of University classified into either a public or private university.

1.8 SIGNIFICANCE OF THE STUDY

The use of educational computer games has been widespread in many schools at different countries. However, the introduction of educational technologies into the schools and colleges of Thailand has been limited. This study will be the first such investigation into the integration of educational computer games within the Thai educational system. It is also an initial review of all the learning and teaching styles relevant to the use of educational computer games. Designers should focus more on the genres which are suitable for the development of educational games. This thesis aspires to be a platform for the promotion of the design of appropriate genres to integrate effective educational computer games into Thai educational forums.

1.9 EXPECTED CONTRIBUTION OF THE STUDY

It is anticipated that all Thai undergraduate students, lecturers, university administrators, educators and game designers will benefit from this research. This research will provide foundational data to assist in establishing frameworks for the designing of educational computer games. These educational games will offer support for implementing and enhancing educational developments in Thailand.

In terms of benefits to the individual student, introducing ECG in the classrooms for teaching and learning might have effects on their self-esteem, enrich the quality of learning, increase academic performance, engage their learning, and allow students to progress in their learning at their own pace. In addition, with perceived enjoyment, perceived ease of use, perceived usefulness, subjective norms and a good attitude toward the use of ECG, students may have the behavioural intent to use this kind of educational tool for their learning. It is the purpose of this thesis to explore and answer these questions. Moreover, the effectiveness of ECG might increase their cognitive skills, visual skills, motor skills, problem solving skills, discovery,

exploration, and motivation flow. Lecturers might have another new teaching tool which may motivate and make lessons more interactive. Using ECG for teaching might increase a lecturer's teaching and academic performance by enhancing and supporting their teaching. It is also hoped that the findings from this thesis will initiate the idea of ECG classroom use in the future plans of university administrators, educators and/ or academicians. Subsequently, it is hoped that the education sector in Thailand will accept the introduction of ECG in classroom learning and began to use more ECG. As a result, the increasing use of computer games for educational purposes might be a prospective indicator for game developers as well as game manufacturers to realise that the education sectors could be one of the largest markets in the future. This expectation can be supported by the following reports and statistics from many countries.

UK continues to be the largest computer and video games market in Europe and it is also the third largest individual market in the world, after US and Japan. The world market has more than tripled in value over the last decade. In 2004, the market was valued at over $21 billion (ELSPA, 2005). Among these figures, ECG in digital platforms such as PlayStation Portable and Nintendo Dual Screen have been widely used as a learning tool in many schools in UK and Japan (Kane, 2007; Kroy, 2008; Rapeepisarn, Pongpankae, Wong, & Fung, 2008a). The University of Bradford in UK joined institutions in France, Ireland, Finland, Italy, Belgium, and Hungary. They have aimed to improve teaching science subjects through mobile games (Bradford, 2006). According to statistics from the Ministry of Information Industry in China, reported in December 2004, the number of PC online gamers has reached 23 million, with a market scale of 2.57 billion RMB. The PC online game market has been developing with a high speed, showing a great market potential. During the period of 2005, they predicted that suppose all the current 325 million Chinese mobile phone users upgrade

their handsets to the medium or high-end handsets with game functions in the following few years, there would be 108 million mobile gamers in China by that time, and the mobile game market scale would reached 12.1 billion RMB each year (ReportLinker, 2005). At the same time several companies in China explored the educational use of mobile games. For example, New Oriental Education and Technology Group (EDU) has entered into an agreement with Nokia to launch a mobile learning initiative that would give students access to selected New Oriental course via their mobile phones (ChinaTechNews, 2007). Singapore's government invested $6 million to promote games in education and learning in 2009. A PricewaterhouseCooper study shows that by 2011, the global games sector is expected to grow to $ 48.9 billion with a compound annual growth rate of 9.1% in the last five year period. Conservative estimates show that the market of 'serious games'- a genre of educational computer games- is about $9 billion" (Singapore, 2009). The University of Hong Kong also developed a mobile learning platform to enhance the quality of teaching and learning with advanced communication technologies (Rapeepisarn, et al., 2008a). In Japan, mobile learning and using games to teach in Japan have gone beyond mere speculation about these channels for learning (Kato & Ricci, 2006).

Finally, it is hoped that the findings of this study may also lead to motivating other related institutes which likewise intend to adopt educational computer games for their learning and teaching activities.

1.10 STRUCTURE OF THESIS

The structure of thesis is presented in Figure 1.3. The next chapter will present a literature review relating to computer games and education.

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1.3 Research questions
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4.2 Research method & strategies
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- ECG acceptance
- Teaching & learning styles
- Game play behaviour

5.2.2 Inferential data & hypotheses
- ECG acceptance factors
- Univ. Location & univ. type and BI
- ECG acceptance factors measured by learning styles
- Learning & teaching styles and game play behaviour
- Gender and game play behaviour

5.3 Qualitative data
5.3.1 Open-ended questions
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Chapter 6: Conclusions

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Figure 1.3: Thesis Structure

CHAPTER 2
EDUCATIONAL COMPUTER GAMES FOR TEACHING AND LEARNING

This chapter investigates the significance of educational computer games (ECG) for teaching and learning. The computer game industry in Thailand and research on computer games in the Thai context were investigated. Due to ECG being considered as an Information and Communication Technology (ICT) or educational technology tool, teaching with ICT in Thailand was also explored. Therefore, the first part of this chapter focuses on Edutainment and ECG.

Edutainment is a broad term and ECG can be classified under the umbrella of Edutainment. Sometimes, ECG is also considered as one genre under computer games. The subsequent part includes the computer game industry in Thailand and research on computer games in the Thai context and Thai educational systems, especially the teaching with ICT in Thai classrooms. Hence, this chapter presents the following seven sections:

2.1 EDUTAINMENT

2.1.1 OVERVIEW OF EDUTAINMENT

One commonly known term when referring to the combination of learning and entertainment is "Edutainment". "*The concept of edutainment is not new, although the term is a neologism. Edutainment facilities have largely used the education aspects while adding entertainment or amusement*" (White, 2003).

This innovative form of education has been successfully used by many education systems around the world (Addis, 2006b; Amory, et al., 1999; Bredemeier & Greenblatt, 1981; Egenfeldt-Nielsen, 2005; Krotoski, 2005; Oyan & Bebko, 1996; Randel, et al., 1992; Shelly, 2006). Through edutainment, learners can learn through play, learn through doing, or learn through simulation. They are learning through direct experiences which have been viewed as a more effective and enjoyable experience than learning through communicated conventional educational methods. These activities also support learners to develop their social behaviour, physical, emotional, cognitive and intellectual development (Harvey, 1995; Lindon, 2002; Rauterberg, 2004; Singhal et al, 2008; White, 2003; Zoney, 2005).

In brief, edutainment is the act of learning through a media such as television programmes, films, music, multimedia, websites and computer games. Entertainment is the medium and education is the content (White, 2003). The development of an edutainment environment is also intended to implement technological innovations in education (Hussain & Eshaq, 2001).

2.1.2 WHY EDUTAINMENT: CRITERIA FOR LEARNING

Edutainment uses new technologies that stimulate all of an individual's senses which create recreation in the content of the message, both in terms of education and entertainment. Its objective is different from any other form of media consumption. A

message, with both educational and entertainment content, has replaced the object in the general interactive scheme. *"This message contribution and the consumers' contribution (their subjective responses) together create an individual's edutainment experience"* (Adam & Moussouri, 2002). Hence, two essential characteristics of edutainment are: interactivity and delivery of message content. The first characteristic, interactivity, is the ability to respond to a user's input. In other words, the user can choose the topics of interest and the way they find them, and can obtain almost immediate responses to his/her queries. The second characteristic is the ability to deliver the message content in a virtual environment (Shih, 1998). Edutainment users have now become responsible for what they choose to learn. These young generation users approach this learning experience in a way similar to adulthood learning, which is characterised by independent learning (Merrium & Caffarella, 1991).

ECG, as a form of Edutainment, includes simultaneous activities. Through ECG, learners can learn through playing or learn through doing. The following are three themes of learning related to edutainment namely: learn through play, learn through doing and learn through simulation.

1) Learn through play: Play is a natural and universal learning tool for children and adults. It is acceptable that the foundation of learning from childhood is through play. Lindon (2002) pointed out "*from babyhood, children use play to promote their own learning; they do not have to be persuaded into playing*." Through play, the learner can develop, create, alter, resolve and understand. All these basic skills are developed as they explore, construct, imitate, discuss, plan, manipulate, problem-solve, dramatise, create and experiment (Wasserman, 1990). The idea to modify traditional games and toys into the classroom has become one of the most essential areas for

pedagogy (Farne', 2005). Therefore, it makes sense to see play as having a valued and valuable place within a school curriculum (Zoney, 2005).

2) Learn through doing: There are three main learning styles that studies have identified (Longstreet, 2005). They are visual learning, where learners prefer to learn by reading and watching; auditory learning, where learners prefer to learn by listening, discussion and talk things through; and kinaesthetic learning, where learners learn by doing. According to Gardner (1993), a student who possesses the ability to use his/her body or parts of body, such as the hand, to solve problem have well-developed kinaesthetic intelligence. In other words, for people who learn best through doing it can be assumed that they will eagerly participate to movement activities, role play, or hands-on games. In experiential education which relates to learning through doing, the learner becomes more actively engaged in the learning process and studies more independently than in traditional didactic education. Lucker and Nadler (1997) discussed the reasons why learning through doing is effective. The reasons are equality, developing relationships quickly, disequilibrium, projective technique, decreased time cycle, the encouragement of chaos and crisis in a safe environment, kinaesthetic imprint, encourage risk taking, diversity of strengths, and fun.

Both playing and doing are probably the oldest forms that allow learners to experience content. At the fundamental level, it is a method of learning from knowing, doing and being. There are some generalities among these terms as shown in Table 2.1:

Table 2.1: Generalities Among "Learn through Play" "Learn through Doing" and "Edutainment" (Rapeepisarn et al., 2006 a)

Characteristics	Generalities
General concepts	• Amusing activities and learning presented at the same time • Effective teaching strategy both inside and outside school • Key facilitator for learning • Natural and universal activity of children and adults • Having rules, but also being free activity without boundaries • Principle means of learning in early childhood • A way of thinking and a vehicle for intuitive of metaphorical mind • Dynamic, active, constructive behaviour
Activities	Explore, hand on approach, touch, practice, imagine, construct, discuss, plan, manipulate, problem solving, dramatise, create, experiment, use logic, critical thinking, visualise, discover
Foundation skills	Memory, self-regulation, oral language abilities, symbolic generalisations, distancing & de-contextualisation, reflective thinking, & meta-cognition, better social skill, abstract thinking & imagination

The reason why play is so important

Ralph Waldo Emerson, philosopher, poet and essayist noted that *"It is a happy talent to know how to play."* Rebecca Krook, play facilitator for kids also stated that "*When kids play, they remember. They may not be aware they are learning, but they sure are aware they are having fun*." (Sqcribd, n.d.). Through play, humans can acquire skills unconsciously and in a more natural way. It can be an enjoyable lifelong activity. As most educators have pointed out, playing is a recreational activity which is easy and fun to do. There are many reasons why play is so important and the benefits play provides to players. From the beginning of life, babies use play to encourage his/ her learning. Naturally, a baby learns through play without consciously knowing it. Babies need not be persuaded to play. Play supports children in all aspects of their development including: exploring intellectually and physically; extending their skills of communication; giving free run to their imagination; promoting their physical and healthy development; providing a vehicle to demonstrate their knowledge; a representation of their experience and to develop all skills children need, including literacy, mathematical reasoning, creating and social skills. Play helps children to

manage their environment through cooperation, helping, sharing and social problem-solving, to further explore their world (Lindon, 2002; C. S. Rogers & Sawyer, 1995; Wasserman, 1990).

Significance of learn through doing

Research has been done previously on assessing how much people can remember from the learning process. The findings are as follows: about 10 percent of what they hear, 20 percent of what they see, 40 percent of what they discuss and 90 percent of what they do (Hussain & Eshaq, 2001). John Dewey was an early twentieth century promoter of the idea of "learn by doing" or "learn through direct experience". He argued that learn through doing is knowledge acquisition through experience by being involved in genuine tasks. Learning is not a process of transmitting information from someone who knows to someone who does not; rather, learning is an active process on the part of the learner, where knowledge and understanding is constructed by the learners. It can be inferred that learning is not only from reading or listening. Rather, learning mainly comes from doing. In fact, reading creates ideas, and action creates learning. As a part of informal learning, learn through doing is a necessary component of formal instruction in colleges and universities for several reasons. Firstly, lecturers seek student opportunities so as to enable them to enter their chosen professions in the job market. In other words, lecturers are concerned about the effectiveness of preparing future generations for industry (Cantor, 1995). Secondly, more non-traditional learners are choosing college study and demanding more diversified modes of learning. In addition, typical college students are also becoming more demanding with respect to what they can learn from college.

In summary, learn through doing has become an integral part of education which aims to develop a student's curriculum experiences and to connect classroom theory

with real world practice. There are a wide variety of kinaesthetic activities - activities that involve learning through doing – that enhance instruction for learning. A classroom game is one of these activities (Gardner, 1993). A simple conclusion to draw is that learning through ECG is probably the oldest form that allows learners to experience content. Using ECG as a form of edutainment for learning may be the best method for both learning through play and learning through doing.

The effectiveness of "learn through play" and "learn through doing" in edutainment are shown in Table 2.2.

Table 2.2: Effectiveness of "Learn through Play", "Learn through Doing" and "Edutainment"
(Rapeepisarn, Wong, Fung, & Cole, 2006a; Rapeepisarn, Wong, Fung, & Depickere, 2006b; Rapeepisarn, Wong, & Fung, 2006c)

Social behaviour: Self control, more positive social interacts and companionship, more altruistic behaviour, less stereotyped views of other, cooperative, helping, sharing, solving social problems, understand their life experiences ability to take turn, negotiate, compromise, work out conflict, develop skills in leadership & management
Cognitive development: Memory, creativity & divergent thinking, construct knowledge, extending skills of mathematical reasoning, basic skills such as counting, reading, and writing
Intellectual development: Resolving problems, understanding how things work, devising strategies
Emotional development: Love, caring, empathy, curiosity, focusing attention on task, lower anxiety
Physical development: Develop gross muscle control, eye-hand coordinative, coordination of movement & speed, a critical precursor to reading and writing skills
Therapeutic effects: Health care (learn good eating habits from computer games), hyperactivity (active doing may reduce impulsivity), brain development (increase neural structure)
Educational development: Provide education and career development of the learners, supporting professional development, holistic approach which incorporates physical activity together with social & emotional challenges, student-centred teaching and learning, connect classroom theory with practice in community, engaging students in an experience that will have real consequences

3) Learn through simulation: Simulations are experimental activities that have gained acceptance in the classroom at all levels of education and training and in a variety of subject areas. A common definition of a simulation is a reproduction of an item or event which was created from an artificial world that approximates the real one

(Prensky, 2001b). Simulations can be used to present information and guide students and also to test their knowledge. Simulations allow students to explore situations that would be difficult, impractical, or impossible to duplicate in a classroom setting. The main reason people learn through simulation is because there is no risk involved in a simulation. The application of simulation software teaches people to operate hazardous equipment that is no danger to a beginner. In addition, simulation is less expensive, can perform the experiments repeatedly and is more convenient than real experiences. According to Bitter (1989), simulation overcomes the limitations of time. Students can travel to a distant site. They only need a short time to see the result of their experimentations, and they can focus on special aspects of topics or an event.

Most ECG can learn through simulation (Cruickshank, 1980; Fisher, 2008; Jansiewicz, 2005; Kashibuchi & Sakamoto, 2001; Klassen & Willoughby, 2003). The three types of learning mentioned above are related to ECG. As edutainment is a form of integrating media education with entertainment, on the other hand, the concept of learn through play is integrating learning with fun and amusement. Edutainment is a form of learning through doing (Rapeepisarn, et al., 2006a). To learn through doing, which is learning through direct experience, has been shown to be more effective and enjoyable than learning through 'information communicated as facts' (Kirriemuir & McFarlane, 2004). Kirreimuir and McFarlane (2004) claimed two key themes common to the development of games for education are 1) learn through play and making learning fun is the motivational power of game, and 2) learn through doing in games such as simulation offers a powerful learning tool.

2.2 COMPUTER GAMES

This section describes computer games in the following features: game genres and game platforms.

2.2.1 GAME GENRES

Computer game experts classified game genres in various categories. Crawford (1984) divided genres of computer games into two broad groups: 1) Skill-and-action games included Combat Skill-and-Action games: Combat Games, Maze Games, Sports Games, Paddle Games, Race Games; and 2) Strategy games comprised of Adventures, D&D Games, Wargames, Games of Change, Educational and Children games, and Interpersonal Games. Bergeron (2006) concluded that the standard genre of game encompasses Action; Adventure; Arcade (Retro); Combat (Fighting); Driving; First-Person Shooter (FPS); Military Shooter; Multiplayer; Puzzle; Real-Time Simulation (RTS); Role Playing Game (RPG); Shooter, Simulation; Sneaker; Sports; Strategy; Third-Person Shooter (TPS); Trivia and Turn-Based. While Prensky (2001a) affirmed that computer game are generally categorised into eight genres consisting of action, adventure, fighting, puzzle, role-playing, simulation, sports and strategy games. Most games fall within a particular category. Sometimes there are overlaps of genres such as a game is both action and adventure, and these are usually called sub-genres. (Oxford, 2004). Another example of a sub genre is a racing game which is not a core genre in itself, rather a sub-genre of sports. Some bridge different gaming styles and, thus, could appear under more than one category simultaneously. For instant, Battle, Racing, Fighting and Shooting games can be a subcategory of Action games. Strategy game may include Puzzle and Adventure games. Additionally, Role Play Games may be a sub-genre or special type of Adventure games.

In summary, game genre classifications in this thesis was selected and integrated from the standard genre categories (Bates, 2004; Wolf, 2001). The following categories of game genre, alphabetically, provide definitions, characteristics, and examples of

game titles as illustrated in Table 2.3. The game genres used in the data collection in this research is based on the definition listed in Table 2.3.

Table 2.3: Characteristic of Game Genre

Game genre	Explanation of Genre	Example of game title
Action Games	The most well known genre & the largest class of computer games. Keeps the player moving and involved all the time. No deep thinking required, primary skills are hand/eye coordination & quick reflexes. It is often about fighting, battle, shooting, racing and highly intense physical play	Beat-em-up, Survival Horror, Unreal Tournament, Doom, Quake, Missile Command
Adventure Games	Focus on storytelling & narrative. Players must move through a complex world, accumulating tools, overcoming obstacles until finally reaching the treasure or goal. Game play typically needs logical thinking & persistence from the player.	Adventure on the ATARI 2600, Gabriel Knight, Indiana Jones, Monkey Island, Time Zone, Wizard and the Princess.
Fighting Games	Sub-genre of action games and is one of the major computer games. Games involve characters who fight usually hand-to-hand, in one-to-one combat situations. Fighters are represented as humans or anthropomorphic characters. The goal is to create quick bursts of swift and intense action.	Bloody Roar, Dead or Alive, Double Dragon, Fight Unlimeted, Mortal Kombat, Starmaster, Street Fighter, Tekken, Virtua Fighter.
Music Games	Include Rhythm and Dance Games. Game play requires players to keep time with a musical rhythm. This grouping of games is differentiated by the timed elements usually synched to music somehow. Many require a specialised controller like Dance Dance Revolution (DDR), but several don't. May include controller simulating drums, turntables, guitars or maracas.	Beatmania, Bust a Groove, Dance Dance Revolution, Donkey Konga, Eyetoy Groove, Guitar Freaks, Para Para Paradise, Pon 'n' Music, Space Channel 5.
Puzzle Games	Require the player to solve logic puzzle or navigate complex locations. Not surrounded with story or actions. Most puzzles should exclude time pressure, but the rules must be clear.	Atari Video Cube, Devil Dice, Intelligent Qube, Jigsaw, Mercury, Myst, Puzzle Bobble.
Racing Games	Using a motorised vehicle to move faster than an opponent to reach a specified goal or beat a specified time. Usually racing games use cars, but motorcycle, power boat, and flight/space racing games also exist.	APX skiing game DOWNHILL, Dog Daze, Indy500, Night Driver, Street Racing.
Role Playing Games	Player assumes the roles of fictional character and collaboratively create stories. The characters may include specifics such as species, race, gender, occupation. Or also include various abilities: strength and dexterity.	Anvil of Dawn, Diable, Dragon Lore 2, Rivers of MUD, Sacred Pools, Sunflower, Unsafe Haven, Zodiac.
Simulation	Contain a mixture of skill, chance, and strategy to simulate or try to accurately depict real world situations, physics, and events as accurately as possible. There are several categories of simulation games: Racing Simulators, Flight Simulators and 'Sim' type games	Flight simulators: Microsoft Flight Simulator 2000: Racing Simulators: NASCAR; 'SIM' type: SimCity-Brotherbund
Shooter Games	Focus on shooting & often destroying. Sometimes called Shoot-Em'-up. Requires the player to blow enemies or objects in order to survive and continue game play.	Asteroids, Berzerk, Centipede, Duckshot, Galaga, Missile Command, Starwar, Tempest
Sports Games	Games that simulate the playing of any sporting activity. Focus on planning & management. Have to know the rules right but can also let players change them. It may let the players customise the game to suit themselves.	Tiger Woods, PGA Tour, NHL 2004.
Strategy Games	Emphasise on thinking, rationalising, theorising, problem-solving, etc. The focus is the combination of analytical skill & tactics. Require careful and skilful thinking and planning in order to achieve victory.	Chess Games, Civilisation, Command and Conquer, Final Fantasy, Tactics, Ogre Tactics, Roller Coaster Tycoon.

Computer Game Genre for Pedagogy

In some cases, game experts or game developers also classified education games as one genre of computer games. To distinguish from other game genre, the particular purpose of educational games is designed to teach or train with explicit educational goals and based on an actual curriculum. The emphasis is on teaching a specific knowledge. Rather than being structured as a straightforward set of lessons or exercise, these programmes are structured like games, in which such elements as scoring, timed performances, or incentives are given for correct answers. Educational games make use of the whole variety of general game genres (as discussed in the previous section) and teaching subjects making it hard to categorise specifically (Schiffer, 2006). Amongst different genres, researchers (Ju & Wagner, 1997; Quinn, 1994; Roberts, 1976) appeared to concentrate on the two types, simulations and adventure. Quinn (1994) reported that the adventure game appears to provide the best foundation for the development of teaching resources. In addition, Kirriemuir & McFarlane (2003) discovered most education games belong to the strategy and simulation genres.

2.2.2 GAME PLATFORMS

Computer and video games can be played on many platforms. For example, DVD-ROMs of CD-ROMs on personal computers either connected to the Internet or disconnected, television-based systems such as game consoles, game-specific handheld consoles such as Nintendo DS and Sony PSP, and other handheld units such as portable computers or mobile phones (ELSPA, 2006; Rapeepisarn, Pongpankae, Wong, & Fung, 2008c).

There is abundant research indicating that digital games have some potential in teaching and learning (Beak, 2010; Kane, 2007; Kcroy, 2008; Kirriemuir, 2002; Nilsson, 2008; Prensky, 2005a; Rapeepisarn, et al., 2008c). Most games implemented

in the classrooms are PC-based. However, other digital game platforms such as handheld and mobile game devices are used in trials for classroom learning. Game consoles are less common in school classrooms. However, console-based delivery systems can also be used for learning purposes (Miller & Robertson, 2011). One of the most outstanding educational console-based game software is *Lightspan.* The software is curriculum-based and it was developed for the PlayStation Console (Kirriemuir, 2002). Handheld games such as PlayStation Portable (PSP) and Nintendo Duel Screen (NDS) have also been widely used as learning tools in many places including schools in UK and Japan (Kane, 2007; Kcroy, 2008; Rapeepisarn, et al., 2008c) due to their small size, portability, ease and simple use, and their variety of functions. In terms of teaching support, instructors can prepare content in audio or video and provide course guidelines and assignments, or discussion points with reference to text-books. The other popular digital game platform for educational use is the mobile phone. Currently mobile phones are not only just a communication device, but have also emerged as an educational tool for learning. There is an attempt to use this device as a learning tool in schools in many places. The University of Bradford (2006) in UK, for example, is aiming to improve teaching science subjects through mobile games. The University of Bradford joined institutions in France, Ireland, Finland, Italy, Belgium and Hungary to improve scientific teaching within schools. The Department of Electrical and Electronics Engineering at the University of Hong Kong has also developed a mobile learning platform to enhance the quality of teaching and learning with advanced communication technologies. In Japan, most Japanese phones are quite advance and run many different kinds of applications and services. Mobile learning and using games to teach in Japan has gone beyond merely speculating about these channels for learning (Kato & Ricci, 2006).

Additionally, in terms of online games, the Internet has become a predominant channel of communication and access (Kirriemuir & McFarlane, 2003). Most of the digital game platforms mentioned above are able to connect to the Internet for downloading educational games. The Children Go Online Survey (UKCGO) found that 71% of young people have access to the Internet via a home computer, 38% via mobile phone, 17% via digital television and 8 % via a computer game console (ELSPA, 2006).

2.3 EDUCATIONAL COMPUTER GAMES

This section is divided into three parts including: an overview of ECG; use of Educational Computer Games (characteristics of ECG, values and advantages of ECG, and goals and purposes of ECG); and a review of the research on educational use of computer games.

2.3.1 OVERVIEW OF ECG

Educational computer games are today becoming a more popular piece of software in many countries (Amory, et al., 1999; Gee, 2003; Kirriemuir & McFarlane, 2003; Prensky, 2005a). Not only teenagers but people of all ages have been drawn into the computer field through the attractive features of computer games. Playing computer games is not only just for fun but also provides literacy and other information for learning. As ECG is one genre of computer game, it has been the subject of frequent controversy. There are strong proponents and opponents on either side. The proponents claim that ECG, especially general computer games, may lead to aggressive behaviour (Anderson & Bushman, 2001; Anderson & Dill, 2000; Cumming, 2008; Gentile & Walsh, 2002; Nicoll & Kieffer, n.d.). However, quite a number of studies opposed this idea. They found that there was no statistical significant correlation between violent computer games and aggressive behaviour (Sacher, 1993; Stupak, 2008; van Schie & Wiegman, 1997; Vaszily, 2008). Some claimed that there was no reason to think that

games were the cause of aggression (Anderson & Dill, 2000; Cowell & Payne, 2000; Roe & Muijs, 1998). However, one has to realise that ECG with the objectives of education should be different. There are many positive aspects of ECG such as the teaching of many skills, including problem-solving abilities, perseverance, pattern recognition, estimating skills, inductive reasoning, mapping memory, quick thinking, and reasoned judgment (Newser, 2008a, 2008b; Sheff, 1994). From these positive aspects, ECG has begun to play a role in education as teaching methodology (Gros, 2006). This technology has also improved so that lecturers can use edutainment games to reinforce concepts, teach skills and provide problem solving experiences in a pleasing, motivating setting. Researchers (Boop, 2006; Gee, 2003; Gikas & van Eck, 2004; Prensky, 2001a) confirmed that ECG can be used for learning and teaching. It can be used to give a better form of education and can even make computers become the unique tools of learning (Jayakanthan, 2002). This will bring ECG into one of the recognised mediums of education. There are some terms relating to educational computer games that sometimes are interchangeable. Those terms will be discussed in the following section.

Different Definitions of ECG

Educational computer games are games designed to teach students about a certain subject or help them to learn a skill as they play. Some people call these types of games 'edutainment' because they combine education and entertainment. ECG can also be defined as an electronic medium with all the characteristics of the gaming environment that have intended educational outcomes, targeted at special groups of learners. Other related terms are Digital Game-based Learning (DGL) and computer games for education.

The term DGL is a term based on the opinions of Marc Prensky and Paul Gee, who are heavy proponents for the adoption of DGL as an accepted instructional design in K12 and higher education courses. Prensky has not given a concise or formal definition in his book Digital Game-based Learning. However, he infers that all games of any kind, including digital versions of such games as chess and Monopoly, can be used as DGL (Dziorny, 2005).

Computer Games for Education and Educational Computer Games are terms many people use interchangeably. In fact, there are some differences. Basically, computer games for education are games that are designed for game-play and are found to contain educational values. While educational computer games are games that are designed for educational purposes in the form of computer games.

Most genres of computer games are used as a learning tool because computer games have rules, goals, interaction, content and a story. ECG are strongly motivating (Gee, 2003). They teach people to think about complex systems to solve problems in a complex world. Games make the player think about decision they are making and how they impact in this world. Games deploy rich visuals that draw players into fantasy worlds, motivate via fun, via challenge and via instant feedback. The instant feedback ECG provides is a crucial aspect for learning. Gee (2003) claimed that ECG provides certain goals for players to achieve. This makes ECG entertaining. While players achieve goals, they feel success and consequently they are motivated. Prensky (2001) pointed out five levels of learning in a game which includes learning how, what, why, where and when and whether. Table 2.4 illustrates the elements that demonstrate that ECG has the potential to become one of the most powerful tools for learning.

Table 2.4: Elements That Show ECG Are Good for Learning (Prensky, 2005; Blunt, 2006; Garcia, 2005; Juul, 2003)

Elements	Benefit for learning
Rule	Games are rule-based. They are inherent in the game and govern the playing process. This gives learners structure
Goals/ Objectives	Establish the game's rules of play and the criteria of winning, define the conditions of victory. This gives learners motivation.
Active Engagement	Consistent active engagement provides engaging fun to a learner
Challenge	Have a clear goal, preferably with multiple levels so that the feeling of challenge to the learner is continuous.
Content/ Story	Can be simple as instruction to the player; it describes why the players are there, what the goal is, what obstacles they will face along the way. This gives learners emotion.
Fantasy	This makes games more interesting as well as increases the efficiency of learning.
Feedback	Learners need an immediate response to what they have learned. This gives learners learning.
Fun	Learners learn best when they have enjoyment and pleasure.
Immediate Reward	Learners require immediate rewards which help to keep them highly motivated.
Interface	Use of interesting graphical user interface should promote active reflection on the part of learners.
Interaction	Design the way players interacts within the game world, e.g., the way they jump, shoots, or dunks; how they interact with their competition or enemies. This introduces learners to social groups.
Interactive	This provides learners activity. Learners are interactive with games they play.
Outcome	The outcome of the game is win, lose or draw depending on the nature of the game. Some games have no outcome. This gives learners a sense of achievement.
Play	Learners learn things through play. This also gives them intense and passionate involvement.
Problem Solving	This sparks the learners' creativity while they are problem solving on the game they are playing.
Quick adaptation	Performance is based on quick adaptation using trial and error methods. This gives learner flow

2.3.2 THE USE OF ECG

Children growing up today can benefit from ECG because they are already exposed to a society that is increasingly dependent on digital technology. The medium of educational games provides an opportunity for lecturers to introduce educational and playful elements into the learning environment. With computer-aided learning programmes, lecturers may assist students on social aspects such as critical learning, knowledge-based communication and effective interpersonal skills. Researchers today have found that computer games can become part of the school curriculum. Researchers (Amory, et al., 1999; Gee, 2003; Kirriemuir & McFarlane, 2005; Miller & Robertson, 2011; Prensky, 2001a) (Garcia, 2005) found that computer games have significant

educational value. The characteristics, values, advantages, goals and purposes of computer games are described next.

2.3.2.1 Characteristics of ECG

Basically, ECG has the same characteristics like any other type of computer game. The particular aspect of this type of game is designed to teach in which the main objective involves the learning of a lesson. Instead of being structured as a straightforward set of lessons or exercises, this type of educational software is structured like games, with such elements as scoring, timed performances, or incentives given for correct answers. The degree to which these programmes can be considered games varies greatly. Some examples of ECG include: Basic Math, eduProfix, Mario's Early Year, Fun with Numbers, Mario Teachers Typing, Math Blaster, Episode 1, Math Grand Prix, Morse, Number Games, Pelmanism, Playschool Math, Spelling Games, Urban Jungle, Word Games, Zoombinis. Like other computer game, ECG have these characteristics (Garcia, 2005):

1. Speed: rapid information must be processed during the game in order for the learner to construct knowledge.
2. Parallel processing: the ability to process parallel streams of information, or multitasking, is a hallmark of the digital generation population.
3. Active engagement: consistent active engagement contributes to high levels of engaging fun a leaner has when playing a digital game. Quick adaptation and problem solving: today's learners live in a world of constant action and where performance is based on quick adaptation using trial and error methods to solve Immediate reward: offering numerous immediate rewards within a game helps to keep learners highly motivated.

4. Fantasy: within the context of the game, fantasy leads to greater interest on the part of the learner as well as increased efficiency of learning.

2.3.2.2 Values, Advantages of ECG

There are many claims about the usefulness of computer games for learning (de Freitas & Maharg, 2010; Egenfeldt-Nielsen, 2005; Gee, 2003; Kirriemuir & McFarlane, 2005; Miller & Robertson, 2011; Prensky, 2005a; Whitton, 2009). Research has led to a situation today where computer and video games have become a common leisure activity for everybody including children, teenagers and adults. As mentioned in the last section, computer games are media based on playing and fun. Most studies also showed that people can learn from play. The questions subsequently arises such as what is the educational value of computer and video games; can computer games motivate the learning environment and if yes, what motivation do they provide; or how computer games are being used to assist teaching and learning in the classroom?

In the past, education has not been considered as a "fun" activity. However, there are now many educational software companies who have recognised the influence and real educational value of computer games and accordingly have incorporated some of the best educational designs. To consider the educational value of computer games, we can see the positive effects of these games in a variety of ways. For instance, ECG encourage the development of social and cognitive skills such as maths, spelling and reading skills; promote the development of strategic thinking, planning skills and problem solving; offer engaging interactivity; offer motivation to users and learners to be able to contribute to achieving educational objectives (Boylan, 2005).

In a learning environment, motivation is important because learning requires effort. ECG can motivate children to learn, according to a report from Ultralab (PublicTechnology.net, 2004). The report is based on a review of research literature,

providing plenty of evidence to show that the alleged "addictive" nature of ECG can be used to help learners to work towards educational goals. ECG can bring a tremendous amount of motivation to a learning environment. ECG motivates children by creating room for friendship and social events. Thus learners can share a subject of mutual interest. Through playing games children can acquire and develop competency such as eye/hand coordination, problem solving, reaction, keyboarding, understanding connections and working with hypothesises. ECG also motivates by challenging a student's thinking, fantasy and creativity.

In terms of social learning, most ECGs can use in a professional context fall into the following categories: teaching, training, operation research, therapy, and entertainment. Among fields that most use games for teaching and training are management science, economics, psychology, sociology, political science, military science, and education. ECGs are often used for training and teaching interpersonal and intercultural communication principles and skills. Social simulation and computer-based role-playing games can help adults explore skills, methods, and concepts rapidly within and engaging nonthreatening and behavioural learning components (Raybourn & Waern, 2004)

2.3.2.3 Goals and Purpose of ECG

Although all games are in some way educational, ECG is designed with explicit educational goals in mind. The main goals and purpose of ECG are designed as a learning tool in order to train or educate people. Even though it may have other purposes such as marketing or advertisement, this type of game needs to retain both an enjoyable experience and educational content.

Many ECG of the past have been skill-and-drill. A common example is MathBlasters. One could argue that there is a place for skill-and-drill in learning; others

might suggest that ECG needs to be built on a constructivist or social constructivist theoretical framework (Ferdig, 2007). When ECG is adopted as a learning tool in classrooms, lecturers should adapt the learning materials to maximise their potential to support learning. As such, the pedagogical value should definitely be taken into account. To understand how it is being enacted through classroom use, Calvo (cited in Gros, 2006) suggested that games can enhance the following functions: 1) motor development, 2) intellectual development, 3) affective development and 4) social development.

In terms of social learning theory, Bandura (1977) emphasizes the idea of observation learning, mental state and modelling process. ECG can serve as a social learning tool. Game players can learn from one another including such concepts as observational learning, imitation, and modelling (Ormrod, 1999)

Moreover, outcomes from several research proved that a significant correlation exists between game playing and a children's problem solving skill and cognitive style (Dreyfous, 1994; Gee, 2003). Kafai (2006) inferred that both instructionist and constructivist perspectives should be involved in making games for learning. In order to make educational computer games "educational", Fisch (2005) suggested that when designing ECG the following matters should be included: 1) matching the education topic to the media, 2) place educational content at the heart of game play and 3) build feedback that supports learners in difficult contents.

2.3.3 REVIEWS OF RESEARCH ON EDUCATIONAL USE OF ECG

Egenfeldt-Nielsen (2006) gave a reason why there needs to be an overview of research in the educational use of computer games:

> *"The educational use of video games is central to the broader area of learning with video games and throws up one or two unique problems related to*

educational scope. We still lack an exclusive overview (on the use of video games for education) focused on the implications of using video games within an educational context. The educational setting presents unique problems in terms of methods, focus, and relevant research questions"

The purpose of this section is to review ECG which promotes and supports learning, ECG and instruction, ECG design impacts on learning and social development, ECG and academic achievement, ECG and learning-centred methodology, and ECG and learning style.

ECG promotes and supports learning: the Federation of American Scientists (2006) provided an overview of the educational value of games, especially in expanding a student's cognitive skills, why they have not yet been easily adopted, and recommendations for action. One interesting finding: *"evidence suggests that good games motivate learners to seek knowledge outside of the game in order to improve their performance. How curricula could be designed to exploit this quality should be explored."* Shuler (2007) also examined the key factors influencing game and learning environments and makes recommendations to expand children's educational media. The use and impact of games on learning were also described in Squire's (2004) PhD thesis. Squire examined the use of Civilisation III for learning world history in grades 6-9. He discussed theory and pedagogic techniques, and then analyses how students learn, what they learn, and how the game mediates students' understandings of history. BBC News (2006) reported video games have a role in school. The finding showed that 59% of teachers would consider using off-the-shelf games in the classroom while 62% of students wanted to use games in school. However, there is a generational divide among teachers and students. More than 70% of teachers never play games outside school while 82% of students said they played games at least once every night.

In addition, Egenfeldt-Nielsen (2006) showed an overview of the effectiveness of learning using ECG, as illustrated in Table 2.5:

Table 2.5: An Overview of Studies on the Effectiveness of Learning from ECG

Author(s)	Year	Genre	Subject	Results
White	1984	Simulation	Physics	Playing the game improved students' problem solving ability related to physics in relation to how force influences motion.
Forsyth & Lancy	1987	Adventure	Geography	The adventure game results in children learning geographic locations with strong retention.
Wiebe & Martin	1994	Adventure	Geography	There is no difference in learning geography facts and attitudes between video games and teaching activities not on a computer.
Betz	1995	Strategy	Engineer	Video games increase motivation and learning among students.
Sedighian	1996	Strategy	Math	The learning outcome is critically affected by teachers' integration of video games and traditional teaching, but video games prove highly effective.
Thomas et al.	1997	Adventure	Sex education	Students learn from playing games both on specific knowledge items and in self-efficacy.
Jolicoeur & Berger	1998		Fractions Spelling	Students learn from video games, but education software is more effective.
Klawe	1998	Adventure	Math	Video games are effective in teaching students about math.
Bensen et al.	1999		Sexual education	Video games are motivating and can improve knowledge related to sexual education.
Noble et al.	2000	Action	Drug education	Students taught through video games find the experience motivating and want to play the video games again.
Lieberman	2001	Action	Asthma, diabetes	A review of a number of research projects supports the notion of learning from video games.
Gander	2002	Strategy	Program-ming	The study finds that video games are especially effective for teaching specific knowledge.
Rosas et al.	2003	Action	Reading and Math	Video games increase motivation, and there is a transfer of competence in technology from using the video game.
Squire et al.	2004	Simulation	Physics	Students using the simulation game performed better compared to the control group.
Egenfeldt-Nielsen	2005	Strategy	History	Students initially learn the same in history when using video games but have better retention.

*Extract from: Egenfeldt-Nielsen (2006)

From Table 2.5, it can be inferred that ECG is already used in various fields of subject areas and are also implicated in various genres of games. Dziorny (2005) mentioned that ECG, or digital game-based learning, is also mostly used in business as well as academically, especially in higher education.

ECG and instruction: One of the research papers bringing attention to the idea of video gaming instruction to a larger audience of educators is Forman's (2004b) *Video Game Studies and the Emerging Instructional Revolution.* Sanford et al. (2006) also supported the idea of teaching with games. They examined teachers' and students' use of, and attitudes towards, commercial off-the-shelf games in schools. Ten case studies were completed in four schools using Sims 2, RollerCoaster Tycoon3 and Knights of Honor. In addition a simulation game –simSchool- was used as a game for teaching (Zibit & Gibson, 2005). This simulation game was designed for teacher's pre-service training. Immersed in a simulated classroom, simSchool players must analyse student learning in order to succeed at the game. One of the classic books concerning educational use of computer games is Prensky's (2001a) *Digital Game-based Learning*. He explained what digital-based learning is, why it is different and better, why it is not just another fad, where it can be used, and how to implement it. Prensky also explained how computer and video games are preparing children for the twenty-first century in his article: "*Don't Bother Me Mom- I'm Learning*". Another frequently referenced book on ECG is Gee's (2003) *What Video Games Have to Teach Us About Learning and Literacy.* Gee discussed the cognitive development that can occur when someone is trying to escape a maze, find a hidden treasure and, even, blasting away at an enemy with a high-powered rifle. Johnson's (2006) *Everything Bad Is Good for You* is another famous publication on computer games in education. Johnson argued that the junk culture we are so eager to dismiss is in fact making us more intelligent. On his book-*Mind in Play*, Kafai (1995) pointed out a whole aspect of using games and simulations in the classroom that is missing from much of the discussion on games and learning. She focused on the learning of science, mathematics, programming and team working skills. The other book is *How Computer Games Help Children Learn* by Shaffer

(2006). David Shaffer showed how to mine the potential of computer game technologies to transfer learning to the home, in communities, and in schools.

ECG design impact learning and social development: Barab et al. (2005) described their article on Quest Alantis, a free learning and teaching project. They described how the game's design impacts learning and social development. The designers of Quest Alantis reflect on the social learning taking place in the environment, the challenges of "policing" student behaviour, and the impact on real-world behaviours (Barab, et al., 2005). Another book that reviewed the aspect of game design is Koster's (2003) *A Theory of Fun for Game Design*. He reviewed the aspect of game design that makes games fun, connects them to learning, and how to balance the challenges for players.

ECG and academic achievement: Blunt's (2006) PhD dissertation presented results from a comparative study using a simulation (Virtual U) in a college business course. Students who used the game for 4-8 hours in addition to standard coursework scored significantly better in the examination. An increase of about 20 points was found, regardless of gender, across all ages from 18-40. A similar study of ECG and academic achievement was conducted by David McDivitt (2008). He used *Muzzy Lane's Making History* in his history study classes to teach the events leading to World War II; three classes used game-based lessons for one week while two did not. The game-based classes scored significantly better on tests, especially essays, about European geography and the causes of the war. Many academics agreed with this concept. For example, Gee (2003), author of the book *What Video Games Have to Teach Us About Learning and Literacy,* said the best games force children to take calculated risks-but unlike in school, if they fail they do not get an F grade, they get

another life. "*Humans like to learn and they like complexity, just as long as it isn't tied to their ego*," Gee said.

ECG and learning-centred methodology: ECG creates a learning centred, learner-guided environment. Students have control over where they go and what they do within the game. The game also allows the freedom to freely explore and experiment within the environment. As students continue to play, they must constantly readjust expectations and interactions based on the causes and consequences of each interaction (Gee, 2003). According to Begg, Dewhurst, and Ellaway (2003), this is a description of a "model paradigm for proactive self-reflective critical learning." Learning centre allows learners to learn through direct experience and through self-learning. Aldrich (2005), *Learning by Doing*, designed for learning professionals and drawn on lessons from both game creators and instructional designers. This guide explained how to select, research, build, sell, deploy and measure the right type of education simulation for the right situation.

ECG and learning style: many educational researchers have studied learning styles, but the study of the relationship of learning styles to learning in the game context is scarcely found. Researchers are emphasising that ECG should be developed by considering the learning styles of students (Chong, Wong, & Thomas, 2005). However, there was a research conducted by Chong et al. (2005) on the impact of learning styles on the effectiveness of digital games in education. They conducted a survey based on Honey and Mumford four types of learning styles on 50 undergraduate students in INCI College Malaysia. They choose three different genres of games. The results showed that student's preferences for the games vary with reference to learning styles. Chong et al. concluded that they need to conduct further studies on different types of learning styles as well as different game genres.

2.4 COMPUTER GAMES IN THAILAND

The computer game industry in many countries has become bigger than other entertainment businesses as such as movies or music. The digital game industry in Thailand is also blooming and progressing enormously. This section presents an overview of the computer game industry in Thailand in two aspects: 1) Thailand digital game development and 2) Thailand game users.

2.4.1 THAILAND DIGITAL GAME DEVELOPMENT

Globally, the computer games industry has become bigger than other entertainment businesses. In 2006, the United States had the highest market value of 333 billion Baht at an exchange rate of 37 Thai Baht to 1 USD (referred to rate quoted by the Bank of Thailand in 2006) (SIPA, 2007). This is followed by the Japanese game market with a value of 187.8 billion Baht, and the Korean game market with a value of 102 billion Baht (SIPA, 2007). Even though the game market in Thailand is rather small in comparison with other markets, the Thai game industry has 5.7 billion Baht in market value which is about 0.61% of the world market (SIPA, 2007). The digital games industry in Thailand is now growing and progressing rapidly with government support under the national IT plan (Thuvasethkul & Koanantakool, 2002).

In the e-Education aspect, as mentioned in Thai National IT policy called IT2010, educators tend to concentrate on what a specific ICT technology can and cannot do for education. Even though many of the technologies have similar characteristics, one technology may have different potentials depending on the purpose for using it. The personal computer and Internet have high flexibility and high interactivity (Hadded & Jurich, 2002). Among various ICT technologies, the computer can also be used as an auxiliary tool in many subject areas including mathematics, sciences and languages. Computer simulators are a good example of the power of technology to improve the

learning process. They are becoming essential tools for in airplane pilots and in medical training. Computer and video games have also started to gain attention in the domain of education and entertainment. Similarly as young people around the world grow up playing digital game in everyday life, Thai children and adults will also spend their time several hours a day playing digital games. Thai software industry associations have taken notice of the rapidly growing demand for digital games. With the government support under the national IT2010 plan, the government's Software Industry Promotion Agency (SIPA) was established to promote Thailand as a leader in the Asian animation and game industry. Other supports also came from related IT associations such as the Association of Thai Software Industry (ATSI) and the Association of Thai Computer Industry (ATCI). The goal of ATSI is to support the software industry in conforming to international standards, while ATCI represents computer software and hardware, distribution and reseller companies and focuses on trade-related issues (Danish-Embassy, 2007).

The annual output values of the software industry in Thailand have increased over the past year. Table 2.6 illustrates growth rates in the software sector from 2005-2008 (Danish-Embassy, 2007).

Table 2.6: Growth Rate of Software Sector 2005-2008

	Recent growth		Expected growth	
	2005	2006	2007	2008
Value in mil. TBH (USD)	41,435 (1,234)	50,917 (1,516)	60,795 (1,810)	77,039 (2,294)
Growth/Expected growth (%)	27	23	19.4	26.7

In terms of the digital game development in Thailand, the International Game Development Association reported that there are roughly 43 Thai Game development companies. It can be observed that they are competing with each other in producing and

developing game applications using various tactics. One of the leading companies is Cyber Planet which has continuously developed game applications. Apart from PC games, Cyber Planet also produces a number of mobile games. Another is Asiasoft Corporation Public Company Limited, a leading online entertainment service provider in Southeast Asia, who focuses on online services in Thailand, Singapore, Malaysia, and Vietnam (IGDA, 2006; Pornwasin, 2009). Table 2.7 illustrates samples of game developing companies, their websites and what they have done.

Table 2.7: Sample of Game Development Companies Listing (IGDA, 2006; Pornwasin, 2009)

Company	website	Profile/business
Asiasoft International	http://www.asiasoft.co.th	Providing games & promoting online content in Thailand, core business covers Online Massive Multiplayer Games
Cyber Planet Interactive	http://www.cyberplanet-i.com	The first & largest developer, product line is casual games available on Nintendo Wii, DS, Playstation2, PC, mobile
Debuz	http://www.debuz.com	Develop game on the mobile phone, outsourcing & co-production for leading services
Digital Asia Concepts	http://www.dacl.net	Produced the famous legend of Ramayana, produced an illustrated book, 3D motion pictures & games
ImagiMax	http://www.imagimax.com	The leading animation & design studio, offers services into 8 categories, CGI for TV Commercial, 3D animation for film, CGI for digital game, etc.
Polygon Devices	http://www.polygondevices.com	Developed 100 % 3D Engine technology, won prizes in the NSC National Software Contest
Sanuk Software	http://www.sanuk.biz	One of the leading game development studio in Bangkok, does projects initiated in-house & commissioned projects

Among many platforms for digital games, the director of SIPA (2007) mentioned that the growth of the PC game market is not going as fast as mobile games due to the higher investment; however, online games seem to be the biggest market now. The speedy growth of online game usage is owed to the accelerated expansion of Internet users. Apart from online games, the Thai games industry can be divided into another five sectors, which are mobile games, console games, handheld games, PC offline games and arcade games. The domestic game market of Thailand has grown rapidly since 2003 due to a large number of gamers entering the market and the

emergence of online games for Thai communities (SIPA, 2007). The increasing growth of six game sectors is shown in Table 2.8.

Table 2.8: Thai Game Market Value by Game Platforms (SIPA, 2007)

Game Platform	2003	2004	2005	2006
	mil. Baht	mil. Baht	mil. Baht	mil. Baht
Online Game	970 (30%)	1,540 (38%)	1,800 (38%)	2,370 (42%)
Mobile Game	115 (4%)	130 (3%)	148 (3%)	170 (3%)
Console Game (Software)	490 (15%)	590 (14%)	700 (15%)	850 (15%)
Handheld Game (Software)	160 (5%)	180 (5%)	250 (6%)	300 (5%)
PC Offline Game	300 (9%)	330 (8%)	360 (8%)	392 (7%)
Arcade Game	1,200 (37%)	1,320 (32%)	1,450 (31%)	1,600 (28%)
Total	**3,235** (100%)	**4,090** (100%)	**4,708** (100%)	**5,682** (100%)

Looking at 2007, the gaming industry in Thailand is still in its nascent stage. The whole market is valued at about US$ 50 million (Bt 1.71 billion) – a small sum compared with the annual turnover of just one game developer in the US, Electronic Arts (EA), which took in $2.95 billion last fiscal year. At the end of year 2007, there was an attempt to lift local mobile game software to the international level through the setting up of the Thai Game Software Industry Association. The association is to encourage the growth of the local game industry, especially with the standardisation of game software developments among Thai game software companies. The association not only sets standards but also gives certification to local game products. Creating standards for local mobile game development, training developers, finding sources of funding and creating an international market is the focus. The association collaborates with universities and government organisations to train game developers. The industry

has around 300 developers, but to make Thailand a game-software development destination requires 5,000 developers (Nation, 2007).

In brief, it is obvious that the gaming industry in Thailand is growing rapidly. Unfortunately, the popularity of employing computer games for teaching and learning in schools is rather scarce.

2.4.2 THAILAND'S GAME USERS

The National Electronics and Computer Technology Centre (NECTEC, 2007) survey found that from 2003 to 2008, The number of Thai Internet users has increased from 6 to 15.2 million. This rapid rate of increase came from a variety of options like Internet connections such as dial up, ADSL, mobile connections, cable modems and satellite dishes. The NECTEC survey also reported that most online game players are students under 20 years old. The majority of them play at home; others play at Internet cafés, at school, and at the work place respectively. The SIPA study found that the online game market is continuously and rapidly growing at a rate of 25 % per year. Starting in 2003, the online game market in Thailand had value of 970 million Bahts (US$ 29 million), then the value increased to 2,370 million Bahts (US$ 70.5 million) in 2006 and 2007 respectively. The figures clearly indicate that the opportunities for online game business in Thailand are growing.

SIPA also conducted a survey to study the basic characteristics and commonalities of Thai game users. The survey was based on a questionnaire with a total of 1,224 respondents who ranged in age from 9-45, in major cities throughout the country. Figure 2.1 to 2.4 illustrates the age groups, educational levels, time levels, and preferred game platforms (SIPA, 2007).

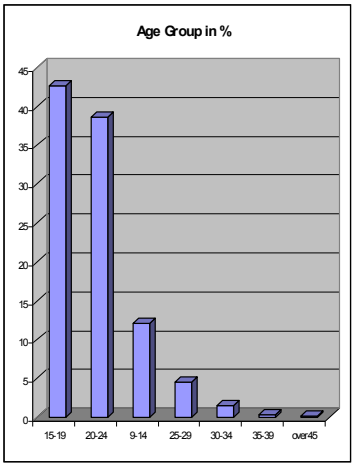


Figure 2.1: Age Group of Game Users

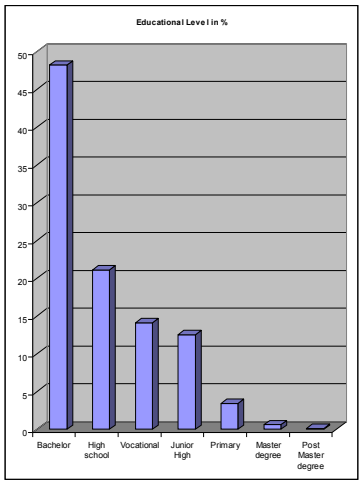


Figure 2.2: Educational Levels of Game Users

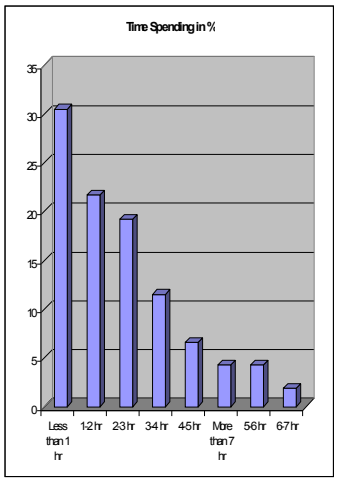


Figure 2.3: Average Time Spent in Playing Games

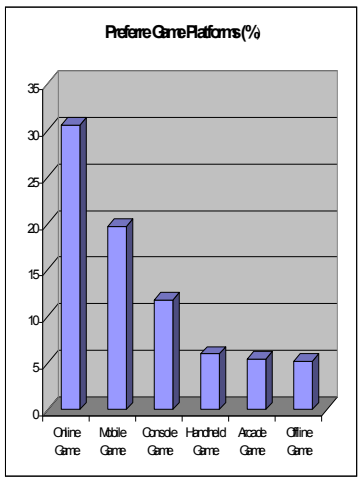


Figure 2.4: Preferred Game Platforms

Source: Thai Digital White Paper: Animation & Games 2007 (SIPA, 2007)

Age Group of Game Users (Figure 2.1):

The respondents' age ranged from 9-45 years old. Most of them were 15-19 years old (42.6%) followed by 20-24 years old (38.6%) and 9-14 years old (12.1%). The least, only 0.2%, were people over 45 years old.

Educational Levels of Game Users (Figure 2.2):

Most of the game users were undergraduate students (590 out of 1,224 or 48.2%). 258 of those (21.1%) were in high schools. Students in vocational schools were in the third place with a total number of 173 (14.1%).

Average Time Spent in Playing Game (Figure 2.3):

30.5% of game users responded that they spent 30 minutes to 1 hour a day playing games, while 21.7% of the game users spent 1-2 hours per day playing games. People who play games more than 7 hours were 4.3%.

Preferred Game Platform (Figure 2.4):

The highest percentage of people who enjoyed online games was 30.6, followed by those who preferred mobile games (19.7%), and those who preferred console games (11.8%). The percentage of people who preferred handheld, arcade and offline games were approximately the same with 6, 5.5 and 5.2 respectively.

All in all, the above SIPA survey shows only the demographic data in general for Thai game users. Missing is any investigation on game play behaviour for students at the tertiary level and also lecturers in university. These are the target groups in this thesis.

2.4.3 RESEARCH ON COMPUTER GAMES IN THAI CONTEXT

The Thai Library Integrated System (ThaiLIS), one nationwide network, gathered the collection of 41 research on computer games in the Thai context from 1993-2008. This includes research papers, articles and theses. The research on computer games were classified into two broad categories: technical and social/psychology aspects. As can be seen from Table 2.9, most of them are in the social/psychology aspect (82.9%), the rest are in the technical aspect.

Table 2.9: Research on Computer Games in Thailand

		frequency	(%)
Categories	Technical	7	17.1
	Social/psychology	34	82.9
	Total	**41**	**100.0**
Target subject	Primary	5	12.2
	Secondary	12	29.3
	Tertiary	3	7.3
	Not mentioned	21	51.2
	Total	**41**	**100.0**
Research Location	Bangkok Metropolis	21	51.2
	Regional areas	20	48.8
	Total	**41**	**100.0**

Among these research, most of the target subjects focus on secondary school students. There are five on primary school students and only three emphasised the tertiary level (undergraduate students). The proportion of research locations between the Bangkok Metropolis and regional areas is approximately the same with percentages of 51.2 and 48.8 respectively.

2.4.3.1 Technical Aspects

The research on technical aspects focused on creative games and program development. One of those, Warachai (2003): *Learning Objected Programming Concept with Warrior Code*, developed games using object-oriented programming by Warrior Code. The Warrior Code is a Java game that can be used with a general micro computer. The software used in this research is DirectX, Macromedia FlashMX, MS Visual Basic, CDX Engine, and Artificial Intelligent with A Star algorithm. Game genres created from this research are RPG, Puzzle and Fighting.

2.4.3.2 Social and Psychology Aspects

Most research on computer games in the social and psychology aspects (82.9%) are behavioural studies (43.3 %), followed by studies on game addictions (13.5%). Attitude surveys, effect from playing games, intelligent tests and mental health/ counselling were in the same proportion (8.1%) The figure of the proportion is illustrated in Table 2.10:

Table 2.10: Computer Games in Social/ Psychology Aspects

Social/ Psychology Aspect	frequency	(%)
Attitude survey	3	8.1
Game addicted	5	13.5
Effect from playing game	3	8.1
Behavioural studies	16	43.3
Intelligent test	3	8.1
Mental health/ Counselling	3	8.1
Cognitive, emotion, creative thinking	4	10.8
Total	**37**	**100.0**

2.4.3.3 Education Aspects

Among research on social/ psychology aspects, there are 13 effects focused on education. Most of them were conducted on learning achievement such as Chaichana (2003): *A Comparative Study of Learning Achievement on Art Composition Through Computer-assisted Instructional Games With and Without a Cue in Serial Summaries;* Silbutra (2006) : *Learning Achievement on Computer Role-Playing Game for Practicing Reading for Main Idea for secondary school students;* and Tesvisal (2006): *A Comparison of Learning Achievement Between Computer Assisted Instruction Through a Game and Traditional Instruction in English on the Lesson Entitled School of Grade 4 students.*

Two of them focused on the learning achievements when teaching with games between genders. The first one is a thesis of Srinaprom (1998) : *The Comparison of English Spelling Achievement of Grade 6 Between Traditional Game and Computer Game;* and the other is Ngaosumarng (2006): *Factors Related to Behavioural of Computer Games Playing of Lower Secondary School Students in Bangkok Metropolis.* The former found that there was no significant statistical difference between genders while teaching with traditional games. On the contrary, there was statistical significance at a level .05 between boys and girls when teaching with educational games. Nevertheless, the later found that learning achievements between boys and girls who learned by computer role-playing games was no different at the significance level of .05.

The subjects used for teaching with computer games in that research are English language skill (n=5), scientific creativity (n=1), mathematic practice (n=1) and art composition (n=1). Most of them call attention to English language skill. The skills tested by computer games are spelling, grammar and reading comprehension. Amongst

the research on English language skill, Laohasurayodhin (1993): *A Study of English Learning Achievements in Using "-ING" of Grade 5 Students through Three Type of Computer Game-Assisted Instruction*, employed three game genres namely: adventure, shooting and puzzles. The results revealed that there were no significant statistical differences among the three genres of computer game-assisted instruction, at a level of .05. The study of scientific creativity by Thummatong (1998) on *The Effect of Computer Games on Scientific Creativity of Lower Secondary School Students* found that the group which was taught by using computer games possessed significantly higher scientific creativity than the group taught by the school's conventional instructional programmes at a .05 level of significance.

It is noted that all this research focused only on learning achievement and they were targeted on primary school learners. There is also no evidence from the research to show the respondents' acceptance of ECG for their teaching and learning at school.

2.4.3.4 Behavioural of Playing Games

As can be seen from Table 2.10, the subcategory of social aspects that was most studied were behavioural studies (43.3 %). From 16 behavioural research studies, it can be concluded as follows:

2.4.3.4.1 Preferred Game Genre

Most of the target subjects preferred playing action games the most. This included fighting and shooting. Other games they played were RPG, adventure, simulation, sport, and puzzles.

2.4.3.4.2 Reasons for Game Playing

Amusement and the release of stress were the main reason most respondents answered. Interestingly, in regard to making the decision to play games, some were curious, followed a playmate, bored from old activities, exhorted by friends, challenged

from friends, etc. One research, Wannaprapa (2004), mentioned that the reason that computer games are engaging and motivating is that it can affect a player toward addiction. Programs attributed to the players' addiction were performance level of game players to show their expertise, online and virtual society, playing in a group could make them famous, challenge, item of the game (it was a reward), character (players could develop a character/s by themselves), competition in order to compete (for the development of characters to become an expert over another person), creating many tasks for the player to do, speciality of the programs, ease of play, beautiful pictures, and ease of communication.

The SIPA survey (2007) found that approximately 42% of the respondents experienced Thai-made games. The reasons for game playing are: easy to play (18.7%), recommended by friends (15.8%), support Thai developers (14.6%), attractive content (13.1%), beautiful images/characters (9.7%), low prices (7.1%), good promotion (3.4%), various game items (2.7%), less bugs (2.4%) and others (2.3%).

2.4.3.4.3 Place of Playing

Most of the players preferred to play at home, while some played at Internet cafés. They chose to play alone rather than play as a team or group. The percentages of the place of playing in descending order were: home/accommodation (64.1%), Internet café/game rooms (27.8%), schools/ colleges/ universities (3.8%), working places/ offices (1.9%), other (0.8%) (SIPA, 2007).

2.4.3.4.4 Day and Time of Playing

Holidays and weekends were the most favourable day for playing games. 4 to 8 pm. was the most prefer time people want of play. Some preferred from 8 to 12 pm.

2.4.3.4.5 How Often Do They Play?

Generally, 1-3 hours a day was the preferred period per day people like to play. In addition they mostly played 1-3 times a week. On average, each time people spent on playing games is 30 minutes to 1 hour (30.5%). Only 4.3 % spent more than 7 hours a time (SIPA, 2007).

In summary, the above research focused on the behaviour in playing games. The target groups were Thai game players in general. These figures did not mention the population specifically on tertiary students or university lecturers which were the target groups of this thesis. Additionally, rarely found was any research that investigated the acceptance on ECG for teaching and learning in the classrooms in Thailand, even though ECG has been accepted as a learning tool for classroom use in many countries (Amory, et al., 1999; Gee, 2003; Kirriemuir & McFarlane, 2005; Prensky, 2001a). Thus, the need to investigate the use of ICT in teaching in Thailand is necessary. Consequently, the following section explores teaching with ICT in Thailand.

2.5 TEACHING AND LEARNING WITH ECG IN THAILAND

The advances in science and technology have changed the world we are now living a society of information. Worldwide high-speed communication, driven via modern, mass media and information which easily accesses people's daily lives, at both home and office, is known as information communication and technology (ICT). This breakthrough has caused humans to depend on information technology (Pitiyanuwat & Anantrasirichai, 2002).

Like many countries, Thailand has exploited the benefits of ICT to move to a "Knowledge-Based Society and Economy (KBS/KBE)". Chapter 9 of the National Education Act of 1999 (ONEC, 2000) mentioned the importance of promoting information technology as an integral part of learning and educational reform. This is

not only a condition to bring about the integration of ICT in education, but the National IT Policy 'IT2010' is also an another important force to push ICT into the learning and teaching environment. One of the five flagship projects to achieve the aim of ICT development is e-Education. Hence, this section paves the background of 'from IT2000 to IT 2010'; 'ICT in Thai Classrooms'; 'integration of ICT in Thai higher education'; 'lecturers and student's attitudes toward ICT'; and 'integrated ICT for a classroom environment'.

2.5.1 FROM IT2000 TO IT2010

The first Thai national IT Policy, called IT2000, was announced by the National IT Committee (NITC) and endorsed by the Cabinet in February 1996. IT 2000 put forward the vision for the country to properly utilise IT to achieve economic prosperity and social equity. To this end, the policy emphasised three common development agendas: (a) to build an equitable national information infrastructure (NII), (b) to invest in people to accelerate the supply of IT manpower and to develop an IT-literate workforce, and (c) to achieve good governance through the use of IT in delivering public services and in government administration (Thuvasethkul & Koanantakool, 2002).

IT 2000 has provided the framework and guidelines for subsequent IT policies and initiatives for the past five years. Since then, ICT has changed tremendously, both in terms of technological advancement, as well as its widespread application in virtually all sectors of the economy. Subsequently, the NITC secretariat has teamed up with the Policy Innovation Centre at King Mongkut University of Technology Thonburi, to conduct research and develop a ten-year National IT Policy for the period 2001-2010, called IT2010. IT2010 identified five main flagships that have to be developed

namely: e-Society, e-Education, e-Government, e-Commerce, and e-Industry (Thuvasethkul & Koanantakool, 2002)

2.5.2 ICT IN THE THAI CLASSROOMS

Researchers (Bransford, Brown, & Cocking, 2000; Roschelle, Pea, Hoadley, Gordin, & Means, 2000) argued that new ICT can bring exciting curricula based on real-world problems into the classroom, and provide scaffolds and tools to enhance learning. The interactivity of technologies is cited as a key feature that enables students to receive feedback on their performance, test and reflect on their ideas, and revise their understanding. The capacity of ICT to reach students in any place and at any time has the potential to promote revolutionary changes in the traditional educational paradigm.

According to the Thai ICT Master Plan for Education (2007-2011), the goals and objectives of utilising ICT for Education Programmes are:

1) Provide all teachers, college lecturers and professors, school children and college students with opportunities to learn to use ICT. The goal is to employ ICT as an enabling tool to access information and gain knowledge link schools, colleges, universities, and libraries electronically to provide students, teachers and lecturers an enriched environment in which distant resources can be made available remotely at their finger tips.
2) Make maximum use of ICT and distance education to meet the needs and aspirations of all citizens for continuing education and skills upgrading without constraint in regards to age, profession, distance, or geographical location.

The important issues regarding the management of ICT in the Thai education system and accessing the importance of ICT in education should be considered. There would appear to be a natural framework for the development of ICT in Thai education which is being made indispensable by government agencies through the need for ICT

educational reform. This developing ICT framework is underpinned by pedagogic/technological and political/legal designs that together create a powerful influence on ICT introduction and use in Thai education. For example, this importance is enumerated and sustained by the Office of the National Educational Commission (2000) who elucidates that as technology is a crucial means for improving the quality of teaching and learning, its role has been emphasised in Sections 63-69 of Chapter 9 of the National Education Act. Thus, the Thai government appears to apply the political/legal imperative to ensure that Thai citizens become not only aware of ICT and its promises, but also places responsibilities on teachers/lecturers and administrators within educational institutes to always consider the benefit to Thai people (Sapianchai & James, 2005) There would appear to be a variety of ICT related imperatives. These are:

1. Teacher/lecturer imperative – to remain abreast of technological changes that will affect student learning, educational administration and society in general;
2. Learner imperative – to expect training and education in technological developments so that they are not deprived of opportunities in later life – at university or work;
3. Social imperative – to generate enough able-bodied individuals to take advantage of technological developments and meet technological requirements;
4. Technological imperative – to develop appropriate technology that enhances the learning environment and learning capability of the learner and the educational provider.

These imperatives, whilst useful in framing the character of technology development, also provide an all embracing theme-set for technological understanding in the complex world of education.

2.5.3 INTEGRATION OF ICT IN THAI HIGHER EDUCATION

UNESCO (2009) has encouraged innovation and maximised the use of ICT for higher education. Many higher education institutions in many places are using ICT to develop course materials, deliver and share course content, lectures and presentations, facilitate communication among lecturers and students, conduct research, and provide administrative and management services. Under the Thai IT Plans of Higher Education Institutions, most of the higher education institutions include training IT-related skills for their teachers, educational personnel and students in their master plan.

When considering the classroom situation, much research tends to focus on the inadequacy of teacher skills when using technology in the classroom. A sample survey suggested the following issues for Thai educational professionals to contemplate (UNESCO, 2003):

1) Much of the current use of ICT in the classroom still focused on the drill and practice type of learning.
2) There would appear to be an inadequate basic infrastructure.
3) Lack of technical support.
4) Integration of ICT in the teaching of subjects has been weak.
5) The absence of policies and management support.

ICT therefore, although useful, may appear to bring complex problems that the Thai education system must address to effectively use it. Research by Wong (2002) indicates quite clearly that the rate of diffusion of ICT in Asia is well below that of Europe. This suggests that the development and use of ICT in the Thailand education system could bring about specific technological issues that are not yet well identified or assessed. Many researchers have commented on the purpose and use of technology in Thai classrooms. However, technology serves many masters and the various

imperatives generated by some writers indicates that technology is utilised for the following purposes in Table 2.11 below (Hawkridge, 1983):

Table 2.11: Utilisation of Technology in Thai Classrooms (based on Hawkridge, 1983)

Imperative	Reflecting
Efficiency	the utilisation of technologies to replace and/or support the teaching process
Vocational	a need for students to develop knowledge and skills that may be useful in the jobs market
Societal	a need for students to integrate with society during school years and after
Pedagogic	changes to the teaching process afforded by technology development and use

Each of the above imperatives attaches an importance that is difficult to be ignored. However, these four imperatives together create pressure on education management to utilise the most effective ways for bringing these imperatives to a successful outcome. It is considered that the juggling of these differing aspects creates so many problems, issues and ultimately far ranging opportunities in the introduction, development and use of technology in Thai education.

To achieve these four imperatives, ECG could have feasible potential to be utilised in an effective way for the classrooms. In terms of the efficiency imperative, many researchers indicated that ECG can support the learning and teaching processes (Addis, 2006b; Amory, et al., 1999; Egenfeldt-Nielsen, 2005; Gee, 2003; Prensky, 2001a). From these results, ECG will certainly have a pedagogic imperative. The use and development of ECG can change the teaching process. In case of the societal imperative, playing ECG can develop social behaviour like self control, cooperation, helping, sharing, and solving social problems. ECG can also develop more positive social interaction and companionship (Gee, 2003; Kirriemuir & McFarlane, 2003; Prensky, 2005a; Rapeepisarn, et al., 2006a). Lastly, in terms of the vocational imperative, learning and training through ECG can meet the need for students to develop knowledge and skills that may be useful to the job market. As an example, two

studies using educational games in vocational training are presented. One study belongs to O'Rourke, et al. (2008) and the other was Foss, et al. (2006). O'Rourke et al. (2008) developed a vocational training computer game to simulate the workplace: The Vocational Game Project. They believed that multi-user computer-based simulator games are well suited to delivering this training. Similar to Foss's and other's (2006) study on game play in vocational training and engineering education, they believed educational games can support training packages for vocational training. They presented a concept for developing learning resources based on dynamic simulators and features from computer games. Unfortunately, the utilisation of ECG as a type of ICT in Thai classrooms, especially in higher education, has not yet been considered.

Nevertheless, to integrate ICT in the classrooms, the conceptions and attitudes of the teacher and learner is an essential issue. The following section explores the teacher and student point of view toward the use of ICT in the classrooms.

2.5.4 LECTURER/STUDENT POINT OF VIEWS TOWARDS ICT IN THE THAI CLASSROOMS

Attitudes on technology appear to affect how technology is viewed and used. A more positive attitude to ICT makes it easier to accept and experiment with. The development of access to facilities requires a managerial strategy that reflects the various uses of technology in terms of the priority of resource needs, and school managerial and structural strategies. All these elements have to work together in order to ensure a variety of access conditions for both staff and students. (Sapianchai & James, 2005).

Lecturer attitude is reflected in the posture that teachers/lecturers have of themselves in relation to their technology skill levels and interests. This importance lies in the desire to learn about technology, use it and be comfortable with it as a necessary

step in bringing an enthusiastic and more importantly, the effectiveness of the educational process. However, Rakes and Casey (2002) suggested that even teachers who hold positive attitudes toward technology may have difficulty transferring these attitudes into productive actions. Students need to be led and the leaders are the teacher/lecturers. As greater numbers of technological systems are installed in educational institutions, the demands on classroom teachers to integrate technology into instruction also increase. Consequently, many teachers/lecturers – especially the more experienced – have perhaps been unable to find effective ways to use technology in their classrooms (Smerdon et al., 2002).

As for students, their attitude toward the integration of ICT for learning is also important. Haywood et al. (2004) believed that student's opinion about the role of ICT in education is a significant component of any university's strategy for its education development programme. Students' preferences for learning mediums are also significant. Quite a few studies found that students are generally very positive about the use of ICT in their learning environment (Haywood, et al., 2004; Shuell & Farber, 2001; Smith, 2002; SPOTPLUS, 2002). This familiarity with ICT requires new considerations in the training of students as the next generation of individuals and manpower of the future. However, the use of ICT in the classrooms from a students' point of view is different. For example, Smith (2002) reports on her study that 31.1% of those surveyed said that "*all classes should have some ICT use*." Whilst 62.5% responded "*Some classes should be using ICT, but only if it is integrated into the class topics*." Only 6.4% responded "*Most classes should not be using technology in the classroom*." However, the use of ICT in the classrooms is inevitably related to faculty members or lecturers. Students described ways in which lecturers are ineffective in their use of technology (Smith, 2002). For example, some lecturers speed up or go too

fast when using computer-enhanced technology. Some may not effectively link the use of ICT to the unique requirements of the course, others may not know how to use the ICT; or that the technology is to demanding of class time or personal time on the part of students. Therefore, it is imperative that lecturers need to focus on an adequate preparation when using ICT in the classrooms.

As for teacher preparation, Srinutapong, et al. (2005) stated that a major issue coming from research on teacher preparation has to do with the provision of ongoing teacher support to continue integrating ICT in their teaching. Teachers do not just need support in the form of a workshop, they need to have access to support throughout their careers as they try to integrate technology into their curricula and seek to improve their teaching. Zhao and Cziko (2001) also identified three conditions that must be fulfilled for teachers to be motivated and use ICT in their practice:

1) Teachers must believe that by using technology they are more likely to achieve a higher-level goal than through other means used ('effectiveness')
2) They must believe that if used, technology will not disturb the other high-level goals that they want to achieve ('disturbances")
3) Finally, teachers must believe that they are in control, having the ability and resources to use ICT effectively ('control')

Zhao and Cziko (2001) also suggested that once the three conditions were achieved, teachers would introduce ICT in their lessons. Cox and Preston (1999) mentioned about a 'technology acceptance model', explaining the interplay between external factors and perceived usefulness and ease of use as the conditions to use ICT. Teachers were reported to include mainly external factors (training, time to explore

software, new computers, appropriate software) when discussing their progress with using ICT for literacy activities (Waite, 2004).

The following reviewed articles observed that a teachers' conception, belief, and attitude toward ICT and the pedagogical approach in these aspects: 1) time spent on ICT, 2) importance of ICT to facilitate students' participation, 3) pedagogies development related to the type of software, 4) how classroom use of ICT can change the practice of the teacher and student and 5) incorporating ICT into teaching and learning could assist Thai students' critical thinking skills.

Dexter, Anderson and Becker (1999) examined teachers' computer usage and their perceptions of the impact of computers on their classroom practice. Teachers made it clear that the computer did not automatically improve teaching practices. The teachers who had adopted more progressive teaching practices over time felt that computers helped them change, but did not think that the computer worked as a catalyst for change. Instead, they offered a variety of reasons for changing practices. They made it clear that their changes in instructional approach were the result of thoughtful reasoning. Their experiences in the classrooms, reflection on those experiences, and the professional culture of a school influenced this knowledge construction process about what does and does not work in the classrooms.

Hakkarainen et al. (2001) analysed the relationship between teachers' skills in using ICT, their pedagogical thinking, and their self-reported practices. The study indicated that teachers who intensively used ICT also emphasised the importance of using ICT for their students. They believe ICT facilitated students' participation in progressive inquiry, collaborative learning, the learners' active engagement in the knowledge formation process, and the learned ability of intelligence. It also indicated that the discrepancy between theory and practice did not seem to be so strong in the

context of teachers who actively use ICT; they appeared to have adequate pedagogical means for pursuing new pedagogical practices.

Niederhauser and Stoddart (2001) stated that computer technology did not embody a single pedagogical orientation. In their survey, they examined the relationship among teachers' pedagogical perspectives and the types of software they used. The pedagogical perspectives can have a powerful influence on how computers get integrated into instructional practices. The results indicated that the students were using skill-based software alone or in combination with open-ended software in the majority of classrooms (85%). Few teachers reported using only student-centred open software. The results indicated that teachers' pedagogical conceptions are related to the types of software they use with their students. Teachers who only used open-ended software had a strong learner-centred orientation and weak computer-directed orientation, whereas the teachers who used only skill-based software had the strongest computer-directed and lowest learner-centred orientations. Also, the availability of different kinds of software obviously has an effect on what kind of software a teacher used.

Kozma (2003) examined the findings from 174 case studies of innovative pedagogical practices using technology. The investigation looked at how classroom worldwide are using technology to change the practices of teachers and students. According to that study, teachers in many countries were beginning to use ICT to help change classroom teaching and learning and are integrating technology in the curriculum. Many of the ICT-based innovation involved multidisciplinary projects and multiple subject areas. Teachers were using ICT to change their role from that of the primary source of information to one who creates structure and provides advice for students, monitors their progress, and assessed their accomplishments. The outcomes

reported in those cases suggested that when teachers use technology to also plan and prepare instruction and collaborate with outside actors and when students use technology in developed, student-centred ways, the students are more likely to develop new ICT, problem solving, information management, collaboration and communication skills.

Rumpagaporn and Darmawan (2007) examined the extent the Thai ICT schools have on classroom learning environments that are associated with certain teacher characteristics using questionnaires, interview surveys, and computer-based classroom observations in order to collect data from 13 Thai ICT model schools. It was posited that students can be assisted in learning critical thinking skills in association with supportive learning environments. The overall findings showed that students could be assisted to learn critical thinking skills through integrating ICT into the teaching and learning processes under the Thai ICT School Pilot Project. The study also concluded that successfully incorporating ICT into teaching and learning is fundamentally dependent on teaching roles. In particular, the findings of the study have major implications for teachers and school management where ICT schools are being established and incorporated in Thailand.

In conclusion, the teacher's perception towards using ICT in the classrooms is becoming more accepted. It was mentioned that incorporating ICT for teaching is helpful. Teachers in many countries are beginning to integrate ICT into the curriculum. They think that ICT also supports students to develop problem solving, information management and communication skills. Some research examined Thai ICT projects. Study has been done on a few Thai ICT model schools, but has not yet been conducted with tertiary students. However, the study concluded that successful teaching and learning depends on a teacher's role and school management. The idea of integrating

ICT into teaching is becoming accepted in Thailand. It may be a good proposition to suggest that ICT can be used to include new technology like education games in the curriculum.

2.5.5 INTEGRATED ECG FOR THE CLASSROOM ENVIRONMENT

Educational computer game, considered as one education technology and a type of ICT, has gained much attention in the discipline of learning and teaching. This type of education technology is becoming popular due to today's youth growing up playing these games and using this technology every day. Researchers (Beak, 2010; Boop, 2006; Gee, 2003; Gikas & van Eck, 2004; Prensky, 2001a) confirmed that computer games can be used for learning and teaching. Computer games can be used to give a better form of education and can even promote computers to be the unique tools of learning (Jayakanthan, 2002).

Most games implemented in the classrooms are PC-based. However, recently other digital platforms such as handheld and mobile game devices are being used in trials for classroom learning. The research by Rapeepisarn, et al. (2008c) showed that handheld games such as Play Station Portable (PSP) and Nintendo Duel Screen (NDS) have also been widely used as learning tools in many places including school in the UK and Japan (Kane, 2007; Kcroy, 2008; Rapeepisarn, et al., 2008c). Most European countries improve scientific teaching within schools through mobile devices and game technologies. In France, Wapedue School in Mountpellier uses these devices for education and bills itself as a "nomadic school" (Prensky, 2005b). China and Hong Kong also developed a mobile learning platform to enhance the quality of teaching and learning with advanced communication technologies. Mobile learning and using games to teach in Japan have gone beyond merely speculating about these channels for learning (Kato & Ricci, 2006).

Thailand has begun to make use of some educational games in the classroom. Like other countries, education games have been used in schools both at the primary and secondary levels. However, the findings by the Interactive Digital Software Association (van Eck, 2005) shows that 35% of game players are under 18, 55% are male; 43% are female, and 43% game players are 18-49. From these figures, it implies that people who are in the college and university age group have played computer games a lot. But the idea of bringing this educational technology to the tertiary level has just begun in some countries. At the moment, this kind of education technology is not yet widely acknowledged or used for the classrooms in Thailand especially at a tertiary level. According to Thai higher education reform (National Education Act 1999), the new approach to teaching and learning is the Student-Centred Learning (SCL) approach. This approach provides a significant shift away from the traditional teacher-centred approach.

One of the goals of SCL is creating and supporting opportunities for authentic learning. SCL is sometime known as activity-based learning or experiential education. Rapeepisarn et al. (2006a) gathered a number of terminologies related to learning through doing and experiential education: active learning, learn by experience, environmental education, adventure education, outdoor learning, natural learning, learn through activity, challenge education, leisure education, and service learning. The features of SCL and the properties of learning through doing or experiential education are compared in Table 2.12.

Table 2.12: Comparison of SCL Features and Learn through Doing's Property

SCL*	Learn through Doing*
• Learning by doing • Make their own decision about learning • Building real world skill • Encourage thinking critically • Develop problem solving skill • Actively participant in their learning • Work in collaboration with other learners • Construct new knowledge & skills by building on their current knowledge and skills • Understand expectations & are encouraged to use self assessment measures	• Authentic activities • Solving one's own problem • Managing real problems • Understand how things work • Actively explore the physical world around themselves • Learning by direct experience and using all the senses • Connect classroom theory with practice in the real world • Engaging students in an experience that will have real consequences • Schools & workplaces at the same time to allow students to apply classroom learning in the community & workplaces

***Adapted from Rapeepisarn et al. (2006a) and Rapeepisarn et.al. (2008c)**

Learn through doing is a form of edutainment (Rapeepisarn, et al., 2006a) and ECG is a form of edutainment as well. From the features of SCL and the properties of learning through doing, it can be suggested that ECG is an educational tool for using to help develop and support SCL in the Thai higher curriculum.

Unfortunately, computer games are not widely accepted in Thai classrooms for teaching and learning owing to the negative image associated with computer games, and society is unaware of the potential of the game industry, although there was enormous growth and progress of Thai digital game industry in recent years. Due to the considerably expanding Thai digital game industry, with government support under the National IT plan, the adoption of ECG for educational purposes for teaching and learning is highly possible. Currently, research toward computer games in the Thai context can be readily found. However they did not focus much on the educational use of ECG especially at the tertiary level.

2.6 SUMMARY

ECG, as a form of edutainment, is a game designed to teach students about certain subject or help them learn a skill as they play. Its major objective is to design

games with explicit educational goals. The main characteristics of ECG are speed, parallel processing, active engagement, quick adaptation and problem solving, immediate reward and fantasy. Many countries have started to accept these kind of games as an effective tool for learning and some use them in the classrooms as well.

The Thai National Education Act and the National IT Policy are important forces to push ICT into the learning and teaching of Thai higher education. Researchers argued that new ICT can bring exciting curricula based on real-world problems into the classroom. Thailand, referring to its National Education Act, indicated ICT needs to accelerate changes in the roles of teachers, students, school administrators, and parents in innovative ways. Many researchers have commented on the purpose and use of technology in Thai classrooms. Some examples of imperatives for the utilisation of ICT in the Thai classrooms commented on by researchers (Hawkridge, 1983) are efficiency and pedagogic. Efficiency reflects on the utilisation of ICT to replace and/ or support the teaching process, while pedagogic reflects to the changes on the teaching process afforded by technology development and use.

Currently, ECG, as one educational technology and a type of ICT, has been widely used as a learning tool in many places. Thailand has begun to make use of games in primary and secondary schools. Nonetheless it is not yet widely accepted at the tertiary level, even though studies show that quite a high percentage of people who have played computer games are college and university students (Interactive Digital Software Association, cited in van Eck (2005). The Thai computer games industries has also progressed and grown rapidly in recent years. This implies there is the possibility for ECG production for the educational market in Thailand. From these observations, it is plausible to integrate ECG into Thai undergraduate classrooms. A review of the literature shows that successfully incorporating ICT into teaching and learning is

fundamentally dependent on teaching roles (Rumpagaporn & Darmawan, 2007), integrating ECG is inevitably dependent on this role as well. In addition, attitude and belief to teaching also appears to affect how technology is viewed and used. Integrating ECG in the curriculum also needs to address both students and teachers' perception toward the use of ECG, a teacher's preparation, and factors that support teaching and learning. This leads to a theoretical and conceptual framework on the adoption of ECG and pedagogical theories related to the teaching and learning processes which will be discussed in Chapter 3.

CHAPTER 3
THEORETICAL FRAMEWORK AND CONCEPTUALISATIONS OF RESEARCH CONSTRUCTS

This chapter presents and reviews three theoretical frameworks, the conceptualisations of research constructs, relationship of variables model, and research proposition and hypothesis. They are divided into eight sections:

3.1 INTRODUCTION

The integration of computer games for education in the classroom has started to gain acceptance in some countries. However, in schools or colleges in countries which have never used computer games in the classrooms, study is still needed to be conducted on the investigation of students' and teachers' beliefs and attitudes toward such usage. It is not desirable to assume that research outcomes found in one country can be applicable to other countries. Therefore, in order to consider the adoption of ECG for teaching and learning, especially for tertiary education in Thailand, studies

need to be carried out. Two broad concepts are used as a guide when considering whether ECG can be used in Thailand. They are concepts under the umbrella of ECG and the adopting of technology theories. (Amory, et al., 1999; Davis, 1989; Farne', 2005; Flemming & Mills, 1992; Garcia, 2005; Keefe, 1989; Kirriemuir & McFarlane, 2004; Prensky, 2001a; Rapeepisarn, Wong, & Fung, 2007). For the concepts of investigating ECG, background on the knowledge of edutainment, pedagogy and computer games need to be investigated. As for the assessment of technology adoption, theories involved included Technology Acceptance Models, Theory of Reasoned Action, and Belief about Teaching with Technology

For the purpose of this research, there are three main related theories that should be investigated. They are technology acceptance theories, pedagogical theories and computer game theories.

3.2 TECHNOLOGY ACCEPTANCE THEORIES

In adopting ECG for teaching and learning, the beliefs of teachers and students, plus attitudes toward the implementation of this educational initiative are critical factors that determine what could happen in the classroom (Tobin, Tippins, & Gallard, 1994). Research has also shown that teachers' beliefs are one of the important factors affecting teaching with computers or ICT use in the classroom (Tobin, et al., 1994). In order to measure the perception, belief, and attitude in adopting ECG in the classroom, the following technology acceptance theories, the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), and Concept of the Beliefs about Teaching with Technology (BATT) are investigated.

3.2.1 THEORY OF REASONED ACTION (TRA)

Theory of Reasoned Action (TRA), illustrated in Figure 3.1 is used to study human behaviour and develop appropriate intervention. This theory provides a

framework to study attitudes toward behaviour. According to the theory, the most important determinant of a person's behaviour is behavioural intent. An individual's attitude towards behaviour includes; behaviour belief, evaluations of behavioural outcomes, subjective norms, normative beliefs, and the motivation to comply.

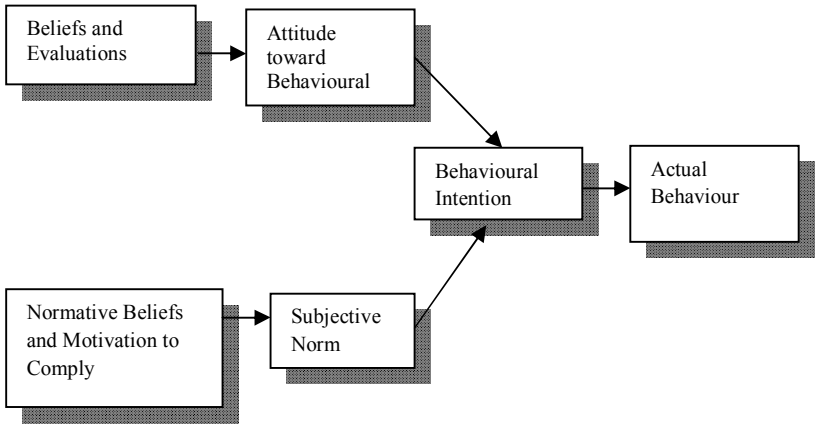


Figure 3.1: Theory of Reasoned Action Model

3.2.2 TECHNOLOGY ACCEPTANCE MODEL (TAM)

Many studies have been conducted in the area of IT adoption and acceptance in order to identify the factors determining the uptake of a particular information technology. One of the conceptual models developed from other models was the model proposed by Davis (1989). The Technology Acceptance Model (TAM) was specially developed in order to explain individual use of IT. TAM was developed by adapting the theory of reasoned action (TRA), diffusion of innovation and social-cognitive theory (Banduru, 1982). TAM, illustrated in Figure 3.2, predicts IT use with two constructs, perceived usefulness and perceived ease of use. TAM has been tested to explain or predict behavioural intention on a variety of technologies such as word processors (Adams, Nelson, & Todd, 1992; Tobin, et al., 1994), spreadsheet software (Adams, Nelson, & Todd, 1992), email (Adams, et al., 1992; Szajna, 1994), voicemail, graphics software (Adams, Nelson, & Todd, 1992), and net conferencing software (Verkatesh & Davis, 2000). Thus the technology acceptance model has been shown to be a valid

model over a variety of commercially available technologies that are primarily used in an office environment or educational environment (Adams, et al., 1992; Davis, 1989; Szajna, 1994).

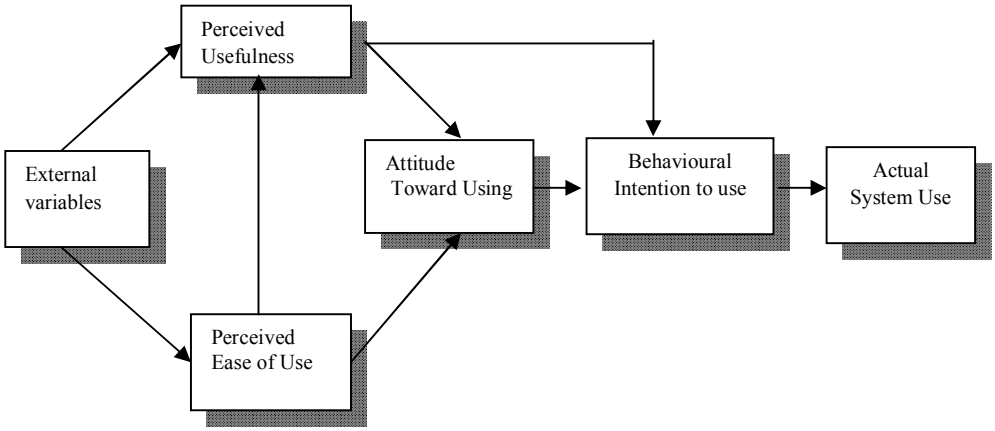


Figure 3.2: Technology Acceptance Model

3.2.3 BELIEF ABOUT TEACHING WITH TECHNOLOGY (BATT)

Based on Ford's motivation system theory items for the Beliefs about Teaching with Technology Instrument (BATT), this instrument measured school leaders and teachers' beliefs concerning support factors that affect technology integration (Ford, 1992). In relation to technology integration in schools, environmental context beliefs would include things such as administrators, teachers, students, parents, buildings, equipment, and professional development. Based on Ford's theory, this environment or context would influence teachers' integration behaviour. This also suggests that context beliefs or perceived behavioural control are important factors for explaining educational technology use.

These three theories are used as predictable tools for the acceptance of ECG for both teachers and students. They can be predicted in term of perceived usefulness, perceived ease of use, subjective norms, actual behaviour, and school support factors that influence the technology acceptance by teachers.

3.3 PEDAGOGICAL THEORIES

In order to understand the potential role of ECG in supporting learning, we need to first answer the questions "What is learning?" and "What forms of teaching and learning are suitable for incorporating game in the classroom?" This is related to the pedagogical theory which includes instruction theory and learning theory. While instruction theory focuses on how to structure material for promoting the education of humans, learning theory is typically used to describe how people learn. Thus learning styles and teaching styles are investigated. Moreover, other pedagogy theories need to be emphasised and examined in order to develop a framework for the deployment of computer games for learning. Different researchers on game-based learning used different pedagogy concepts to analyse games in the context of the learning environment. One of these is Prensky (2001a) who claimed that teachers have to understand the type of learning content. Prensky proposed the relationship of learning content, learning activities and possible game style. Gee (2004) also attempted with a list of 36 learning principles in computer games and Gee (2003), which contain 12 principles. Gee's principles were strongly centred on the traditional ways of guided learning by doing [cited in Boop, (2006)]. Boop (2006) proposed a framework to answer three main questions that are important to educational game design. These questions were: 1) what actually is the learning purpose? 2) what is and should be the material used to reach these goals? and 3) how should this learning content be learned? Boop (2006) proposed three subfields of didactic analysis include analysis of learning goals, analysis of learning content, and analysis of learning and teaching methods to answer the above three questions. The other researchers in this area were Gikas and Van Eck (2004). In their research: "*Integrating Video Games into the Classroom:*

Where to Begin?" they used theories of Gagné's learning capabilities and Bloom's taxonomy to compare with Bate's (2004) Game taxonomy.

Hence, this section provides the basic concepts of each learning theory. The learning theories and concepts include: Honey and Mumford's Learning Style, Grasha-Richman's teaching style, Bloom's Leaning Objectives, Gagné's Learning Capabilities, and Prensky's Learning Contents

3.3.1 LEARNING STYLES (VARK; HONEY & MUMFORD)

A learning style is useful in identifying the methods by which people prefer to receive information from their environment and undertake their learning. There are numerous models of learning styles available. In the past three decades, over 30 learning style assessment instruments have been developed (Flemming & Mills, 1992; Guild & Garger, 1985). One of the well known and widely used instrument measuring learner perceived information is VARK Learning Styles (Flemming & Mills, 1992). These classifications, illustrated in Table A1, (see Appendix A) have been termed as visual learning, auditory learning, verbal learning (read/ write) and kinesthetic learning.

In addition, Honey & Mumford learning style is also examined as the Preferred Learning Styles. Honey & Mumford classified learners' characteristics into 4 types: Activists, Reflectors, Theorists, and Pragmatists. (See Tables A2, A3 in Appendix A)

3.3.2 TEACHING STYLES (GRASHA & RIECHMANN)

As teachers, it is their job to be able to reach out to all students in order to let their students learn as much as possible. To understand the teaching style review in this chapter, four types of teaching styles according to Grasha-Riechmann (Scoville, 2006) are investigated. They are Formal Authority, Demonstrator, Facilitator and Delegator. The Grasha-Riechmann teaching style is illustrated in Table A4. (See Appendix A)

3.3.3 BLOOM'S TAXONOMY (LEARNING OBJECTIVES)

Bloom's (1956) taxonomy of educational objectives includes three domains: cognitive (about knowledge), affective (about attitudes) and psychomotor (about doing). Among these three domains, the cognitive domain is the most widely accepted system. It was classified into a hierarchy of skills ranging from knowledge, comprehension, application, analysis, synthesis and evaluation. Blooms said that the main reason in constructing a taxonomy of educational objectives is to facilitate communication (Bates, 2004). An awareness of these levels can help one determine how well students really know the course content. A hierarchy of six levels, description (learner action), and key verbs associate with each cognitive domain, and some potential IT activities are illustrated in Table A5 (see Appendix A)

3.3.4 GAGNÉ INTELLECTUAL SKILLS OF LEARNING CAPABILITIES

When people consider about learning capability, Gagné's theory of intellectual skill could be considered one of the popular constructs. In general, Gagné's taxonomy of learning (Gagne', Briggs, & Wager, 1992) states that there are five major categories of learning outcomes: verbal information, intellectual skills, cognitive strategies, motor skills, and attitude. The five subcategories of intellectual skills are hierarchical in nature (low level skills to high level skills). Intellectual skills are the capabilities that make human individuals competent. They enable him/her to respond to conceptualisations in his/her environment. Gagné's hierarchy of intellectual skills follows programmed instruction since one skill must be learned before another can be mastered. The five levels of learning capabilities are illustrated in Figure A1 (see Appendix A)

3.3.5 PRENSKY'S LEARNING CONTENT AND LEARNING ACTIVITIES

Prensky (2001a) discussed about how to combine gameplay and learning in his paper "*Computer Games and Learning: Digital Game-Based Learning*". He claimed that teachers have to understand the types of learning content. With different kinds of learning content, teachers can see what kinds of learning are really going on such as learning facts, skills, judgement, theory, reasoning, process, procedure, creativity, language, system, observation and communication. Additionally, teacher can choose different learning activities according to particular types of content. Prensky proposed the relationship of learning content, learning activities and possible game type as illustrate in Table A6 (see Appendix A)

In this thesis, teaching and learning styles are used as the independent variables related to the playing ECG behaviour. Learning objectives, learning capabilities and learning activities are integrated and proposed as conceptual framework related to game genre.

3.4 CONCEPTUALISATION OF ECG

To adopt ECG for teaching and learning, we need to understand the concept of these educational technologies. Under the umbrella of ECG, there are the concepts of edutainment, pedagogy and computer game theory. While "Edutainment" is the combination of education and entertainment, ECG is the integration of play game and learning from a game. A number of "Pedagogy" theories are related to ECG as mentioned in Section 3.3. Inevitably, to understand ECG, the "Educational Use of Computer Game" concept should be examined. As ECG is considered as one genre of computer game, it then has the same characteristics like any type of computer game. Therefore, this thesis will bring together its criteria, characteristics, genres, platforms, and factors effecting on game preference as independent variables.

3.5 CONCEPTUALISATIONS OF RESEARCH CONSTRUCTS

The research constructs conceptualised for this thesis are based on previous related literature from Chapter 2 and the theoretical framework. In order to investigate the factors that affect the use of ECG in the classroom by Thai lecturers and students, variable "Behavioural Intent to Use" is used as a determinant for the adoption of ECG. In addition, to examine the learning and teaching styles that benefits from the use of ECG, the measurement of learning and teaching styles are also investigated. Furthermore, other demographic data variables and computer game play behaviours are also studied.

3.5.1 DETERMINANTS OF BEHAVIOURAL INTENT TO USE

Behaviour intent to use (BI) is used as a dependent variable in this survey. It is considered as one essential variable used to indicate how hard people are willing to try and how much effort they are planning to exert. To better predict, explain, and determine user acceptance, we need to better understand why people accept or reject ECG for learning. The ability to predict people's ECG acceptance is from a measure of their intentions, and the ability to explain their intentions is related to their perceived usefulness, perceived ease of use, their attitude, subject norms and related variables. Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) is a well-researched theory in predicting and explaining behaviour in an extensive range of domains. According to TRA, a persons' performance of a specified behaviour is determined by their behavioural intention to use (BI). This variable is jointly determined by the persons' attitude toward use (AU) and subjective norm (SN). This can be shown in the following expression:

$$BI = AU+SN$$

Additionally, Technology Acceptance Model (TAM) (Davis, 1986), the extension from TRA, puts forward two particular beliefs, perceived usefulness (PU) and perceived ease of use (PEOU) to determine the behaviour intention. This can be shown as an expression:

$$BI = PU + PEOU$$

The survey study of Thai lecturers and students in adopting ECG has employed variables used in both TRA and TAM to predict the behavioural intent to use. One more variable, perceived enjoyment (PE,) has also been included. PE is used for measuring the extent to which the activity of the system is perceived to be enjoyable in its own right (Davis, Bogozzi, & Warshow, 1992). PE can be seen as an intrinsic motivation to use an information system. A number of studies on PE (Pikkarainan, Pikkarainan, Karjaluoto, & Pahnila, 2004) had noticed that PE significantly affects intentions to use computers. Playing a computer game can be assumed to be an activity of learning through playing. Computer games bring together the ideas of games, play, fun, and entertainment. Therefore, it makes sense to consider PE as one of the variables that affects the intent to use ECG. Apart from these, other essential factors which may influence lecturers' beliefs and their support for technology integration into the classroom should be considered. The Beliefs about Teaching with Technology (BATT) instrument was employed for this purpose. In this survey the researcher named this variable as University Environment Support Factor (UESF). Hence, the model of predicting and explaining the adoption of educational computer games in this study can be shown in the following expression:

$$BI = PU + PEOU + AU + SN + PE + UESF$$

To conclude, the adopting of ECG in this survey is based on TRA and TAM, including PE which was use as another indicator to measure the level of fun,

amusement, or enjoyment. The adoption of this education technology is determined by the dependent variable (BI) which was predicted by independent variables: PU, PEOU, AU, SN, PE and UESF.

3.5.2 MEASUREMENT OF LEARNING AND TEACHING STYLES

With the purpose to answer the research questions "What Learning Styles of Thai Students Will Benefit from Using ECG?" and "What Teaching Styles of Thai Lecturers Will Benefit from Using ECG?", the measurement of learning and teaching styles were investigated in this survey. Various instruments are available in order to assist lecturers and researchers in identifying the ways students learn. Learning style inventory (LSI) is one of those instruments. One of the widely used LSI instruments measuring learner's perceived information is VARK learning styles (Flemming & Mills, 1992). VARK stands for Visual, Aural, Read/ Write and Kinesthetic, which relate to four different learning styles as defined by Neil Fleming. This model was expanded from earlier Neo-linguistic programming (VAK) models (Hawk & Shah, 2007).

ECG is a form of Edutainment and Edutainment is a form of learn through doing (Rapeepisarn, et al., 2006a). In other words, learning through experience or learning though doing is a form of the learning tools of "Edutainment." Experiential learning is used to describe the sort of learning undertaken by students who are given a chance to acquire and apply knowledge, skills, and feelings in an immediate and relevant setting. Among the learning styles which are classified as experiential, Honey and Mumford's learning style is recognised as one of the well-known in experiential learning (Chong, et al., 2005; Coffield, Moseley, Hall, & Ecclestone, 2004; Swailes & Senior, 1999). Honey & Mumford used the term "experience" in each of the four stages of their questionnaire (Beard & Wilson, 2002). Hence, the Honey and Mumford learning style is used for measuring the preferred learning style in this thesis. These learning styles

are easy to remember, widely understood, accepted and used by most learners (Chong, et al., 2005; Honey & Mumford, 1992).

There are two versions of the Honey & Mumford Learning Styles Questionnaire. The 80-item is the original questionnaire that has 80 questions. The 40-item is shorter with only 40 questions. This thesis uses the 40-item version for the following reasons:

- It is ideal as an initial introduction for people who have not previously given much consideration to how they learn.
- It is useful if time is at a premium- the questionnaire takes less time to complete and score.
- It helps people stay focused- there are fewer suggestions for action to choose between.
- The wording is concise and better suited to a more diverse audience.

Honey and Mumford (1992) classified learners into activist, reflector, theorist and pragmatist. These four styles are a convenient way for describing differences in learning preferences and, of course they map onto the stages in each loop of the continuous learning cycle. The followings are examples of each learning style described in the simplest and concise manner. Table 3.1 also demonstrates these four styles in a doing and thinking orientation as well as brain dominance.

Activists: *"I'll try anything once." Act first, consider afterward*

Reflectors: *"To be cautious." Stand back and observe from many different perspectives.*

Theorists: *"If it's logical, it's good." Think problems through in a vertical, step by step. Keen on basic assumptions, principles, theories…*

Pragmatists: "There is always a better way." Keen to try out ideas, theories & techniques to see if they work in practice

Table 3.1 Honey & Mumford Learning Style: Doing and Thinking Orientation, and Brain Dominance (Honey & Mumford 1992)

Orientations	**Doing Orientation**	**Thinking Orientation**
	Activist, Pragmatist	Reflector, Theorist
Brain Dominance	**Right**	**Left**
	Activist, Pragmatist	Reflector, Theorist
	(intuition, spontaneous, qualitative)	(factual, analytical, quantitative)

To measure a lecturer's teaching style, it is essential to understand the inclusive definition of it. Hoyt and Lee (2002) stated that a teaching style refers to the ways teaching approaches can be combined. In other words, teaching style is a combination of various teaching methods. Pajares (1992) argued that teaching styles include a teacher's beliefs, attitudes toward schooling, teaching, learning and students. Dunn and Dunn (1979) attempted to find the root of teaching style and posit that teaching style is developed based on a model system. They believe that a teacher's teaching style is a direct result of the way a teacher learned. While Conti (1989) defined teaching style as a range of behaviours that allow the teacher to operate comfortably and adds that these behaviours or qualities are persistent from context to context and are not linked to the content Darkenwald (1989) saw teaching style as based on characteristic behaviours for engagement in promoting student learning. Kaplan and Kies (1995) defined teaching style more narrowly. They said teaching style is personal behaviours, but also the media that is used to transmit and receive data or information to the learner. However, Grasha (1994) assumed that teaching styles represent not only a belief system, but also behaviours and needs that a teacher exhibited in a class. Grasha (1996) also mentioned:

"Understanding our teaching styles would be enhanced if we had a list of the elements of style that we use as for examining ourselves…Various authors emphasise different aspects of how people teach and thus there is little agreement about the elements of style."

Grasha identified the elements of styles including: general modes of classroom behaviour; characteristics associated with a popular instructor; the teaching methods employed; behaviours common to all college faculty; the roles teachers play; personality traits; archetypal forms; and metaphors for teaching. As a result, he outlined five teaching styles that represent faculty orientations or beliefs about teaching (Grasha, 1996). Grasha's five teaching styles include the Expert, Formal Authority, Personal Model, Facilitator, and Delegator.

3.5.3 DEMOGRAPHIC DATA VARIABLES

The three variables selected for testing the hypotheses in this research are: university type, university location and gender. The rationale are discussed in Sections 3.5.3.1 to 3.5.3.3

3.5.3.1 Public and Private Universities

The type of university is one of the independent variables studied in this research. Public and private universities are two main categories of university type. There are several reasons that this variable is studied. Basically, these two types of university are differentiated in terms of the support from the government. A public university is predominantly funded by a national or sub-national government, whereas, a private university is mainly supported by tuition fees, endowment, and alumni donations. However, this depends on the region, as private university may be subjected to government regulation as well. Usually the tuition fee of a private university is more expensive than a public university. For example, the tuition fee cost in American private

universities is approximately 9-10 times higher that it is at public institution (Universities, 2008). The number of universities between public and private is one of the other differences. For instance, the majority of universities in Australia are public. There are 38 public universities and four private universities (IAU, 2008). Some countries in Europe, for example, in Finland, Greece, and Ireland, all the universities are public. However, in quite a number of countries in Europe, only some are private, but almost all universities are public such as in Austria, Denmark, France, Germany, Italy, and Sweden (WHED, 2011). In the United Kingdom, all universities are funded mostly by government teaching and grants except for the University of Buckingham and Richmond University. However, unlike in other European countries, the British government does not own the universities' assets and university staff are not government officials. In China and India, nearly most of all universities and research institutions are public. There are few private undergraduate college in China (mostly engineering schools) sponsored by some private enterprises. In Japan, public universities refer to schools that are not national universities but are run by local governments. There are 76 public universities, compared to 87 national and 571 private universities (IAU, 2008).

Higher education institutions in Thailand are comprised of public and private universities, institutions, colleges, and community colleges. Public universities in Thailand are formally called government universities. They still receive some support from the government, but their staff are not classified as civil servants. At present, there are 146 higher education institutions and 19 community colleges under the jurisdiction of the Commission on Higher Education which can be classified as follows (SEAMEO, 2009) :

1) 78 public higher education institutions including:

- 13 autonomous universities
- 15 traditional universities
- 40 Rejabhat universities
- 9 Rajamangala Technology universities
- Pathumwan Institute of Technology

2) 68 private higher education institutions

- 39 universities/ institutions
- 29 colleges

3) 19 community colleges

Besides the differences in the number of public and private universities, there is controversy as to in the quality and prestige in these two types of universities. In some countries, public universities are not as prestigious as private universities, and some careers might be more difficult to enter after graduation. For example, in USA, and Japan, most of the prestigious universities and colleges, including all of the universities belonging to the Ivy League, are private. In Japan, most of the leading research universities are also private (WHED, 2011). Conversely, in other countries, including Thailand, the priority for students who choose to study in is a public rather than private institution. Students who do not achieve high enough scores to gain admittance into a public university will consider a private university as their subsequent choice. In addition, the study environment, educational conditions, the size and personal relationships in the two types of universities are different. Public universities are much larger and more diverse than the average private university, and students may feel more comfortable around the larger student population that it offers. On the other hand, the large size of public universities may distance the student from the educational atmosphere, making them feel more anonymous in the student

population. Private universities generally have smaller class sizes. Students generally build stronger, more personal relationships with their professors and lecturers. There are special programmes designed to increase communication and dialogue between the two (Universities, 2008).

For the diversities and differences of public and private mentioned above, the researcher employed the type of university as an independent variable. The assumption is specified that the respondents from a different type of university will have a different decision to adopt ECG in the classroom.

3.5.3.2 University Location

Like the type of university, university location is another independent variable in this research. University location is categorised as metropolitan and regional. These terminologies might have the similar meaning as "urban" and "rural" but not exactly the same concept. A metropolitan university in this research refers to a university in a major or large city such as Bangkok and the surrounding metropolitan area. While a regional university is one which is located in another particular area or district rather than in a major city. The longitudinal Survey of Australian Youth –LSAY (ACER, 2002) defined metropolitan students as those who are studying in a capital city with 10,000 or more inhabitants, while regional areas are defined as those centres with populations between 1,000 and 99,999 persons, and rural or remote areas are defined as those centres with less than 1,000 persons. However, these definitions can vary widely between different nations. Rural-urban differences in education can be found in many different countries around the world. For example, students in rural Canada are falling behind their urban counterparts. Rural schools are disadvantaged relative to urban schools with respect to access to, and use of, information and communication technology (ICT) (CCL, 2006). Bangladesh and China also have a big gap between

rural and urban education. In Bangladesh, most successful schools and students are from urban areas, especially in the metropolitan areas (Jakiyamani, 2008). In China, the number of college graduates in urban areas is 43.8 times greater than in rural areas; and the number of graduate students in urban areas is 68.1 times greater than in rural areas (Sun, 2010).

In Thailand, the average education attainment of urban Thais is much higher than rural Thais. However, this was a feature from more than two decades ago. The cities and towns, especially the capital city, used to have the potential to serve as a centre of information and knowledge diffusion. In the past, a number of universities were located only in the metropolitan and surroundings areas. The main universities in Thailand were Chulaongkorn, Thammasat, Kasetsart, Mahidol and Srinakarinwirot in Bangkok and their branch colleges. There were "general" universities such as Chiangmai, Khon Kaen, Prince Songkla University which were later founded in other major urban areas. The rest were teacher's colleges in individual provinces and some private universities such as Bangkok, Assumption, Rangsit Universities (Sakurai, 2004). During the first year of the 21st century, the number of universities increased dramatically on a controversial move by then Taksin government to rename many public institutes as universities (SEAMEO, 2005). In 2009 the number of higher education institutes (HEI) including universities is distributed around the country. Statistics from the Commission of Higher Education showed that 15% of HEI were in the North, 19 % in the Central, 19% in the Northeast, 13% in the South, 5% in the East and 29% in Bangkok (SEAMEO, 2009).

Apart from the differences in the number of universities between metropolitan and regional, campus life, communication with faculty, other activities, study conditions and entertainment are other divergent factors besides university location. Rural campus

life is free from big city disturbances such as air pollution and noisy traffic. Outdoor activities are abundant. The ability to communicate directly with faculty is an additional benefit. Students are not only able to see their professors in class but also can interact in their housing units or in campus clubs (Bookin-Weiner, n.d.). Conversely, students in urban universities have a higher range of choices when it comes to entertainment, restaurants, food markets, etc. Life in urban universities is very influenced by the city where the university is located: the size of the city, the cultural life, and the geography (Bookin-Weiner, n.d.). In addition, entertainment might be more varied for student at large urban universities than those in a rural campus. These factors are not different from the urban and rural campus in Thailand. Another difference such as ICT usage might not be a major aspect between university locations (urban-rural) since recently the ICT infrastructure is supplied equally nationwide in Thailand (ONEC, 2000).

Due to the distinction between urban and rural education in many places around the world, the variable "school location" or "university location" was generally included in the research. For example, Gupta and Mandal (1996) studied the effect of education. They employed sex-marital status, values of individuals and two types of location (rural and urban). Hence, the university location was studied in this research on the assumption that there might be different respondents from different university locations on different perceived enjoyment of ECG; or the respondents from different university locations might have different behavioural intent to use ECG in the classroom.

3.5.3.3 Gender

Association between gender and computer games is one of the controversial areas in the study of computer games. There are quite a large number of studies on gender and computer games. From the Gender and Computer Games Literature

Reference List (http://www.itu.dk/~tltaylor/teaching/genderlit.html), there are more than 50 items. Although this is not a complete list, it includes some background theory, some classics on gender and technology, and some more recent work especially on computer games. Some general studies on gender comprises of *Games and Gender; Digital Games and Gender; The Non-Sense of Gender in NeverWinter Nights; Play between World;* and *Understanding Computer Game Culture*. Most of the titles of research focus on females are: *WomenGamers and Geme Girl Advance*; *Girls Playing Computer Games; Killing Like a Girl: Gendered Gaming and Girl Gamers' Visibility; From Barbie to Mortal Kombat; Troubling Games for Girls: Notes from the Edge of Game Design; Next Level: Women's Digital Activism through Gaming; Women Just want to Have Fun: A Study of Adult Female Players of Digital Games; Demon Girl Power: Regimes of Form and Force in Videogames Primal and Buffy the Vampire Slayer.*

Computer game playing behaviour and the preference of games between males and females are quite different. On average, girls and women are less involved with video games than boys and men, and when they do play, they often prefer different games (Hartmann & Klimmt, 2006). Results of study (Mohood, Oliver, & McGrath, 2000) indicated that not only do males play video games more than females; males also have a greater preference for violent games, while males and females prefer non-violent games equally. Nzegwu (2000) also supported that boys are more likely than girls to choose to play computer games, and the children of both sexes consider computer games to be boy's toys. The fact that more boys play computer games leads to more men in computer-related fields, and that the fields that are growing in scope and importance every day (Kramer & Lehman, 1990). Furthermore, many studies conducted in social science fields such as psychology reported that girls and young

women display less interest in digital games, have less game-related knowledge, and play less frequently and for shorter durations than do boys and young men (R. M. Brown, Hall, Holtzer, Brown, & brown, 1997; Cassell & Jenkins, 1998; Lucas & Sherry, 2004; Wright et al., 2001). Researchers at the Stanford School of Medicine conducted a study that determined that the areas of the brain that offers reward for the sort of stimulus provided by videogames is more active in men than in women (Cavalli, 2008). A study at Stanford also found that both female and male participants were equally skilled at the game, but that the males were much more motivated to maximise their score as quickly as possible (Cavalli, 2008). However, publications suggested that the amount of female game playing has increased, at least in U.K. and the U.S. (Bryce & Rutter, 2002; Jenkins, 1998). According to user data for U.S. market (ESA, 2005), 43% of all video game players are female. Online games have also been adopted by many female players as well (44% of all online-players are female, ESA, 2005). Hartmann and Klimmt, (2006) concluded that the research suggests video games have traditionally been a realm dominated by males, but that due to the emergence of female subcultures adopting contemporary video games designed for males, and the advent of new games that successfully engage female players, the gender gap has started to narrow, at least in the U.S., such that players are no longer overwhelmingly male.

From literature, gender is one of the controversial variables included in many research on computer game. Thus, in this thesis, the researcher realises that gender is a significant variable used to consider the adoption of computer games as a learning tool in the classroom. As a result, gender is included in the survey.

3.6 RELATIONSHIP OF THE VARIABLE MODEL

This section presents the relations of variables into five clusters. These clusters were constructed according to research questions 1, 2, 3 and 5 (Question 4 would be discussed in the interview section). They are:

- ECG Acceptance Model
- Pedagogy with Behavioural Intent to Use Model
- Demographic with BI Model
- Pedagogy with Computer Game Play Behaviour Model
- Gender with Computer Game Play Behaviour Model

3.6.1 ECG ACCEPTANCE MODEL

The ECG Acceptance Model was constructed in order to response to the first objective of this research: "To investigate the factors which impact Thai lecturers and students in their use of ECG in the classroom." As mentioned in Section 3.5, in order to investigate the factors which affect the use of ECG in the classroom by Thai lecturers and students, the variable "Behavioural Intent to Use" is used as the determinant of the adoption of ECG. From the Theory of Reasoned Action (TRA); the Technology Acceptance Model (TAM); and the Beliefs about Teaching with Technology (BATT), the researcher has cautiously reviewed the selective variables considered mainly suitable for ECG acceptance in this research. Those variables are: PU, PEOU, AU, SN, PE, and UESF. These variables were used for explaining and predicting the dependent variable "BI". The lists of variables and ECG Acceptance Model are illustrated in Table 3.2.

Table 3.2: The Variables in ECG Acceptance Model

Independent Variables	Dependent Variable
Perceived Usefulness (PU)	Behavioural Intent to Use (BI)
Perceived Ease of Use (PEOU)	
Attitude Towards Use (AU)	
Subjective Norms (SN)	
Perceived Enjoyment (PE)	
University Environment Support Factors (UESF)	

3.6.2 PEDAGOGY WITH BEHAVIOURAL INTENT TO USE

The variables of pedagogy in this research are teaching styles and learning styles. The study of the correlation between teaching and learning styles with behavioural intent to use is another factor in response to the first objective as well as the second objective of this research: "To identify the various learning and teaching styles which may make best use of ECG." The five categories of teaching styles of Grasha & Riechmann (Expert, Formal Authority, Demonstrator, Facilitator, and Delegator) were used as independent variables in the teaching styles cluster. The learning styles in this research were classified into two clusters: perceptual learning styles and preferred learning styles. Four types of VARK learning styles (Visual, Auditory, Read/Write, and Kinesthetic) were used as independent variables in the perceived learning styles cluster. Finally, four types of Honey and Mumford learning styles (Activists, Reflectors, Theorists, and Pragmatists) were used as independent variables in the preferred learning style cluster. Table 3.3 illustrates the list of variables which establishes the relationship between the pedagogy and BI model.

Table 3.3: The Variables from Relationship Between Pedagogy and BI

Independent Variables		Dependent Variable
Perceive Learning styles:	Visual	
(PCLS)	Auditory	Behavioural Intent to Use (BI)
	Read/Write	
	Kinesthetic	
Preferred Learning Styles:	Activists	
(PFLS)	Reflectors	Behavioural Intent to Use (BI)
	Theorists	
	Pragmatists	
Teaching Styles:	Expert	
(TS)	Formal Authority	
	Demonstrator	Behavioural Intent to Use (BI)
	Facilitator	
	Delegator	

3.6.3 DEMOGRAPHIC WITH BEHAVIOURAL INTENT TO USE

One of the assumptions of this research states: "Lecturers and students in different university types and different university locations may have a different behavioural intention to use ECG." To prove this assumption and to answer research question 1: "What Factors Will Influence the Successful Introduction of ECG into the Classroom by Thai Lecturers and Students?", the correlation between "University Type" and "University Location" with "Behavioural Intent to Use" has to be tested. Table 3.4 illustrates the list of variables illustrating the relationships between university type (UT) and university location (UL) with the BI model.

Table 3.4: The Variables from the Relationship Between UT and UL with BI

Independent Variables		Dependent Variable
University Type (UT)	Public	Behavioural Intent to Use (BI)
	Private	
University Location (UL)	Metropolitan	Behavioural Intent to Use (BI)
	Regional	

3.6.4 PEDAGOGY WITH COMPUTER GAME PLAY BEHAVIOUR

Pedagogy in this research is teaching and learning style; Computer Game Play Behaviour can be defined in two variables: Playing Games and Level of Experience in Game Playing. The relation between Pedagogy and Computer Game Play Behaviour has been constructed in order to answer research question 5: "Are There Any Relationships Between Learning Styles, Teaching Styles, and Gender with Computer Game Play Behaviour?" The lists of variables and Pedagogy with Computer Game Play Behaviour Model are illustrated in Table 3.5.

Table 3.5: The Variables from the Relationships Between Pedagogy with Computer Game Play Behaviour

Independent Variables		Dependent Variable
Learning Styles: (LS)	Activists	Playing Games
	Reflectors	
	Theorists	
	Pragmatists	
Teaching Styles: (TS)	Expert	Level of Experience
	Formal Authority	
	Demonstrator	
	Facilitator	
	Delegator	
Learning Styles: (LS)	Activists	Level of Experience
	Reflectors	
	Theorists	
	Pragmatists	
Teaching Styles: (TS)	Expert	Playing Games
	Formal Authority	
	Demonstrator	
	Facilitator	
	Delegator	

3.6.5 GENDER WITH COMPUTER GAME PLAY BEHAVIOUR

The relationship of Gender and Computer Game Play Behaviour was constructed according to proposition 5 of this research: "Different Gender Affects on

Different Game Play Behaviour." Table 3.6 illustrates the list of variables illustrates the relationship between Gender and Computer Game Play Behaviour model.

Table 3.6: The Variables from the Relationships Between Gender and Computer Game Play Behaviour

Independent Variables	Dependent Variable
Gender	Playing Game
	Level of Experience

In conclusion, all variables in this research can be modelled in their relationships as illustrated in Figure 3.3: "Relationship of Variables and Hypotheses" in Section 3.7

3.7 RESEARCH PROPOSITION, RESERCH QUESTIONS, AND HYPOTHESES

A research proposition is a single potentially testable component of a theory. It is a conclusion which was drawn about the relationships among concepts, derived from the axiomatic groundwork (Babbie, 1998). Deriving from the research proposition, research questions and hypotheses can be constructed. In this case, a research question may be considered a refined restatement of a proposition that is testable. Hence, the research question can be defined as: (1) framed as a question, and (2) makes the proposition testable by suggesting a way to evaluate it. A single research question may generate several hypotheses. To generate the hypothesis is to write the statement of expectation or prediction derived from the research question, often involving the relationships between two variables (Jackson, 2003). In this research, five propositions were constructed, five research questions were derived, and subsequently 20 hypotheses were generated. Table 3.7 illustrates the relationships of propositions, research questions, and hypotheses; and Figure 3.3 illustrates the relationships of the variables and hypotheses.

Table 3.7: Research Propositions, Research Questions, and Hypotheses

Research Propositions	Research Questions	Hypotheses
Proposition 1: "Students and Lecturers Behavioural Intent to Use Are Predicted by ECG Acceptance Factors (PU, PEOU, AU, SN, PE and UESF)"	**Question 1:** "What Factors Will Affect the Use of ECG in Classroom by Lecturers and Students?"	Hypotheses 1 to 6
Proposition 2: "The Different University Type and University Location of Respondents Will Affect the Use of ECG in Classroom"		Hypotheses 13 to 14
Proposition 3: "Students' Different Learning Styles and Lecturers' Different Learning Styles Affect on Their Behavioural Intent to Use ECG in Classroom"	**Question 2:** "What Learning Styles of Thai Students Will Benefit from Using ECG?" **Question 3:** "What Teaching Styles of Thai Lecturers Will Benefit from Using ECG?"	Hypotheses 7 to 12
Proposition 4: "Different Learning Styles and Teaching Styles Affect on Different Computer Game Play Behaviour"	**Question 5:** "Are There Any Relationships Between Learning Styles and Teaching Styles with Computer Game Play Behaviour?"	Hypotheses 15 to 18
Proposition 5: "Different Gender Affects on Different Computer Game Play Behaviour"	**Question 6:** "Are There Any Relationships Between Genders with Computer Game Play Behaviour?"	Hypotheses 19 to 20

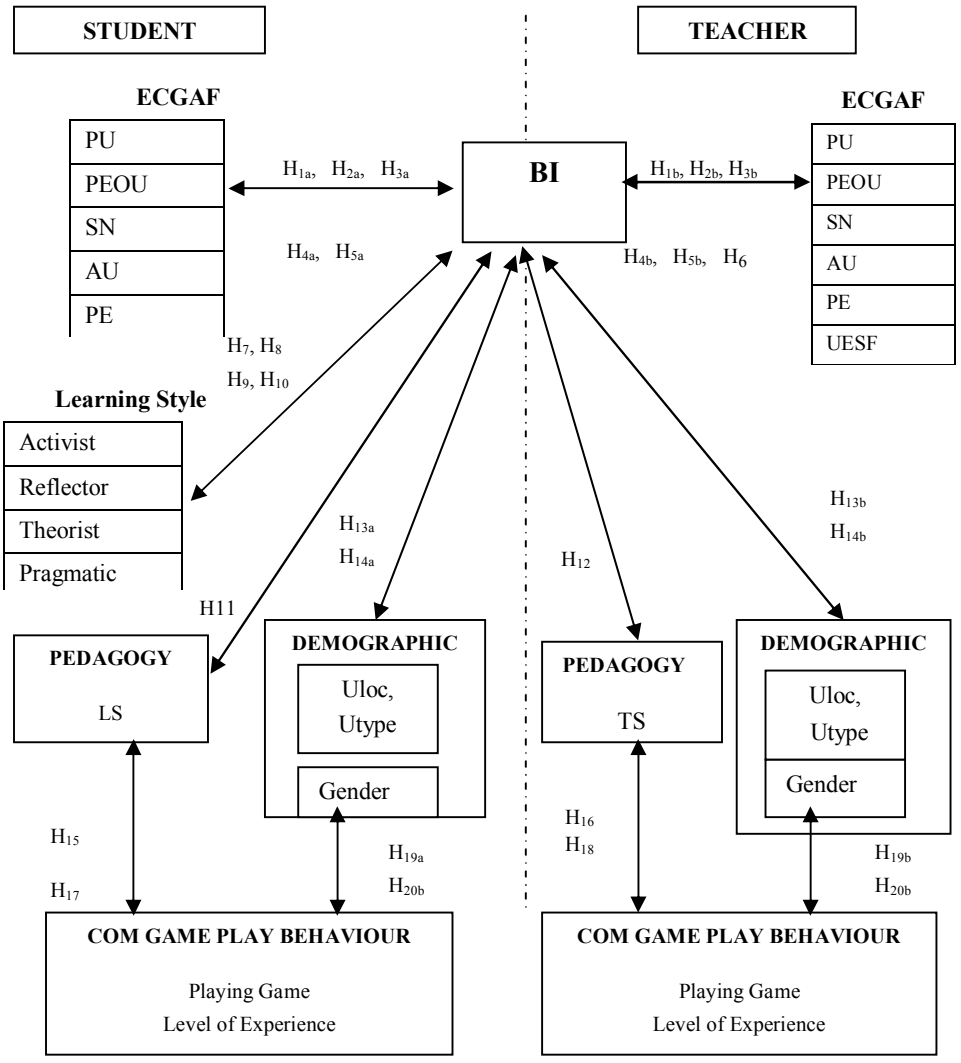


Figure 3.3: Relationship of Variables and Hypotheses

According to Figure 3.3, 20 hypotheses were generated. These hypotheses were classified under six clusters: 1) ECG Acceptance Factors and BI; 2) ECG Acceptance Factors and BI measured by Learning Styles; 3) Learning & Teaching Styles and BI; 4) Demographic Data and BI; 5) Learning & Teaching and Computer Game Play Behaviour; and 6) Gender and Computer Game Play Behaviour. Twenty hypotheses were illustrated in Table 3.8.

Table 3.8: The Hypotheses of the Thesis

Cluster	Related Proposition
Cluster 1: ECG Acceptance Factors and BI (H_1-H_6)	Proposition 1: "Students and Lecturers Behaviour Intent to Use Are Predicted by ECG Acceptance Factors (PU, PEOU, AU, SN, PE, and UESF)."
H_1: There Is a Linear Correlation Between Perceived Usefulness and Behavioural Intention to Use.	
H_{1a}: There Is a Linear Correlation Between Students' Perceived Usefulness and Students' Behavioural Intention to Use	
H_{1b}: There Is a linear Correlation Between Lecturers' Perceived Usefulness and Lecturers' Behavioural Intention to Use.	
H_2: There Is a Linear Correlation Between Perceived Ease of Use and Behavioural Intention to Use.	
H_{2a}: There Is a Linear Correlation Between Students' Perceived Ease of Use and Students' Behavioural Intention to Use.	
H_{2b}: There Is a Linear Correlation Between Lecturers' Perceived Ease of Use and Lecturers' Behavioural Intention to Use.	
H_3: There Is a Linear Correlation Between Attitude Towards Use and Behavioural Intention to Use.	
H_{3a}: There Is a Linear Correlation Between Students' Attitude Towards Use and Students' Behavioural Intention to Use.	
H_{3b}: There Is a Linear Correlation Between Lecturers' Attitude Towards Use and Lecturers' Behavioural Intention to Use.	
H_4: There Is a Linear Correlation Between Subject Norm and Behavioural Intention to Use.	
H_{4a}: There Is a Linear Correlation Between Students' Subject Norm and Students' Behavioural Intention to Use.	
H_{4b}: There Is a Linear Correlation Between Lecturers' Subjective Norms and Lecturers' Behavioural Intention to Use.	
H_5: There Is a Linear Correlation Between Perceived Enjoyment and Behavioural Intention to Use	
H_{5a}: There Is a Linear Correlation Between Perceived Enjoyment and Students' Behavioural Intention to Use.	
H_{5b}: There Is a Linear Correlation Between Lecturers' Perceived Enjoyment and Lecturers' Behavioural Intention to Use.	
H6: There Is a Linear Correlation Between University Environment Support Factors and Lecturers' Behavioural Intention to Use.	
Cluster 2: ECG Acceptance Factors and BI Measured by Learning Styles. (H_7-H_{10})	Proposition 3: "Students' Different Learning Styles and Lecturers' Teaching Styles Affect on Their Behaviour Intent to Use ECG in the Classroom."
H_7: There Is a Linear Correlation Between the Acceptance of Educational Computer Games and the Behavioural Intention to Use as Measured by the Activist Learning Style	
H_8: There Is a Linear Correlation Between the Acceptance of Educational Computer Games and the Behavioural Intention to Use as Measured by the Reflector Learning Style	
H_9: There Is a Linear Correlation Between the Acceptance of Educational Computer Games and the Behavioural Intention to Use as Measured by the Theorist Learning Style	
H_{10}: There Is a Linear Correlation Between the Acceptance of Educational Computer Games and the Behavioural Intention to Use as Measured by the Pragmatic Learning Style	
Cluster 3: Learning and Teaching Styles and BI (H_{11}-H_{12})	Proposition 3: "Students' Different Learning Styles and Lecturers' Teaching Styles Affect on Their Behaviour Intent to Use ECG in the

	Classroom."
H_{11}: Students with different Learning Styles have different Behavioural Intentions to Use Educational Computer Games in the classroom. H_{12}: Lecturers with different Teaching Styles have different Behavioural Intentions to Use Educational Computer Games in the classroom.	
Cluster 4: Demographic Data and BI (H_{13}-H_{14})	Proposition 2: The Different University Type and University Location of Respondents Will Affect the Use of ECG in the Classroom."
H_{13}: Varying University Locations have different Behavioural Intentions to Use H_{13a}: Students in different University Locations have different Behavioural Intentions to Use Educational Computer Games in the Classroom. H_{13b}: Lecturers in different University Locations have different Behavioural Intentions to Use Educational Computer Games in the Classroom. H_{14}: Differing University Types have different Behavioural Intentions to Use H_{14a}: Students in differing University Types have different Behavioural Intentions to Use Educational Computer Games in the Classroom. H_{14b}: Lecturers in differing University Types have different Behavioural Intentions to Use Educational Computer Games in the Classroom.	
Cluster 5: Learning & Teaching Styles and Computer Game Play Behaviour (H_{15}-H_{18})	Proposition 4: "Different Learning Styles and Teaching Styles Affect on Different Computer Game Play Behaviour."
H_{15}: There Is a Correlation Between Learning Styles and Playing Games. H_{16}: There Is a Correlation Between Teaching Styles and Playing Games. H_{17}: There Is a Correlation Between Learning Styles and Levels of Experience. H_{18}: There Is a Correlation Between Teaching Styles and Levels of Experience	
Cluster 6: Gender and Computer Game Play Behaviour (H_{19}-H_{20})	Proposition 5: "Different Gender Affects on Different Computer Game Play Behaviour."
H_{19}: There Is a Correlation Genders and Playing Games. H_{19a}: There Is a Correlation Between a Student's Gender and Playing Games. H_{19b}: There Is a Correlation Between a Lecturer's Gender and Playing Games. H_{20}: There Is a Correlation between Genders and Levels of Experience H_{20a}: There Is a Correlation Between a Student's Gender and the Level of Experience. H_{20b}: There Is a Correlation Between a Lecturer's Gender and the Level of Experience.	

3.8 SUMMARY

Investigating the feasibility of adopting ECG into Thai undergraduate courses is the purpose of this thesis. Three main objectives are to investigate the impact of lecturers and students in their use of ECG, to identify learning and teaching styles which may make best use of ECG, and to determine the appropriate game genre to develop an effective ECG. In order to achieve these objectives, three theoretical frameworks namely the technology acceptance model, pedagogical theories, and conceptualisation of ECG have been investigated. In addition, demographic data variables which assume that some factors affect the use of ECG have also been studied. These variables are

private and public universities, universities in metropolitan and regional areas, and gender of lecturers and students.

According to the five research questions identified in Chapter 1, 20 hypotheses have been formulated in order for testing to prove and find the results to answer those research questions. Research methodology, data collection, data analysis, and how hypotheses have been tested are discussed in the following chapter.

CHAPTER 4
RESEARCH METHODOLOGY

This chapter presents and discusses the issues related to the research methodology and research design of the study. It includes the following sections:

4.1 Research method

4.2 Data collection method and technique

4.3 Research population and sampling

4.4 Data analysis

4.5 Summary

4.1 RESEARCH METHOD

Due to the different approaches to data sources and data analysis, most researchers can get a benefit research by blending both quantitative and qualitative research in their studies. In this thesis both of these research methods are combined and applied throughout the research.

There are many research methodologies, for example, experimental research, survey research, ethnography, phenomenological research, grounded theory, heuristic inquiry, action research, discourse analysis, etc. (Crotty, 1998). Among these methodologies, survey research methodology is considered to be the most appropriate for this thesis. It is concerned with drawing a sample of subjects from a population and studying this in order to make inferences about the population. The populations in this research are students and lecturers at the undergraduate level in Thailand. The researcher randomly selected a sample of respondents from a population and administered a standardised questionnaire to them. Among the several types of surveys,

they include written survey, oral survey, electronic surveys or an example survey. This research focuses on the written and oral surveys.

A written survey can be a mail survey, group administered questionnaires or drop-off survey (Fowler, 1993). A drop-off survey was used in this research. After receiving the consent from each university sampled, questionnaires were dropped-off to the university administrative staff office. The questionnaires were distributed to the target respondents with the support of the university. Respondents could answer the survey at their own convenience and return the questionnaire to the staff office at any time.

Oral surveys were also conducted after the written survey was finished. The oral survey was voluntary. Respondents were asked at the end of the questionnaire the option to participate in an interview. They were informed the estimated time for the interview and received the interview questions in advance.

4.2 DATA COLLECTION METHOD AND TECHNIQUE

This research employed two methods of data collection including questionnaires and interviews. The questionnaire survey was self-administered and the interview was voluntary process agreed by a respondent upon completion of the questionnaire.

4.2.1 QUESTIONNAIRE DESIGN

Successful questionnaires take the respondent through the questions in such a way that he or she finds it easy to give accurate answers to the questions (Hague, 1993). The steps of questionnaire design in this thesis included:

1. **Defining objectives of the survey:** the objective survey was significant and was used as a guideline for developing the questionnaire.

2. **Covering letter:** it was also essential to attach a cover letter to introduce respondents to the study and explain the survey objectives. To establish credentials and

legitimacy, the cover letter of this survey explained that the study was a research project of the School of Information Technology, Murdoch University, Perth, Australia, and that all information obtained would be subject to anonymity and confidentiality and used only for the purposes of the present study.

3. Self-administered questionnaire development: After the objectives of the study and the sampling group were defined, the survey questions were composed. The questionnaire development focused on three areas: technology acceptance; teaching & learning; and computer games according to the research model shown in Chapter 1 and the theoretical framework discussed in Chapter 3. Hence, the research model based on the conceptualisation of research constructs is formulated as shown in Figure 4.1.

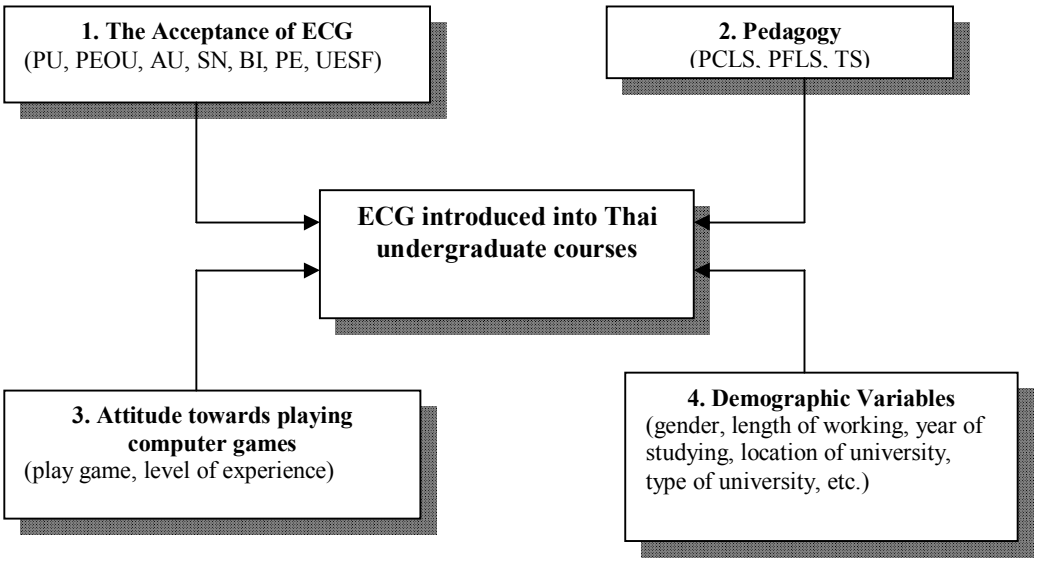


Figure 4.1: Research Model Based on the Conceptualisation of Research Constructs

From Figure 4.1, box 1: the acceptance of ECG was formulated in order to answer research question 1: "Which Factors Will Influence the Successful Introduction of ECG into the Classroom by Thai Lecturers and Students?" Box 2: Pedagogy was formulated in order to answer research question 2 and 3: "Which Learning Styles Will Derive Benefit from the Use of ECG?" and "Which Teaching Styles Will Derive

Benefit from the Use of ECG?" respectively. Box 3: Attitudes toward playing computer games was formulated in order to answer research question 4: "Which Computer Game Genres Will be Appropriate for ECG in the Educational Environment of Thai Undergraduate Courses?" Box 4: demographic variables: gender, the length of working, the year of studying, university location and university type were formulated as the general information of the respondents. There are three general reasons for obtaining these data (Czaja & Blair, 1996). First, analysis may require them. Second, they may be needed to compare the demographic distributions in our study to census data in order to assess the representativeness of the sample. Third, if post stratification was chosen, this data will be needed. In this research, demographic data is collected at the beginning of the questionnaire. It is best to begin with a question most respondents will find relatively easy to answer (Czaja & Blair, 1996). One obvious argument in favour of the beginning of the questionnaire is that normally background questions are easier to answer and can ease the respondent into the questionnaire. Consequently, the questionnaire was structured and separated into four parts:

Part A: Demographic Information. It comprised six questions: length of working (for respondent who is instructor) or year of studying (for student), gender, experience on educational technology and computer games, university location, and university type. All questions were established as nominal scales.

Part B: Educational Computer Game Acceptance. According to the Section 3.4: Conceptualisations of Research Constructs in Chapter 3, in order to investigate those factors affecting the use of ECG in the classroom by Thai lecturers and students, variable "Behavioural Intent to Use" is used as a determinant for the adoption of ECG. The model of predicting and explaining the adoption of educational computer games discussed in Chapter 3 can be shown by the following expression:

$$BI = PU + PEOU + AU + SN + PE + UESF$$

Accordingly, part B was structured into 7 portions according to the seven variables shown in the above expression. The respondent's opinions toward these variables were established on a five-point Likert Scale (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree). The operationalisation of each variable used in this part is described below.

Behavioural Intent to Use (BI) is the indication of how hard people are willing to try and how much effort they are willing to exert (Venkatesh, 2003). In other words, the degree to which lecturers and students are willing to use ECGs in the classroom.

According to an example reported in Ajzen and Fishbein (1980), the measure of BI is a single item. The reason for using one item is the conceptualisation of BI does not readily lend itself to measurement with a number of items (Rawstorne, 2005). BI is not a multiple component construct such as attitude. As such, measuring BI with multiple components runs the risk of measuring something other than BI, such as behavioural expectation (Warshow & Davis, 1985), as there are only limited ways in which a person's intention to perform a given action within a particular context and time can be asked (Rawstorne, 2005). However, in this survey the measure of BI is two question items. Statements in both questions measure the behavioural intention to use ECG in the future. One is a positive statement; the other is a negative statement. According to Corn (2007), a Likert Scaling is a bipolar scaling method, measuring either positive or negative responses to a statement.

Perceived Usefulness (PU) is the degree to which a person believes that educational computer games (ECG) in the classrooms would be advantageous and provide positive, expected outcomes (Davis, 1989). In an operational definition, PU

mean the level ECG can support and enhance the effectiveness of learning & teaching, engage students during learning and allow students to progress at their own pace.

Venkatesh et al. (2003) proposed six indicators used for measuring PU. They include these key phases: 1. enable to accomplish tasks, 2. improve job performance, 3. increase productivity, 4. enhance effectiveness on the job, 5. make it easier to do the job and 6. The system useful in the job.

Perceived Ease of Use (PEOU) is the degree to which a person believes that the use of ECG would take less effort (Davis, 1989). This can be measured by how simple it is to learn to operate ECG in the classroom.

Key phases used for measuring PEOU include: the system would be easy for a user, easy to get the system do what he/she wants, clear and understandable, flexible to interact with, easy for a user to become skillful, and overall, a system a user believes it is easy to use (Davis, 1989; Moore & Benbasat, 1991; Thompson, Higgins, & Howell, 1991). Conversely, some are proposed in negative phases (Thompson, et al., 1991): take too much time from normal duties, too complicate, difficult to understand, and take too long to learn how to use.

Attitude Towards Use (AU) is how an individual feels (positive or negative) about using ECG in the classroom (Davis, 1989). Learners have confidence, find ECG useful and enjoy using it in the classroom.

Key phases used for measuring AU include (Compeau & Huggins, 1995; Compeau, Huggins, & Huff, 1999; Davis, 1989; Fisbein & Ajzen, 1975; Taylor & Todd, 1995; Thompson, et al., 1991): using the system is a bad/good idea, using the system is a foolish/wise idea, dislike/like the idea of using the system, make work more interesting, like working with the system, it is hard and using the system is frustrating, I

find it hard to stop working and find it useful, I get bored quickly when using the system.

Subjective Norms (SN) is the perception that most people who are important to the respondent think he/she should or should not use ECG in the classroom (Davis, 1989; Thompson, et al., 1991). In other words, positive or negative influence from respondents' colleagues, friends, supervisors and superiors regarding the use of ECG in the classroom by students and lecturers.

Key phases used for measuring SN include people who influence another's behaviour which causes them to think about a system, one uses it because of the proportion of coworkers who use the system, senior management of a business have been helpful in the use, a supervisor is very supportive of user, people in an organisation who use the system have a high profile (Ajzen, 1991; Davis, 1989; Mathieson, 1991; Moore & Benbasat, 1991; Taylor & Todd, 1995; Thompson, et al., 1991).

Perceived Enjoyment (PE) is the degree to which the use of ECG is perceived to be enjoyable in its own right (Pikkarainan, et al., 2004). Perceived enjoyment can also be defined as the extent to which the activities of using a certain technology is perceived as being enjoyable (Davis, et al., 1992). It is also the degree of enjoyment, amusing, pleasure, gratification, excitement, stimulation, challenge and competition experiencd in playing with ECG in the classroom.

Pikkarairen et al. (2004) proposed five indicators to be used for measuing PE. The key words include: fun, pleasant, positive, exciting and wise.

University Environment Support Factors (UESF) are elements which influence a lecturers' beliefs and their support for technology integration into the classroom. Likewise for technology integration into universities (Ford, 1992). These supportive environment factors will help lecturers to effectively use ECG in the

classroom. These include resources, professsional development, support from teachers, students, parents, and administrators, buildings and equipments, etc. UESF was used only in the lecturer's questionnaire. Instruments used in measuring lecturer's opionions in this portion were adopted from the "Beliefs about Teaching with Technology (BATT) instrument, (http://www.iste.org/jrte/34/1/abstracts/lumpe.efm). The instrument is composed of 14 questions. A respondent's opinions toward these variables are established on a five-point Likert Scale (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree).

Part C: Teaching Styles/ Learning Styles. This part was structured as teaching or learning styles dependent on whether the respondent is an instructor or student. The survey instruments in this part borrowed questions from standard inventory surveys. Teaching style is adopted from 40 items of the Grasha-Riechman Inventory Teaching style (http://longleaf.net/teachingstyle.htm). As for learning styles, the respondents are asked to response in both their perceptual learning style and preferred learning style. Perception Learning Styles are adopted from the VARK questionnaire (http://www.vark.learn.com/English/page.asp?=cpmtact). Preferred Learning Styles are adopted from the Honey and Mumford Learning Styles Questionnaire (http://brainbox.co.uk/A2_LEARNSTYLE/pages/ roughandready.htm).

Part D: Experience on Computer Games. This part relates to the experience and behaviour in playing computer games. All questions are established on a nominal scale. One question is established in ranking 1 to 3 according to the degree of importance regarding a respondent's opinion. Questions included in this part are: experience of game playing; game platforms a respondent likes to play; the frequency, the length and the places they play computer games, the preferences and expectations from the computer games. In this part, it also includes open-ended questions asking

about a respondent's concern if ECG has to be adopted into the curriculum and other further comments about the use of ECG in the classroom.

4. **Interviewing questionnaire:** At the end of the self-administered questionnaire, participants were asked to participate in an interveiw. They were informed of the estimated time for the interview and received the interview questions prior to the interview. If the participant would like to participate, an arrangement was made to conduct an interview. The participant was informed that the completion of the interview is voluntary and could decide not to participate at anytime by simply stopping answering questions. Questions structured for the interview included six questions for the students and seven questions for the lecturer. Some interview questions required feedback to answer the research question 4: "Which Computer Game Genres Will be Appropriate for ECG in the Education Environments of Thai Undergraduate Courses?" Some questions called for feedback to support research question 1: "Which Factors Will Influence the Successful Introduction of ECG in the Classroom by Thai Lecturers and Students?" Other interview questions indirectly supported the research questions. However, the feedback from all of the interview questions are expected to support teaching and learning with ECG in the classroom.

The self-administered questionnaires and interview questions were divided into two sets: a first set: "student questionnaire", distributed to students and a second set: "teacher questionnaire" distributed to instructors. Both sets of questionnaires provided a common set of questions, and contained different questions in some parts of the questionnaire.

4.2.2 TRANSLATION AND BACK-TRANSLATION

The English version of the self-administered questionnaire and interview questions were translated into Thai, using a method involving translation and back-

translation. The researcher translated the questionnaires and interview questions into the Thai language. After that they were back-translated into English by a Thai lecturer who is teaching English as a second language, and was not involved in the original translated version. Original version and back-translated versions were then compared. Some minor revisions were made to ensure that both versions convey the same meaning as the original version. Once these were completed, the Thai version was content validity tested by three experts and pilot tested using a small sample of students and lecturers (detailed in Section 4.2.3) to ensure its comprehensibility and readability.

4.2.3 RELIABILITY AND VALIDITY OF RESEARCH INSTRUMENT

Validity of research instrument

A questionnaire is valid if it measures what it is supposed to measure and it is reliable if the responses are consistent and stable (Frazer & Lawley, 2000). In this research the content validity of the questionnaire has been assessed. Content validity or face validity assesses the correspondence between the individual items and the concept through ratings by expert judges, and pre-tests with comparable sub-populations or other means (Hair, Anderson, Tatham, & Black, 1995). This research used both strategies to test content validity by asking two experts in the field of information technology and one expert in the field of educational technology to provide their judgement on the questionnaire. The questionnaire, the background and objective of the research, and the question wording check list (see Table 4.1) were provided to three experts to check whether individual items corresponded with the objectives and concept of study. Some minor revisions were made to the instrument according to their suggestions.

Table 4.1: Question Wording: Check List for Content Validity Assessment*

Question Wording Principle	No	Yes (specify the items)	Comments
Is the question brief?			
Will the words be uniformly understood?			
Is the question too vague?			
Is the question too precise?			
Is the question necessary?			
Is it a double question?			
Does the question have a double negative?			
Are the answer choices mutually exclusive when only one answer is requested?			
Is the question biased?			
Is the question objectionable?			
Is the question too demanding			
Can the question stand alone?			
Is the question applicable to all respondents?			
Dose the question lead the respondent?			
Other comments			

* Adapted from: Frazer & Lawley (2000)

The questionnaire was pre-tested by sub-populations. These pre-test groups were selected in the School of Information Technology in two universities in Thailand. One was in Bangkok; the other was in a North-Eastern province. There is no rule of thumb to the size of people in pre-testing, but around 20 to 30 people could be included in total (Frazer & Lawley, 2000). This research employed 26 people, 18 undergraduate students and 8 instructors. Respondents were asked to both fill out the questionnaire and to make comments on the suitability of the questions. Feedback from the respondents helped clarify some questions. The questionnaire was revised to incorporate the suggestions made by these respondents.

Finally, the feedbacks from pre-testing and expert content checking were used to refine the questions.

Reliability of Research Instrument

According to the questionnaire design in Section 4.2.1, most of the survey instruments in this questionnaire have been adopted from existing questionnaires elsewhere and those have already been tested for reliability and validity. Converse and Presser (1986) recommended that researchers be able to consult published compilations of survey questions. This will not only give researchers some ideas on how to develop a questionnaire, but researchers can even borrow questions from surveys that reflect their own research. Since these questions and questionnaires have already been tested and used effectively, researchers will save both time and effort (Converse & Presser, 1986). In Part B of this research, Theory of Technology Acceptance (TAM, TRA and BATT) has been adopted and integrated as a component in ECG Acceptance. Part C: Teaching Style (in the teacher questionnaire) and Learning Style (in the student questionnaire), Grasha-Riechman Inventory Teaching style, VARK questionnaire and Honey and Mumford Learning Styles Questionnarie have also been adopted.

Educational Computer Game Acceptance

The instrument used for measuring the technology acceptance in part B, the questionnaire survey items to assess PU, PEOU, AU, SN, PE, UESF and BI, has been constructed in many research as referenced in Section 4.2.1. The reliability of the questionnaire has been assumed by making reference to these standard questionnaires. Questionnarie items for the University Environment Support Factor (UESF) were replicated exclusively from Lumpe and Chamber's (2001) Beliefs About Teaching with Technology (BATT) questionnaire. Lumpe and Chambers (2001) advocated that the items in BATT are valid and reliable to assess the perceived behavioural control structure. Table 4.2 shows a summary of variables in ECG acceptance and respective questionaire items.

Table 4.2: Summary of Variables in ECG Acceptance and Respective Questionnaire Items

Variables	Questionnaire items used by previous researchers	Questionnaire items constructed in this research
PU	Using the system in my job would:	Using ECG as a learning tool would:
	Enable me to an accomplish task	Increase my teaching/my learning and academic performance
	Improve my job performance	Enhance the effectiveness on my teaching/ learning
	Increase my productivity	Engage the students during learning
	Enhance my effectiveness on the job	Allow the students to progress at their own pace
	Not supporting my job in anyway	Not support my teaching/ learning
PEOU	Learning to operate would be easy	Easy for me to learn to operate ECG
	Easy to get the system to do what I want it to do	Cumbersome to use ECG for teaching/ learning
	The system is so complicated	Too complicate and difficult to learn ECG
	It is difficult to understand what is going on	Time consuming to familiarise with ECG
	Overall, I believe the system is easy to use	Overall, I think ECG is easy to use
AU	I think I have self-assurance to use the system	Have self confidence in using ECG
	Using the system is a foolish idea	Feel anxiety when using ECG
	The system makes work interesting and useful	It is hard to learn new ECG
	Using the system is frustrating for me	Use ECG is useful
	I dislike the idea of using the system	I dislike the idea of using ECG
SN	People who are important to me think I should use the system:	People who influence or be important for respondent on using ECG:
	My co-workers	My colleagues in this faculty/ my teacher
	The senior management of this business	My colleagues in other faculties/ my friends in other faculty
	My supervisor	My friends/ my parent
	People in my organisation	My supervisor at work/ my academic supervisor
	People outside my organisation but who do the same business	
PE	Using this system would be:	Using ECG in classroom would be:
	Fun	Fun and amusing
	Pleasant	Pleasant and gratifying
	Positive	Excited and stimulating
	Exciting	Boring and tedious
	Boring	Challenging and competitive
UESF	Resources	Resources
	Professional development	Professional development
	Access to the Internet	Access to the Internet
	Quality software	Quality software
	Physical classroom structure	Physical classroom structure
	Support from school administrators	Support from school administrators
	Support from parents	Support from parents
	Support from other teachers	Support from other teachers
	Technical support	Technical support
	Time to plan for ICT implementation	Time to plan for ICT implementation
	Smaller class size	Smaller class size
	Time to let student to use ICT	Time to let student to use ICT
BI	I intent to use this system in the near future	I intent to use ECG in my future teaching / learning
		I definitely do not think I will use ECG in the classroom

Teaching and learning styles

This research includes Grasha-Riechman Inventory Teaching style in Part C of the questionnaire and is used only for lecturer questionnaire. The Vark learning style Questionnaire and Honey and Mumford Learning Styles Questionnarie were also used in Part C, but used only for the student's questionnaire.

One of the most recognised works on teaching style is Grasha's (2002) work, Teaching With Style (Deggs, Machtmes, & Johnson, 2008). The instrument assesses a teacher's teaching style and yields an individual score on five distinct teaching styles (Expert, Formal Authority, Personal Model, Facilitator, and Delegator). Grasha (1996) reported acceptable reliability (α =0.68-0.75 on individual scales, and α =0.72 for the entire test) and validity. The psychometric study for the Teaching Style Inventory (TSI) received a similar finding of those by Grasha (LaBillois & Lagace-Seguin, 2007).

The learning Styles Questionnaire (LSQ) by Honey & Mumford is used as a preferred learning style in this research. Honey & Mumford's Learning Style Questionnaire was derived from the same conceptual basis as Kolb's Learning Style Inventory and may provide a more reliable and valid measure of Kolb's learning style constructs (Cockerton, Naz, & Sheppard, 2002). Quite a number of researchers utilised Honey & Mumford in their research for the reason of high reliability. For example, Ronan (1996) in his research measured the reliability of the questionnaire from Honey & Mumford; the result is 0.989, which was very high. The reliability of the original item of the questionnaire from Honey & Mumford had an Alpha Cronbach value of 0.89. The adaptation of the original item had also been done by Nafisah & Nurhaiza (2005) and Baharuddin (1999). The result from the test is 0.8013 which is considered very highly reliable if the Alpha-Cronbach value is above 0.8. Besides having high reliability, LSQ by Honey and Mumford (1992) was chosen because it is suitable for

teenagers (Riding, 1991). Hence, LSQ by Honey and Mumford is assumed to be an appropriate questionnaire for Thai undergraduate students.

The VARK learning style instrument addresses sensory perceptions and can work toward establishing a dialogue on differences that may exist in the way an individual prefers to learn (Levin-Brown, Bonham, Saxon, & Boylan, 2008). Originally, VARK theory was developed by Fleming in 1987. It was considered exclusively the instructional preference of individuals using the visual, aural, read/write, and kinesthetic styles (Flemming, 2001). The VARK questionnaire consists of 16 questions. A participant is asked to choose from four responses that best represents their way of learning. More than one response can be selected if appropriate, or can be left blank if no responses apply. The VARK questionnaire has established reliability and validity (T. Brown, Cosgriff, & French, 2008) and has been used with nursing students previously (Clark, 2000; Flemming, 2001).

4.3 RESEARCH POPULATION AND SAMPLING

4.3.1 POPULATION

The population of the study consisted of students and lecturers at the undergraduate level in Thailand. The population was identified for analysis purposes by gender, year of study (student survey); length of teaching (lecturer survey); experience on educational technology and computer games; university location; and university type.

4.3.2 SAMPLE S SIZE AND SAMPLING

In this study the sample was a set of respondents selected from universities in Thailand. Two target groups of samples were students and instructors. These two samples were selected to complete the questionnaire survey only.

The interview survey was conducted after respondents completed the questionnaire survey. At the end of the questionnaire, participants were asked to participate in the interview. The interview was a voluntary process. Hence, the sample size in an interview survey depended on the number of voluntary participants.

Sample size

The sample size was calculated based on Yamane's (1967) sample size and margin error table. The number of undergraduate students in Thailand was 1,951,210 (OHEC, 2010). According to Yamane's sample size table, a population size exceeding 100,000, where the confidence level is 95%, suggests the sample size should be 400.

Sampling

The sampling procedure is multistage sampling. The first step is the use of **simple random sampling.** It is used to select the target universities. The second step is stratified random sampling. **Stratification** is the process of grouping members of the population into relatively homogeneous subgroups before sampling. This technique is used to find the proportion of participants. The sampling methods in the survey were processed as follow:

First, the participants were recruited from the School of Information Technology in four universities: two private and two public universities with two of them being metropolitan, and the other two from regional areas. These four universities were selected by using a random sampling technique.

Second, after receiving the consent from each university, the participants were selected by using a stratified random sampling. The numbers of selected participants from each university were proportionately allocated. There are two steps in this selection.

Step 1: Find the proportion of the participants from each university

The populations of students in the Faculty of Information Technology from university 1, 2, 3, 4 were 283, 339, 249, and 250 respectively. The populations of lecturers in the same faculty from university 1, 2, 3, 4 were 24, 31, 29, and 21 respectively. The result of the sample size is illustrated in Table 4.3:

Table 4.3: Sample Size of Participants in Each University

University	Student		Lecturer	
	Population	**Sample size**	Population	**Sample size**
1	283	**101**	24	**9**
2	339	**121**	31	**12**
3	249	**89**	29	**11**
4	250	**89**	21	**8**
Total	1121	**400**	105	**40**

Step 2: Find the proportion in each stratum (year of student)

The populations of students divided by year (year 1, year 2, year 3, and year 4+) of study in university 1, 2, 3 and 4 are illustrated in Table 4.4.

Table 4.4: Sample Size of Students Divided by Year of Study

Year	University 1		University 2		University 3		University 4		**Total Sample**
	pop	Sample	Pop	Sample	Pop	Sample	Pop	Sample	
1	70	**25**	75	**27**	70	**25**	70	**25**	**102**
2	78	**28**	95	**34**	70	**25**	70	**25**	**112**
3	92	**33**	112	**40**	73	**26**	73	**26**	**125**
4+	43	**15**	57	**20**	36	**13**	37	**13**	**61**
Total	283	**101**	339	**121**	249	**89**	250	**89**	**400**

4.3.3 THE RESPONSE RATE

From the total of 400 questionnaires returned by students, only two questionnaires were unused, and were not integrated as elements of the sample size (398 cases). A total of 32 out of 40 were questionnaires returned from lecturers.

The reasons that two unused questionnaire were excluded was because there were only two sections completed with the rest of the questions left unmarked. As for the interview survey, there were 18 interviewees voluntarily participating in this survey.

4.4 Data Analysis

Data analysis was performed after the data collection was completed. This process provided arguments for the research discussion and the drawing of conclusions. All questionnaire data was manually entered by the researcher and analysed using SPSS version 14.0. The statistics used for data analysis in the quantitative part were descriptive and inferential statistics. Content analysis was used in the qualitative part.

Descriptive statistics were used to describe the basic features of the data in a study. In this survey percentile, mean and standard deviation are used. Percentile was used for the nominal scale data mostly in part one, Demographic data and some in part D (Experience on Computer Game). Mean and Standard Deviation used for measuring of central tendency and variability of those data in the 5-point Likert scale. (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree. To draw the conclusion from each question, the value of the "mean" has been calculated and the data has been interpreted according to this criterion:

Value of "mean" between	Interpretation
1.00-1.50	Strongly disagree
1.51-2.50	Disagree
2.51-3.50	Neutral
3.51-4.50	Agree
4.51-5.00	Strongly Agree

The data interpretation has been reversed for those question items which are negative statements. Thus, the value of "mean" has been interpreted according to the following criterion:

Value of "mean" between	Interpretation
4.51-5.00	Strongly disagree
3.51-4.50	Disagree
2.51-3.50	Neutral
1.51-2.50	Agree
1.00-1.50	Strongly Agree

Inferential statistics in this research, including Regression Analysis, Analysis of Variance (ANOVA), t-test, contingency table, were used for hypothesis testing.

Regression Analysis was utilised in this thesis because regressions have two primary functions: to summarise some data, and to examine it for statistically significant trends (Draper & Smith, 1998; Leedy, 1997). Regression was also utilised to analyse the data for variations or differences in one variable to variations or differences in another variable (Leedy, 1997). Regression can be used for prediction, forecasting, inference, and modelling of casual relationships of two or more variables (Leedy, 1997). In order to answer research question 1: "What Factors Will Affect the Use of ECG in the Classroom by Lecturers and Students?", and to test hypothesis proposition 1: "Students and Lecturers Behavioural Intent to Use Are Predicted by ECG Acceptance Factors (PU, PEOU, AU, SN, PE, and USEF)". In brief, regression analysis used to predict the ECG acceptance factors toward the dependent variable (Behavioural Intent to Use-BI) was used in this thesis.

Analysis of Variance (ANOVA) was utilised because it allows a test of difference among two or more means to be conducted. A researcher can compare the amount of variation within each group and compare it with the amount of variance between groups. In order to answer research question 2: "What Learning Styles of Thai Students Will Benefit from Using ECG?" and research question 3: "What Teaching Styles of Thai Lecturers Will Benefit from Using ECG?", and test hypothesis proposition 3: "Students' Different Learning Styles and Lecturers' Different Teaching

Styles Affect on Their Behavioural Intent to Use ECG in the Classroom." ANOVA has been used for analysing and hypothesis testing in these two propositions because the two variables, learning style and teaching style, were in more than two categories.

t-test for Independent Samples was used to assess whether two sample means differed to a given level of statistical significance. In this thesis, t-tests were used to test hypothesis proposition 2: "The Different University Type and University Location of Respondents Will Affect the Use of ECG in the Classroom." as this research defined only two categories of university type and two categories of university location.

Chi-square and the Contingency Tables

Hypothesis tests on contingency tables are based on a statistic called Chi-square (Grimm, 1993). Contingency tables or cross-tabulation tables were used in this research because the researcher wanted to define the relationships between two variables (nominal scale) in a row and column form. Chi-square was applied to determine the significance to the extent that: (1) the data was reported in raw frequencies, (2) the measured variables were independent, (3) the independent and dependent variables were mutually exclusive and exhaustive, and (4) the observed frequencies were large. A probability of 0.05 or less was the standard used to determine significances (Nikulin & Greenwood, 1996; Rea & Parker, 1997). To answer research question 4: "Are There Any Relationships Between Learning Style, Teaching Style and Gender with Playing Game Behavioural", Chi-square tests and cross-tabulation tables were used to test two hypotheses, propositions 4 and 5. Hypothesis proposition 4 is "Different Learning styles and Teaching Styles Affect on Different Game Playing Behavioural"; and hypothesis proposition 5 is "Different Gender Affects on Different Game Play Behavioural"

Content Analysis is a summarising, quantitative analysis of messages that relies on the scientific method (Krippendorff, 2004). The term content analysis has different meanings among qualitative researchers, and these interpretations lead to different methods of analysis. Terms such as 'transforming', 'interpreting', 'transcription', and 'make sense of' qualitative data are prominent (Punch, 1998). Among these terms, 'transcription' has been used in this interview survey. During this interview survey, the data was recorded using an audio recorder. Hence, the transcription is a necessary step on the way toward interpretation. After each interview of this survey, the transcription was rechecked and then sent back to the participants to confirm what had been discussed in the interview.

The interview survey selected interview questions which are relevant for answering the research question 4: "Which Computer Games Genres Will be Appropriate for Educational Computer Games in the Educational Environments of Thai Undergraduate Courses?" The rest of interview questions were somewhat related to other research questions in one way or another.

The concrete methodical procedure basically includes three techniques (Flick, 2002): summarising content analysis; explicative content analysis; and structuring content analysis. This survey utilised summarising content analysis. This means the interview materials are paraphrased; less relevant passages and paraphrases with the same meanings are skipped (first reduction) and similar paraphrased are bundled and summarised (second reduction). In brief, it is a combination of reducing the material by skipping statements included in a generalisation, in the sense of summarising it on a higher level of abstraction.

The procedure of content analysis mentioned above mostly concerns with the qualitative method. Those strategies include: transforming, interpreting, transcription

and summarising. Thomas' book: Blending Qualitative and Quantitative Research Methods in Theses and Dissertations (Thomas, 2003), suggests a researcher apply key words and phrased in exploring sources. Sometime keywords come from word frequently used in the context of an interview or open-ended answers. These frequently used words can be counted and presented as quantitative data. This survey used techniques mentioned above including 'transcription', 'interpretation', summarising, keywords and phrase setting, categories and frequently word used counting for data analysis.

4.5 SUMMARY

This chapter introduced the methodology and methods used in this research. It includes: 1) research method: quantitative and qualitative methods were integrated throughout of the research; 2) data collection method and technique: self-administered questionnaire and interview were used as data collection tools, questionnaire development, reliability and validity of research instrument were presented; 3) research population and sampling: 400 students and 40 lecturers were two target group samples, simple random and stratified samplings were employed in this survey; 4) data analysis: both descriptive and inferential statistics used for analysing data were: percentile, mean, standard deviation, regression analysis, ANOVA, t-test, Chi-square and content analysis method. The results of the data analysis via these statistical techniques will be discussed in Chapter 5.

CHAPTER 5
PRESENTATION AND ANALYSIS OF DATA

This chapter's focus is on the results of the self-administered questionnaire and interview. The data was analysed in both a quantitative and qualitative method. Participants' characteristics include demographic data, learning and teaching styles, and game play behaviours. To measure the adoption of educational computer games in the classroom, in other words, the acceptance of educational computer games by students and lecturers in Thai universities and the ECG acceptance factors is presented. Supplementary from the research results, the conceptual framework proposition is also presented. Accordingly, there are five sections in this chapter which are:

5.1 Introduction

5.2 Quantitative data

5.3 Qualitative data

5.4 Conceptual framework proposition

5.5 Summary.

5.1 INTRODUCTION

This chapter reports the findings from the survey research. The survey was conducted at four Thai universities, two public and two private. Two are in the metropolitan and two are in regional areas. Questionnaires to 400 students and 40 lecturers were distributed. 398 (99%) and 32 (80%) of the questionnaires from students and lecturers were returned. Table 5.1 shows the number of participants from the four universities.

Table 5.1: The Number of Participants in Four Universities

		University			
		Student		*Lecturer*	
		frequency	*(%)*	*Frequency*	*(%)*
	Univ. 1	*101*	*25.4*	*7*	*21.9*
	Univ. 2	*121*	*30.4*	*9*	*28.1*
	Univ. 3	*87*	*21.8*	*10*	*31.2*
	Univ. 4	89	22.4	6	18.8
	Total	**398**	**100.0**	**32**	**100.0**
University Location					
	Metropolitan	188	47.2	17	53.1
	Regional	210	52.8	15	46.9
	Total	**398**	**100.0**	**32**	**100.0**
University Type					
	Public	222	55.8	16	50.0
	Private	176	44.2	16	50.0
	Total	**398**	**100.0**	**32**	**100.0**

The presentation and data analysis in this chapter was divided into two parts: quantitative and qualitative. The quantitative part included descriptive and inferential data; the qualitative part includes data analyses from open-ended and interview questions. Hypotheses were tested to answer the research questions. To answer some research questions, further studies and analysis were carried out. Subsequently, they were proposed as a conceptual framework and suggested as criterion for colleges and universities to use as guidelines for implementing ECG in the classroom. The structure of presentation, data analysis and conceptual framework propositions are illustrated in Figure 5.1.

5.2 QUANTITATIVE DATA

This section presents the data in both a descriptive and inferential format. Descriptive data from the survey included the data from both students and lecturers in demographic, ECG acceptance factors, learning style of students, teaching style of lecturers, and game play behaviours in Section 5.2.1. While inferential data showed the

relationship of variables and the test of hypotheses which were described and analysed in Section 5.2.2.

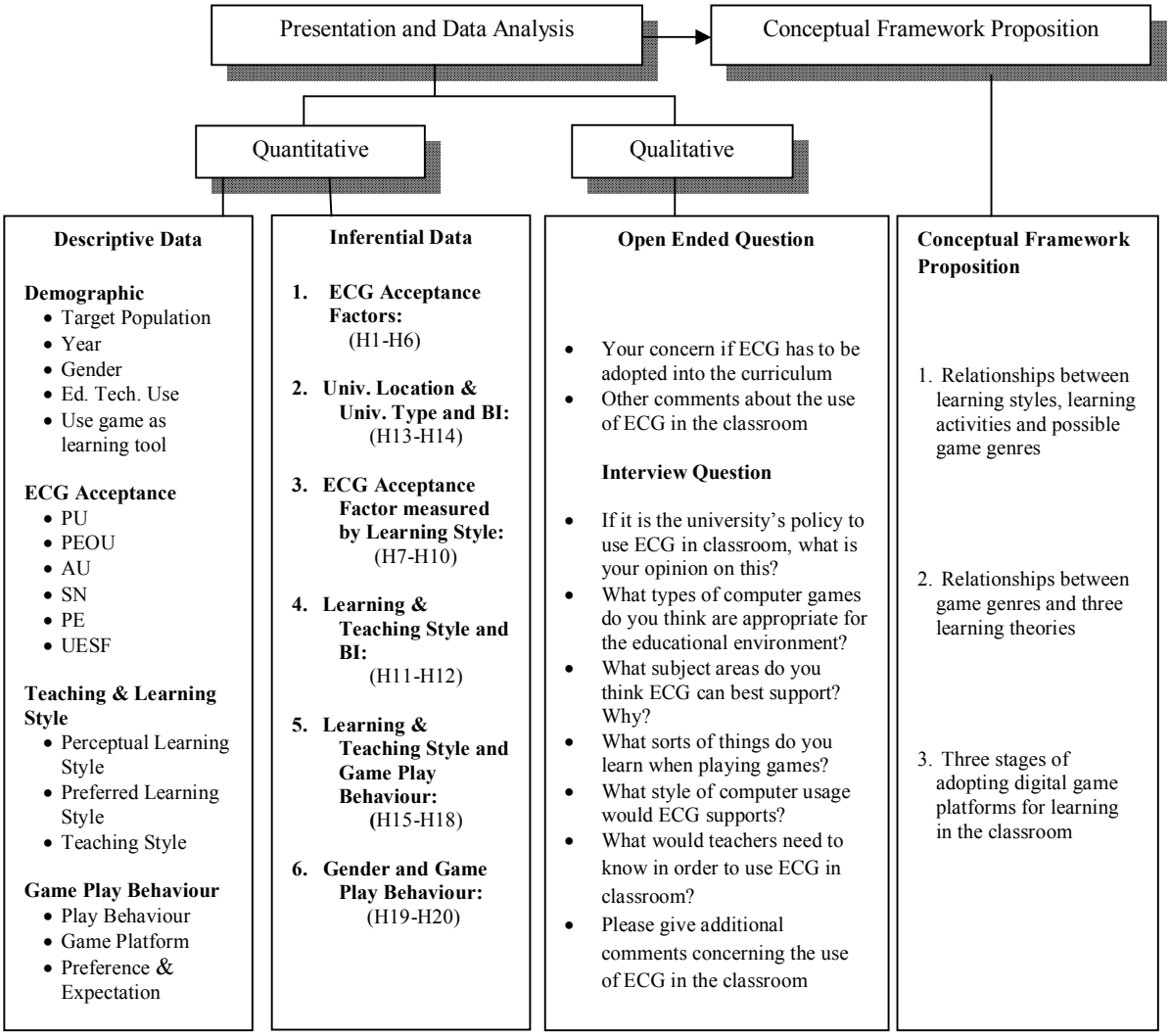


Fig. 5.1: The Structure of Chapter 5

5.2.1 DESCRIPTIVE DATA

Descriptive data in this section shows the demographic, ECG acceptance, learning and teaching styles, plus game play behaviours.

5.2.1.1 Demographic

Participants' demographic information was categorised as follow: gender, year of study (student), year of teaching (lecturer), education technology use, and use of games as a learning tool.

Table 5.2: Summaries Characteristics of Respondents from Gender, Year of Study, Year of Teaching, Educational Technology Use, and Computer Game Use as a Learning Tool

		Student		Lecturer	
		frequency	%	Frequency	(%)
Gender	Male	233	58.4	16	50.0
	Female	165	41.6	16	50.0
	Total	**398**	**100.0**	**32**	**100.0**
Year of Study	Year 1	102	25.6		
	Year 2	112	28.1		
	Year 3	125	31.4		
	Year 4	59	14.8		
	Total	**398**	**100.0**		
Year of Teaching	1-5 years			15	48.4
	6-10 years			8	25.8
	More than 10 years			8	25.8
	Total[1]			**31**	**100.0**
Educational Technology Use[2]	E-learning	208	52.3	20	62.5
	CAI	122	30.7	11	34.4
	WWW	349	87.7	28	87.5
	Others	4	1.0	0	0
Use Computer Game as Learning Tool	Yes	256	66.6	9	28.1
	No	119	29.9	23	71.9
	Total[3]	**384**	**100.0**	**31**	**100.0**

[1] One respondent did not answer
[2] Respondents can answer more than 1 item
[3] 14 students did not answer; 1 lecturer did not answer

As depicted in Table 5.2, male students are slightly higher in frequency than female students at a percentage of 58.4 and 41.6 respectively, while the male and female lecturers are equal. Students in year 3 tallied the most respondents with a percentage of 31.4, while the least respondents came from year 4 with a percentage of 14.8. The rest are year 2 and 3 with a percentage of 28.1 and 31.4 respectively. Lecturers who teach from 1-5 years ranked highest at (48.4%). Lecturers who teach between 6-10 years and over than ten years are equal with a percentage of 25.8.

In terms of types of educational technology used, both students and lecturers use the World Wide Web the most with percentages of 87.7 and 87.5. Likewise, both students and lecturers use CAI the least with percentages of 30.7 and 34.4. The rest is

E-learning in which students and lecturers use a percentage of 52.3 and 62.5 respectively. When asked about the use of computer games as learning tools, students with experience are higher than those who have never use games with percentages of 66.6 compared to 29.9. In contrast, lecturers who have never use computer games exceed those who have, with percentages of 71.9 and 28.1 respectively.

5.2.1.2 ECG Acceptance

Educational Computer Games (ECG) Acceptance Factors include Perceived Usefulness (PU), Perceive Ease of Use (PEOU), Attitude Towards the Use (AU), Social Norms (SN) (Other persons who influence one's opinion), Perceived Enjoyment (PE), and University Environment Support Factors (UESF). This section presents the results of all the above factors which affect the dependent variable (Behaviour Intent to Use Educational Computer Games-BI) of both students and lecturers. The University Environment Support Factor is the only one factor that is more likely to be concerned with lectures than with students. Accordingly this factor was not measured with students. Table 5.3 summarises the results of the mean and standard deviation of ECG acceptance factors in both students and lecturers.

Table 5.3: Summary Results for Mean and Standard Deviation of ECG Acceptance Factors by Students and Lecturers

ECG acceptance factors	Student			Lecturer		
	Mean	S.D.*	Interpret	Mean	S.D.*	Interpret
Perceived Usefulness	3.77	0.72	Agree	3.75	0.71	Agree
Perceived Ease of Use	3.44	0.48	Neutral	3.44	0.63	Agree
Attitude Towards the Use	3.78	0.69	Agree	3.74	0.73	Agree
Social Norms	3.67	0.71	Agree	3.60	0.77	Agree
Perceived Enjoyment	4.05	0.66	Agree	3.94	0.65	Agree
University Environment Support Factors				3.88	0.73	Agree

*S.D. = standard deviation

From Table 5.3, most ECG acceptance factors are found to be in agreement from a student's point of view. Only one factor, Perceived Ease of Use was found to be "neutral". All ECG acceptance factors are in agreement from the lecturers' point of

view. Among those factors, Perceived Enjoyment has the highest mean (4.05, 0.66) and (3.94, 0.65) from both the students and lecturers' opinions.

The descriptive results of mean and standard deviation for all the details of each ECG Acceptance factor (PU, PEOU, AU, SN, PE, UESF) by both students and lecturers are shown in Appendix B.

5.2.1.3 Learning and Teaching Styles

This section presents the breakdown on student learning styles (Perceptual and Preferred Learning Style) and lecturer teaching styles in Tables 5.4 and 5.5.

Table 5.4: Students' Learning Styles

Perceptual LS			Preferred LS		
	Frequency	(%)		frequency	(%)
Visual	173	43.5	Activist	76	19.1
Aural	102	25.6	Theorist	58	14.6
Read	72	18.1	Reflector	91	22.9
Kinaesthetic	51	12.8	Pragmatist	173	43.5
Total	398	100.0	Total	398	100.0

Table 5.4 illustrates the students' learning styles in two parts: Perceptual Learning Styles and Preferred Learning Styles. Concerning Perceptual Learning Styles, it can be seen that most of the students have a visual perceptual style of learning (43.5%), followed by aural (25.6 %), read (18.1 %) and kinaesthetic (12.8 %). Regarding Preferred Learning Styles, most students are pragmatist (43.5%), followed by reflector (22.9 %), activist (19.1 %) and theorist (14.6 %).

Table 5.5: Lecturers' Teaching Style

Teaching Styles	frequency	(%)
Expert	2	6.9
Formal	4	13.8
Personal	3	10.4
Facilitator	12	41.4
Delegator	8	27.6
Total	**29**	**100.0**

Note: three respondents did not respond

Table 5.5 shows the proportion and percentage of lecturers' teaching styles. Most of the lecturers are Facilitator (41.4 %) and the least number are Expert (6.9 %). The remaining teaching styles are Delegator, Formal and Personal with the percentage of 27.6, 13.8 and 10.4 respectively.

5.2.1.4 Game Playing Behaviour

Game playing behaviour in this section is divided into Play Behaviour, Game Platform, and Preference and Expectation from Games as shown in Tables 5.6-5.10.

Play Behaviour

Table 5.6: Play Behaviour

Play Behaviour		Student		Lecturer	
		Frequency	(%)	frequency	(%)
1. Do you play games?	Yes	370	93.0	29	74.2
	No	28	7.0	2	25.8
	Total[1]	**398**	**100.0**	**31**	**100.0**
2. Level of Experience	Beginner	66	16.6	8	27.6
	Intermediate	198	49.7	17	59.6
	Advanced	106	26.6	4	13.8
	Total	**370**	**100.0**	**29**	**100.0**
3. How often do you play games?	Everyday	115	31.3	4	13.8
	4-6 times a week	94	25.5	3	10.3
	2-3 times a week	84	22.8	7	24.1
	Once a week	23	6.3	4	13.8
	Less than once a week	52	14	11	38.0
	Total[2]	**368**	**100.0**	**29**	**100.0**
4. How long do you play a game each time?	Less than 30 minutes	12	3.3	5	17.2
	Up to 30 minutes	28	7.6	2	7.0
	Up to 1 hour	67	18.2	13	44.8
	Up to 2 hours	89	24.2	4	13.8
	More than 2 hours	172	46.7	5	17.2
	Total[3]	**368**	**100.0**	**29**	**100.0**
5. Where do you often play games?	At university	65	17.7	5	17.2
	At home	275	74.7	23	79.4
	At a friend's house	8	2.2	1	3.4
	At game arcade	11	3.0	-	-
	Other places	9	2.4	-	-
	Total[4]	**368**	**100.0**	**29**	**100.0**

[1] One lecturer did not response to this item
[2, 3, 4] Among the students who played games, there were 2 students who did not response to these items

Table 5.6 compares the game playing behaviour between students and lecturers. Firstly, most of the students and lecturers play games with percentages of 93.0 and 74.2 respectively. Secondly, most of them (both students and lecturers) have game playing experience at the intermediated level with percentages of 49.7 and 59.6. Only 16.6 % of the students and 27.6 % of lecturers are beginners, the rest are advanced. Third, most of the students play every day (31.3 %) whilst most of the lecturers play less than once a week (38.0 %). Fourth, most of students play more than two hours each time (46.7 %) whereas most of the lecturers play up to 1 hour (44.8 %). Finally, most of the students and lecturers play games at home with percentages of 74.7 and 79.4 respectively.

Game Genres

From Table 5.6, item 1, among the respondents who play computer games (93% and 74.2 % of students and lecturers), they were asked to name three games they usually play. Their answers have been classified into 13 game genres as illustrated in Table 5.7.

Table 5.7: Game Genres That Students and Lecturers Play

Game genre	frequency	Percentage
Action	52	5.0
Adventure	52	5.0
Battle	10	1.0
Music (song) game	93	8.9
Fighting	8	0.8
First Person Shooter	21	2.0
Flight Simulator	2	0.2
Puzzle	93	8.9
Racing	33	3.2
Real Time Strategy	233	22.5
Role Play Game (RPG)	216	20.8
Sport game	156	15.0
Shooter	69	6.7
Total	**1,038**	**100.0**

*Respondents can answer more than one game genre

According to Table 5.7, three game genres which both students and lecturers play most were Strategy (22.5%), Role Play (20.8%) and Sport Games (15%) respectively.

Game Platforms

Table 5.8: Game Platforms

Game Platforms	Student		Lecturer	
	frequency	(%)	Frequency	(%)
Personal Computer	367	92.2	26	89.7
Console	230	57.8	15	51.7
Handheld	162	40.7	9	31.0
Mobile phone	260	65.3	14	48.2

Note: Respondents can answer more than 1 item

Table 5.8 shows the game platforms students and lecturers play. The most popular game platform is the personal computer. 92.2 % of students and 89.7% of lecturers use this platform. As for students, the second popular is the mobile phone (65.3%) followed by console (57.8 %) and handheld (40.7 %). Lecturers play on consoles and mobile devices in a closer proportion (51.7 % and 48.2 % respectively) than play on handheld (31.0 %).

Table 5.9: Game Platforms Classified by Types of Each Platform

Game Platforms		Student		Lecturer	
		frequency	(%)	frequency	(%)
1)Personal Computer					
(Type)	Microsoft	366	92.0	25	86.2
	MAC	1	0.3	1	3.5
	Total	**367**	**92.2**	**26**	**89.7**
(Media use)	CD/ DVD	240	60.3	15	51.7
	Internet download	262	65.8	13	44.8
	Online deliver service	204	51.3	10	34.5
2)Console	PlayStation	198	49.7	9	31.1
	Nintendo Wii	19	4.8	3	10.3
	Microsoft Xbox	13	3.3	3	10.3
	Total	**230**	**57.8**	**15**	**51.7**
3)Handheld	Gameboy	95	23.9	1	3.4
	PSP	51	12.8	4	13.8
	NDS	16	4.0	4	13.8
	Total	**162**	**40.7**	**9**	**31.0**
4)Mobile Phone	Nokia	223	56.0	9	31.0
	Sumsung	11	2.8	1	3.4
	Motorola	4	1.0	-	-
	Sony Ericsson	16	4.0	-	-
	LG	6	1.5	-	-
	Others	-	-	4	13.8
	Total	**260**	**65.3**	**14**	**48.2**

Table 5.9 shows the proportion of game platforms classified by types of each platform. It can be seen that the personal computer is the top type: most of the students and lecturers use Microsoft over the MAC with a percentage of 92.0 and 89.7 respectively. By media use, most students download games from the Internet (65.8%) while most lecturers use CD/DVD (51.7%). On consoles, most of the students and lecturers use PlayStation Console with percentages of 49.7 and 31.1 respectively. The most popular handheld game among students is The Gameboy (23.9%) while the rest include PSP and NDS. Conversely, most lecturers play PSP and NDS. Only 3.4 % play with the Gameboy. Nokia is the most popular mobile game used both by students (56.0%) and by lecturers (31.0%). Students use Sony Ericsson, Samsung, LG and Motorola in descending order.

Preferences and Expectation from games

Table 5.10: Preferences and Expectations from Games

Item	Student						Lecturer					
	Rank 1		Rank 2		Rank 3		Rank 1		Rank 2		Rank 3	
	f	%	f	%	F	%	f	%	F	%	F	%
Storyline	74	18.6	62	15.6	61	15.3	4	12.5	6	18.8	5	15.6
Character design	41	10.3	62	15.6	55	13.8	1	3.1	7	21.9	6	18.8
Graphic design	43	10.8	44	11.1	53	13.3	2	6.3	3	9.4	4	12.5
Enjoyment	131	32.9	67	16.8	54	13.6	16	50.0	5	15.6	3	9.4
Sound effect	7	1.8	9	2.3	29	7.3	-	-	1	3.1	1	3.1
Mode of play	38	1.8	89	22.4	60	15.1	6	18.8	6	18.8	4	12.5
Educational value	25	6.3	14	3.5	23	5.8	1	3.1	-	-	2	6.3
Ease of winning	7	1.8	18	4.5	28	7.0	-	-	1	3.1	4	12.5

* f = frequency

Table 5.10 shows students' and lecturers' preferences and expectations from games. From column Rank 1, both students and lecturers rank "Enjoyment" the most with percentages of 32.9 and 50.0 respectively. As for students, the percentage of preferences and expectations from games can be classified in descending order as following: (1) enjoyment (2) storyline (3) graphic design (4) character design (5) mode of play (6) educational value (7) sound effect and (8) ease of winning. The percentage

of preference and expectations from the lecturers can be classified as follow: (1) enjoyment (2) mode of play (3) storyline (4) graphic design (5) character design and (6) educational value.

From column Rank 2, the top three percentages of the students ranked were (1) 22.4 % for mode of play, (2) 16.8 % for enjoyment and (3) 15.6 % are for storyline and character design. Whereas the top three percentages for lecturers were (1) 21.9% at character design, (2) 18.8% at storyline and mode of play and (3) 15.6% is enjoyment.

From Column Rank 3, the top three percentage students ranked were (1) 15.3% for storyline, (2) 15.1% for mode of play and (3) 13.8% for character design. Along with the top three percentage lecturers ranked were (1) 18.8% character design, (2) 15.6% storyline and (3) 12.5% graphic design, mode of play and ease of winning.

5.2.2 INFERENTIAL DATA AND HYPOTHESIS TESTING

This section presents the results of hypothesis tests by using inferential statistically draw conclusions and predictions based on the descriptive data. There are five hypothesis propositions. Conclusions were drawn from the results of hypothesis tests to assess the research propositions and ultimately answer the research questions. In the following sub-sections 5.2.2.1 to 5.2.2.6, the four research questions are dealt with by stating the research propositions, and the conclusion of the test results that provided answers to the research questions.

The first question is: “What Factors Will Affect the Use of Educational Computer Games in the Classroom by Lecturers and Students?”

In order to answer this question, two research propositions were suggested and the associated hypotheses were formulated to provide statistical assessments of the propositions that are required for answering the research question. Proposition 1 and related hypotheses are illustrated in Table 5.11

Table 5.11: Proposition 1 and Related Hypotheses

Hypotheses	Proposition
H_1: There Is a Linear Correlation Between Perceived Usefulness and Behaviour Intent to Use H_{1a}: *"There Is a Linear Correlation Between Students' Perceived of Usefulness and Students' Behavioural Intent to Use"* H_{1b}: *"There Is a Linear Correlation Between Lecturers' Perceived of Usefulness and Lecturers' Behavioural Intent to Use"* **H_2: *"There Is a Linear Correlation Between Perceived East of Use and Behavioural Intent to Use"*** H_{2a}: *"There Is a Linear Correlation Between Students' Perceived Ease of Use and Students' Behavioural Intent to Use"* H_{2b}: *"There Is a Linear Correlation Between Lecturers' Perceived Ease of Use and Lecturers' Behavioural Intent to Use"* **H_3: *"There Is a Linear Correlation Between Attitude Towards Use and Behavioural Intent to Use"*** H_{3a}: *"There Is a Linear Correlation Between Students' Attitude Towards Use and Students' Behavioural Intent to Use"* H_{3b}: *"There Is a Linear Correlation Between Lecturers' Attitude Towards Use and Lecturers' Behavioural Intent to Use"* **H_4: *"There Is a Linear Correlation Between Subject Norms and Behavioural Intent to Use"*** H_{4a}: *"There Is a Linear Correlation Between Students' Subject Norms and Students' Behavioural Intent to Use"* H_{4b}: *"There Is a Linear Correlation Between Lecturers' Subject Norms and Lecturers' Behavioural Intent to Use"* **H_5: *"There Is a Linear Correlation Between Perceived Enjoyment and Behavioural Intent to Use"*** H_{5a}: *"There Is a Linear Correlation Between Perceived Enjoyment and Students' Behavioural Intent to Use"* H_{5b}: *"There Is a Linear Correlation Between Lecturers' Perceived Enjoyment and Lecturers' Behavioural Intent to Use"* **H_6: *"There Is a Linear Correlation Between University Environment Support Factors and Lecturers' Behavioural Intent to Use"***	**Proposition 1**: "*Students and Lectures Behavioural Intent to Use are Predicted by ECG Acceptance Factors (PU, PEOU, AU, SN, PE and USEF)*"

The results of hypothesis testing $H_1 - H_6$ are described in Section 5.2.2.1 below:

5.2.2.1 ECG Acceptance Factor

By regression analysis using the "enter" method, the results show values of Standardised and Unstandardised Coefficients, t-test, R-value, R Square, Adjust R Square, F-value, and significance in Tables 5.12-5.22 and the results of the hypothesis tests are shown in these following tables.

Student

Table 5.12: Output of Correlation Between Students' PU and Behavioural Intent to Use ECG in Classroom

Perceived Usefulness of ECG	Unstd Coef.		Std Coef.	T	Sig.
	B	S.E.	Beta		
1. Using educational computer games as a tool for leaning in classroom increases/ will increase my learning and academic performance	.119	.066	.123	1.798	.000
2. Using educational computer games enhances/ will enhance the effectiveness on my learning	.006	.069	.006	.090	.929
3. Educational computer games engage/ will engage me during my learning	.165	.050	.188	3.332	.001
4. Educational computer games allow/ will allow me to progress at my own pace	.065	.055	.070	1.200	.231
5. Educational computer games do not support my learning	.285	.038	.355	.7547	.000
R	.578				
R Square	.335				
Adjust R Square	.326				
F	39.119				
Sig.	.000				

Table 5.12 shows the output of correlation between Perceived Usefulness and Behavioural Intent to Use ECG in the classroom by students. From the table, item 1, 3 and 5 have statistical significance at 0.05. This implies that students believe using ECG as a tool for learning will increase their learning and academic performance, will engage during them learning, and will support their learning. On the whole, the R Square is .335 with statistical significance at 0.05. This means students' Perceived Usefulness resulted in a significant proportion of variance in depression scores, R^2=.335, p<.05. This test result supports hypothesis H_{1a}: "There Is a Linear Correlation Between Students' Perceived Usefulness and Students' Behavioural Intent to Use." It can be interpreted that in general, students' perceived usefulness of ECG has a linear correlation with Behavioural Intent to Use.

Table 5.13: Output of Correlation Between Students' PEOU and Behavioural Intent to Use ECG in Classroom

Perceived Ease of Use of ECG	Unstd Coef. B	Unstd Coef. S.E.	Std Coef. Beta	t	Sig.
6. Learning to operate educational computer games in the classroom is/ will be easy for me	1.341	.053	.128	2.472	.014
7. It is/ will be convenient to use educational computer games for learning in classrooms	.084	.054	.079	1.573	.117
8. Learning how to play educational computer games in classes is/ will be too complicate and difficult	.071	.045	.077	1.595	.111
9. It is/ will be time consuming to familiarise myself with educational computer games	.305	.039	.364	7.782	.000
10. Overall, I think educational computer games are/ will be easy to use	.117	.039	.143	3.046	.002
R	.721				
R Square	.520				
Adjust R Square	.514				
F	84.521				
Sig.	.000				

From Table 5.13, three out of five items (which are item 6, 9 and 10) are statistically significant at 0.05. It can be inferred that students believe learning to operate ECG will be easy, familiarisation won't be time consuming, and overall they think ECG will be easy to use. R Square from this Table is .520, statistically significant at 0.05. This means students' Perceived Ease of Use explains a significant proportion of the variance in depression scores, R^2=.520, p<.05. This test result supports hypothesis H_{2a}: "There Is a Linear Correlation Between Students' Perceived Ease of Use and Students' Behavioural Intent to Use." This implies that students' Perceived Ease of Use has a linear correlation with Behavioural Intent to Use ECG at 52.0%.

Table 5.14: Output of Correlation Between Students' AU and Behavioural Intent to Use ECG in Classroom

Attitude Towards the Use of ECG	Unstd Coef. B	Unstd Coef. S.E.	Std Coef. Beta	T	Sig.
11. I think I have/ may have self-confidence in using educational computer games in class	.179	.046	.173	3.866	.000
12. I think I feel/ may feel anxiety when using educational computer games in classrooms	.089	.034	.108	2.616	.009
13. I think it is hard to learn a new educational computer game	.106	.034	.130	3.151	.002
14. I think the use of educational computer games in classrooms is useful	.198	.047	.200	4.215	.000
15. I dislike the idea of using educational computer games in classroom	.300	.038	.352	7.816	.000
R	.721				
R Square	.520				
Adjust R Square	.514				
F	84.521				
Sig.	.000				

Table 5.14 shows the correlation between students' Attitude Towards Use and Behavioural Intent to Use ECG. Interestingly, every item shows statistical significance at 0.05. R Square is .520 being statistically significant at 0.05. This means students' Attitude Towards Use explained a significant proportion of variance in depression scores, R^2=.520, p<.05. This test result supports hypothesis H_{3a}: "There Is a Linear Correlation Between Students' Attitude Towards Use and Students' Behavioural Intent to Use." It means students' Attitude Towards Use has a linear correlation with Behavioural Intent to Use ECG at 52.0%.

Table 5.15: Output of Correlation Between Students' Social Norm (Influence from Others Towards Student's Opinion) and Behavioural Intent to Use ECG in Classroom

Social Norm	Unstd Coef.		Std Coef.	T	Sig.
	B	S.E	Beta		
16. I think I should use educational computer games if my teacher recommends them	.352	.057	.348	6.163	.000
17. I think I should use educational computer games if my friends studying in other faculties are using them	-181	.052	-.201	-3.483	.001
18. My parents think using educational computer games is a good idea	.066	.045	.079	1.474	.141
19. My friends think I should use educational computer games in the classroom	.223	.054	.247	4.355	.000
20. My supervisor think using educational computer games is a good idea	.125	.058	.126	2.163	.031
R	.527				
R Square	.248				
Adjust R Square	.269				
F	30.133				
Sig.	.000				

Table 5.15 illustrates the output of the correlation students' Social Norms (influence from others towards a students' opinion) and Behavioural Intent to Use. R Square from this table figures at .248, statistically significant at 0.05. This means students' Social Norm explained a significant proportion of variance in depression scores, R^2=.248, p<.05. This test result supports hypothesis H_{4a}: "There is a Linear Correlation Between Students' Social Norm and Students' Behavioural Intent to Use." It implies that students' Social Norm has a linear correlation with Behavioural Intent to Use ECG at 24.8%. It can also seen that most of the items are statistical significant at

0.05. Only item 18 is not statistically significant. This can imply that a student's parents have no influence towards their behavioural intent to use ECG.

Table 5.16: Output of Correlation Between Students' PE and Behavioural Intent to Use ECG in Classroom

Perceived Enjoyment of ECG	Unstd Coef.		Std Coef.	t	Sig.
	B	S.E.	Beta		
21. Using educational computer games in the classroom is/ will be fun and amusing	.182	.062	.170	2.941	.003
22. Using educational computer games in the classroom is/ will be pleasant and gratifying	.144	.054	.140	2.655	.008
23. Using educational computer games in the classroom is/ will be exciting and stimulating	.080	.060	.077	1.346	.179
24. Using educational computer games in the classroom is/ will be boring and tedious	.308	.033	.396	9.243	.000
25. Using educational computer games in the classroom is/ will be challenging and competitive	.064	.046	.066	1.397	.163
R	.647				
R Square	.419				
Adjust R Square	.411				
F	56.174				
Sig.	.000				

Table 5.16 shows the output of correlation between student's Perceived Enjoyment and Behavioural Intent to Use ECG. Three items (21, 22, and 24) are statistically significant at 0.05. It can be said that students believe ECG will be fun and amusing, pleasant and gratify, and exciting and stimulating. Overall, R Square figures at .419 with a statistical significant factor of 0.05. This means students' Perceived Enjoyment explained a significant proportion of the variance in depression scores at R^2=.419, p<.05. This test result supports hypothesis H_{5a}: "There Is a Linear Correlation Between Students' Perceived Enjoyment and Students' Behavioural Intent to Use." It can be interpreted that students' Perceived Enjoyment has a linear correlation with Behavioural Intent to Use ECG at 41.9%.

Lecturers

Table 5.17: Output of Correlation Between Lecturers' PU and Behavioural Intent to Use ECG in Classroom

Perceived Usefulness of ECG	Unstd Coef. B	Unstd Coef. S.E.	Std Coef. Beta	t	Sig.
1. Using educational computer games as a tool for teaching in the classroom increases/ will increase my teaching and academic performance	-.615	.370	-.534	-1.663	.108
2. Using educational computer games enhances/ will enhance the effectiveness on my teaching	.852	.480	.693	1.776	.087
3. Educational computer games engage/ will engage my students during my teaching	.195	.193	.167	1.007	.323
4. Educational computer games allow/ will allow my students to progress at their own pace	.260	.239	.200	1.088	.286
5. Educational computer games do not support my teaching	.228	.232	.241	.980	.336
R	.774				
R Square	.554				
Adjust R Square	.468				
F	6.459				
Sig.	.001				

Table 5.17 shows the output of the correlation between Lecturers' Perceived Usefulness and Behavioural Intent to Use ECG in the classroom. From the table, none of the items is statistically significant at 0.05. However, on the whole, the R Square is .554, statistically significant at 0.05. This means lecturers' Perceived Usefulness explained a significant proportion of the variance in depression scores, R^2=.554, p<.05. This test result supports hypothesis H_{1b}: "There Is a Linear Correlation Between Lecturers' Perceived Usefulness and Lecturers' Behavioural Intent to Use." It can be interpreted that in general, lecturers' perceived usefulness of ECG has a linear correlation with Behavioural Intent to Use at 55.4 %

Table 5.18: Output of Correlation Between Lecturers' PEOU and Behavioural Intent to Use ECG in Classroom

Ease of Use of ECG	Unstd Coef. B	Unstd Coef. S.E.	Std Coef. Beta	t	Sig.
6. Learning to operate educational computer games in the classroom is/ will be easy for me	.193	.230	.176	.838	.027
7. It is/ will be convenient to use educational computer games for learning in classrooms	-.299	.196	-.327	-1.520	.140
8. Learning how to play educational computer games in classes is/ will be too complicate and difficult	-.077	.190	-.075	-.407	.687
9. It is/ will be time consuming to familiarise myself with educational computer games	.361	.176	.394	2.050	.050
10. Overall, I think educational computer games are/ will be easy to use	.238	.183	.254	1.303	.204
R	.531				
R Square	.282				
Adjust R Square	.144				
F	2.044				
Sig.	.105				

From Table 5.18, two out of five items (which are items 6 and 9) are statistically significant at 0.05. It can be inferred that lecturers believe learning to operate ECG will be easy and familiarisation won't be time consuming. The R Square from this table is .282 with no statistical significance at 0.05. This means lecturers' Perceived Ease of Use explained a significant proportion of the variance in depression scores, R^2=.282, p>.05. This test result rejects hypothesis H_{2b}: "There Is a Linear Correlation Between Lecturers' Perceived Ease of Use and Lecturers' Behavioural Intent to Use." This implies that there is no linear correlation between lecturers' Perceived Ease of Use and Behavioural Intent to Use ECG.

Table 5.19: Output of Correlation Between Lecturers' AU and Behavioural Intent to Use ECG in Classroom

Attitude Towards Use of ECG	Unstd Coef.		Std Coef.	t	Sig.
	B	S.E.	Beta		
11. I think I have/ may have self-confidence in using educational computer games in class	-.026	.161	-.025	-.159	.197
12. I think I feel/ may feel anxiety when using educational computer games in classrooms	-.016	.145	-.016	-.108	.915
13. I think it is hard to learn a new educational computer game	.111	.120	.125	.928	.362
14. I think the use of educational computer games in classrooms is useful	.348	.189	.368	1.838	.077
15. I dislike the idea of using educational computer games in the classroom	.357	.163	.442	2.199	.037
R	.767				
R Square	.588				
Adjust R Square	.509				
F	7.419				
Sig.	.000				

Table 5.19 shows the correlation between lecturers' Attitude Towards Use and Behavioural Intent to Use ECG. Only one item (item 15) shows a statistical significance at 0.05. The R Square is .588 with a statistical significance at 0.05. This means lecturers' Attitude Towards Use explained a significant proportion of variance in depression scores, R^2=.588, p<.05. This test result supports hypothesis H_{3b}: "There Is a Linear Correlation Between Lecturers' Attitude Towards Use and Lecturers' Behavioural Intent to Use." It means lecturers' Attitude Towards Use has a linear correlation with Behavioural Intent to Use ECG at 58.8%.

Table 5.20: Output of Correlation Between Lecturers' SN and Behavioural Intent to Use ECG in Classroom

Social Norm	Unstd Coef.		Std Coef.	t	Sig.
	B	S. E.	Beta		
16. I think I should use educational computer games if my colleagues in this faculty recommend it	.160	.262	.168	.611	.547
17. I think I should use educational computer games if my colleagues in other faculties are using it	.037	.252	.038	.148	.884
18. My colleagues think using educational computer games is a good idea	.663	.221	.545	2.997	.006
19. My friends think I should use educational computer games in the classroom	-.437	.232	-.432	-.1882	.027
20. My superiors at work think using educational computer games is a good idea	.508	.288	.464	1.764	.090
R	.791				
R Square	.625				
Adjust R Square	.550				
F	8.332				
Sig.	.000				

Table 5.20 illustrates the output of the correlation between lecturers' Social Norm (Influence from others towards a lecturers' opinion) and Behavioural Intent to Use. R Square from this table figures at .625 with a statistical significance at 0.05. This means lecturers' Social Norm explained a significant proportion of variance in depression scores, R^2=.625, p<.05. This test result supports hypothesis H_{4b}: "There Is a Linear Correlation Between Lecturers' Social Norm and Lecturers' Behavioural Intent to Use." It implies that lecturers' Social Norm has a linear correlation with Behavioural Intent to Use ECG at 62.5%. It can also seen that two out of five items (item 18, and 19) are statistically significant at 0.05. It can be implied that colleagues at work and friends have more influence towards a lecturers' Behavioural Intent to Use ECG than other groups of people.

Table 5.21: Output of Correlation Between Lecturers' PE and Behavioural Intent to Use ECG in Classroom

Perceived Enjoyment of ECG	Unstd Coef.		Std Coef.	t	Sig.
	B	S. E.	Beta		
21. Using educational computer games in the classroom is/ will be fun and amusing	.139	.217	.123	.642	.527
22. Using educational computer games in the classroom is/ will be pleasant and gratifying	-.086	.293	-.061	-.294	.771
23. Using educational computer games in the classroom is/ will be exciting and stimulating	.554	.294	.398	1.881	.071
24. Using educational computer games in the classroom is/ will be boring and tedious	.301	.150	.331	2.010	.050
25. Using educational computer games in the classroom is/ will be challenging and competitive	.187	.202	.167	.927	.362
R	.768				
R Square	.590				
Adjust R Square	.512				
F	7.497				
Sig.	.000				

Table 5.21 shows the output of correlation between a student's Perceived Enjoyment and Behavioural Intent to Use ECG. Only item 24 shows a statistical significance at 0.05. However, overall, R Square figures at .590 with a statistical significant level of 0.05. This means lecturers' Perceived Enjoyment explained a significant proportion of the variance in depression scores, R^2=.59, p<.05. This test result supports hypothesis H_{5b}: "There Is Linear Correlation Between Lecturers' Perceived Enjoyment and Lecturers' Behavioural Intent to Use." It can be interpreted that lecturers' Perceived Enjoyment has a linear correlation with Behavioural Intent to Use ECG at 59.0%.

Table 5.22: Output of Correlation Between UESF and Behavioural Intent to Use ECG in Classroom

University Environment Support Factors	Unstd Coef.		Std Coef.	t	Sig.
	B	S. E.	Beta		
28. Resources (funding, equipment, etc.)	-.257	.357	-.335	-.718	.484
29. Professional development opportunities for using educational computer games	.112	.457	.104	.245	.810
30. Access to Internet	.108	.401	.077	.268	.792
31. Quality of software	.861	.385	.795	2.235	.041
32. Physical classroom structures	.016	.256	.019	.065	.949
33. Support from university administrators	-.109	.317	-.131	-.344	.735
34. Support from other teachers	.133	.352	.132	.377	.712
35. Support from students' parents	-.199	.256	-.142	-.465	.649
36. Technical support (technician)	-.699	.456	-.715	-1.533	.146
37. Time to plan for technology implementation	.625	.672	.641	.931	.367
38. Time to let student use technology	-.290	.384	-.221	-.757	.461
39. Smaller class room	.314	.234	.372	1.343	.199
40. Mobile equipment (laptops, etc.)	-.174	.357	-.185	-.486	.634
41. Proper connections (computer to projector, etc.)	.171	.338	.211	.505	.621
R	.780				
R Square	.609				
Adjust R Square	.244				
F	1.699				
Sig.	.168				

Table 5.22 illustrates the output correlations between University Environment Support Factors and Behavioural Intent to Use ECG by lecturers. Among 14 university environment support factors, only one factor-quality of software- has a statistical significant level at 0.05. The rest of the factors are not statistically significant. On the whole, the results can be seen for the R Square which is .609 with no statistical significance at 0.05. This means University Environment Support Factors explained a

significant proportion of the variance in depression scores, R^2=.609, p>.05. This test result rejects hypothesis H_6: "There Is a Linear Correlation Between University Environment Support Factors and Lecturers' Behavioural Intent to Use." It can be implied that University Environment Support Factors have no linear correlation with Behavioural Intent to Use ECG.

In addition to the first question, an assumption of the different types and locations of the universities of the respondents would have a different behavioural intent to use ECG in classroom was also formulated. This brings the assumption to proposition 2 and the related hypotheses as depicted in Table 5.23.

Table 5.23: Proposition 2 and Related Hypotheses

Hypotheses	Proposition
H_{13}: *"Different University Location Produced Different Behavioural Intent to Use"*	**Proposition 2:**
H13a: *"Students in Different University Location have Different Behavioural Intent to Use Educational Computer Games in the Classroom"*	"The Different University Type and University Location of Respondents Will Affect the Use of ECG in the Classroom."
H13b: *"Lecturers in Different University Location have Different Behavioural Intent to Use Educational Computer Games in the Classroom"*	
H_{14}: *"Different University Type has Different Behavioural Intent to Use"*	
H14a: *"Students in Different University Types have Different Behavioural Intent to Use Educational Computer Games in the Classroom"*	
H_{14b}: *"Lecturers in Different University Types have Different Behavioural Intent to Use Educational Computer Games in the Classroom"*	

The results of hypothesis testing H_{13} – H_{14} are described in Section 5.2.2.2 below:

5.2.2.2 Relation Between University Locations & University Types and the Behaviour Intent to Use

University Location

Table 5.24: Descriptive Statistics of University Locations and BI

	STUDENT			LECTURER		
Group	**Number of respondents**	**Mean**	**Std. Deviation**	**Number of respondents**	**Mean**	**Std. Deviation**
Metropolitan	188	3.997	.876	17	3.794	1.159
Region	210	3.857	.842	15	3.966	.693

Table 5.24 shows the mean of students in metropolitan and regional areas are (3.997, .876) and (3.857, .842) respectively. In order to verify the significance of the difference, an independent t-test (two-tailed) was performed as shown in Table 5.25. Likewise, the mean of lecturers in metropolitan and regional area are slightly different with (3.794, 1.159) and (3.966, .693) respectively. To verify the significance of this difference, an independent t-test (two-tailed) was also applied as shown in Table 5.25.

Table 5.25: Results from Independent t-test Compare Mean of Students in Different University Location Towards Behaviour Intent to Use

Equal Variances	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
assumed	1.626	396	.105	.1402	.08621
not assumed	1.623	387.15	.105	.1402	.08641

It can be seen from Table 5.25 that the significance (2-tailed test) is .105. This means there was not a statistically significant effect from students in different university locations, t (396) = 1.626, p > .05 with their Behavioural Intent to Use. This hypothesis test failed to validate hypothesis H_{13a}: "Students in Different University Locations have Different Behavioural Intent to Use Educational Computer Games in the Classroom." This can infer that there is no statistical significant difference between the students in metropolitan and regional areas towards Behaviour Intent to Use ECG.

Table 5.26: Results from Independent t-test Compare the Mean of Lecturers in Different University Location Towards Behaviour Intent to Use

Equal Variances	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
assumed	-.502	30	.619	-.1725	.34384
Not assumed	-.517	26.6	.609	-.1725	.33349

Table 5.26 shows the significance (2-tailed test) is .619. This means there was not a statistical significant effect for the lecturers in different university location, t (30) = -502, p > .05 with their Behavioural Intent to Use. This hypothesis test failed to support hypothesis H_{13b}: "Lecturers in Different University Locations have Different

Behavioural Intent to Use Educational Computer Games in the Classroom." It can be assumed that there is no statistical significant difference between the lecturers in metropolitan and regional areas towards Behavioural Intent to Use ECG.

University Type

Table 5.27: Descriptive Statistics of University Types and BI

	STUDENT			LECTURER		
Group	Number of respondents	Mean	Std. Deviation	Number of respondents	Mean	Std. Deviation
Public	222	3.939	.811	16	3.593	.215
Private	176	3.903	.920	16	4.156	.248

Table 5.27 shows the number of respondents, mean and standard deviation of students and lecturers in public and private universities towards the Behavioural Intent to Use ECG. The mean for student from public and private universities was (3.939, .811), and (3.903, .920) respectively, whereas the mean for lecturers was (3.593, .215), and (4.156, .248). In order to verify the significance of the difference, an independent t-test (two-tailed) was performed as shown in Tables 5.28 and 5.29.

Table 5.28: Results from Independent t-test Compare Mean of Students in Different University Types Towards Behaviour Intent to Use

Equal Variances	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
assumed	.412	396	.681	.0358	.08693
not assumed	.406	351.308	.685	.0358	.08821

Table 5.28 shows that the significance (2-tailed test) is 0.681. This means there was not a statistical significant effect for the students in different university types, t (396) = .412, $p > .05$ with their Behavioural Intent to Use. This hypothesis test failed to accept hypothesis H_{14a}: "Students in Different University Types Have Different Behavioural Intent to Use Educational Computer Games in the Classroom." It infers

that there is no statistical significant difference at 0.05 between the students in public and private universities towards Behavioural Intent to Use ECG.

Table 5.29: Results from Independent t-test Comparing the Mean of Lecturers in Different University Types Towards Behavioural Intent to Use

Equal Variances	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
assumed	-1.710	30	.098	-5.625	.32894
not assumed	-1.710	29.387	.098	-5.625	.32894

Table 5.29 shows the significance (2-tailed test) is 0.098. This means there was not a statistical significant effect for the students in different university location, t (396) = 1.626, $p > .05$ with their Behavioural Intent to Use. This hypothesis test failed to confirm hypothesis H_{13a}: "Students in Different University Locations Have Different Behavioural Intent to Use Educational Computer Games in the Classroom." It can be inferred that there is no statistical significant difference at 0.05 between the lecturers in public and private universities towards behavioural intent to use ECG.

The second research question was "What Learning Styles by Thai Students Will Benefit from Using Educational Computer Games?" And the third research question was "What Teaching Styles by Thai Lecturers Will Benefit from Using Educational Computer Games?"

In order to answer this question, proposition 3 was suggested and associated hypotheses were formulated to provide a statistical assessment of the proposition that is required for answering research questions 3 and 4. Proposition 3 and the related hypotheses are illustrated in Table 5.30:

Table 5.30: Proposition 3 and Related Hypotheses

Hypotheses	Proposition
H_7: *"There Is a Linear Correlation Between Educational Computer Games Acceptance and Behavioural Intent to Use as Measured by the Activist Learning Style"* **H_8:** *"There Is a Linear Correlation Between Educational Computer Games Acceptance and Behavioural Intent to Use as Measured by the Theorist Learning Style"* **H_9:** *"There Is a Linear Correlation Between Educational Computer Games Acceptance and Behavioural Intent to Use as Measured by the Reflector Learning Style"* **H_{10}:** *"There Is a Linear Correlation Between Educational Computer Games Acceptance and Behavioural Intent to Use as Measured by the Pragmatic Learning Style"* **H_{11}:** *"Students with Different Learning Styles have Different Behavioural Intent to Use Educational Computer Games in the Classroom"* **H_{12}:** *"Lecturers with Different Teaching Styles have Different Behavioural Intent to Use Educational Computer Games in the Classroom"*	**Proposition 3:** *"Students' Different Learning Styles and Lecturers' Different Teaching Styles Affect Their Behavioural Intent to Use EGC in the Classroom."*

The results of hypothesis testing $H_7 - H_{12}$ are described in Sections 5.2.2.3 and 5.2.2.4 below.

5.2.2.3 ECG Acceptance Factors Measured by Learning Styles

Table 5.31: Output of the Correlation Between ECG Acceptance Factors with BI Measured by the Activist Learning Style

ECG Acceptance Factors	Unstd Coef.		Std Coef.	T	Sig.
	B	S.E.	Beta		
PU	-.259	.118	-.012	-.123	.902
PEOU	-.014	.133	-.025	-.309	.758
AU	.634	.129	.532	4.915	.000
SN	.069	.103	.067	.674	.503
PE	.436	.119	.342	3.661	.000
R	.799				
R Square	.638				
Adjust R Square	.612				
F	24.677				
Sig.	.000				

Table 5.31 shows the output of correlation between ECG acceptance factors with Behavioural Intent to Use as measured by the Activist Learning Style of students. When measured by the Activist Learning Style, the results show that students Attitude Towards Use (AU) and Perceived Enjoyment are statistically significant at 0.05. However, the entire results can be seen from the R Square value .638 with a statistical significance at 0.05. This means the Activist Learning Style of students explained a significant proportion of variance in depression scores, R^2=.638, p<.05. This test result

supports hypothesis H_7: "There Is a Linear Correlation Between Educational Computer Games Acceptance and Behavioural Intent to Use as Measured by the Activist Learning Style." It can be implied that when measured by the Activist Learning Style, there remains a linear correlation between ECG Acceptance Factors with Behavioural Intent to Use ECG at 63.8%.

Table 5.32: Output of Correlation Between ECG Acceptance Factors with BI Measured by the Theorist Learning Style

ECG Acceptance Factors	Unstd Coef.		Std Coef.	t	Sig.
	B	S.E.	Beta		
PU	.155	.120	.123	1.291	.200
PEOU	-.197	.171	-.093	-1.156	.251
AU	.675	.136	.491	4.971	.000
SN	-.065	.122	-.051	-529	.598
PE	.400	.113	.338	3.553	.001
R	.771				
R Square	.594				
Adjust R Square	.570				
F	24.889				
Sig.	.000				

Table 5.32 shows the correlation output between ECG Acceptance Factors with Behavioural Intent to Use ECG as measured by the Theorist Learning Styles of students. The results show that students' attitude towards use and perceived enjoyment are statistically significant at 0.05. The rest have no statistical significance. The entire results can be seen from the Square value of R .594 with a statistical significance of 0.05. This means the Theorist Learning Style of students explained a significant proportion of the variance in depression scores, R^2=.594, p<.05. This test result supports hypothesis H_8: "There Is a Linear Correlation between Educational Computer Games Acceptance and Behavioural Intent to Use as Measured by the Theorist Learning Style." It can be interpreted that when measured by the Theorist Learning Styles, there is a linear correlation between ECG Acceptance Factors with Behavioural Intent to Use at 59.4%.

Table 5.33: Output of Correlation Between ECG Acceptance Factors with BI Measured by the Reflector Learning Style

ECG Acceptance Factors	Unstd Coef.		Std Coef.	t	Sig.
	B	S.E.	Beta		
PU	.189	.197	.132	.961	.341
PEOU	-.265	.192	-.158	-1.379	.174
AU	.622	.182	.482	3.423	.001
SN	.195	.169	.131	1.152	.255
PE	.212	.206	.144	1.032	.307
R	.681				
R Square	.464				
Adjust R Square	.412				
F	8.987				
Sig.	.000				

Table 5.33 illustrates the correlation output between ECG Acceptance with Behavioural Intent to Use as measured by the Reflector Learning Style of students. It can be seen that only students' attitude towards use is statistical significant at 0.05. In general, R Square figures at .464 with a statistical significance at 0.05. This means the Reflector Learning Style of students explained a significant proportion of the variance in depression scores, R^2=.464, p<.05. This test result supports hypothesis H_9: "There Is a Linear Correlation Between Educational Computer Games Acceptance and Behavioural Intent to Use as Measured by the Reflector Learning Style." It can be said that when measured by the Reflector Learning Style, there is a linear correlation between ECG Acceptance Factors and Behavioural Intent to Use ECG.

Table 5.34: Output of Correlation Between ECG acceptance Factors with BI Measured by the Pragmatist Learning Style

ECG Acceptance Factors	Unstd Coef.		Std Coef.	t	Sig.
	B	S.E.	Beta		
PU	.156	.076	.139	2.072	.040
PEOU	-.118	.099	-.065	-1.186	.237
AU	.611	.083	.507	7.338	.000
SN	.065	.082	.053	.794	.428
PE	.290	.095	.217	3.050	.003
R	.765				
R Square	.585				
Adjust R Square	.572				
F	46.708				
Sig.	.000				

Table 5.34 displays correlation output between ECG Acceptance Factors with Behavioural Intent to Use as measured by the Pragmatist Learning Style of Students. The results show three out of five factors (PU, AU and PE) that have statistical significance at 0.05. Overall results can be seen from the R Square value .585 with a statistical significance of 0.05. This means the Pragmatist Learning Style by students explained a significant proportion of the variance in depression scores, R^2=.585, p<.05. This test result supports hypothesis H_{10}: "There Is a Linear Correlation Between Educational Computer Games Acceptance and Behavioural Intent to Use as Measured by the Pragmatist Theorist Learning Style." This result can imply that when measured by the Pragmatist Learning Style, there is a linear correlation between ECG Acceptance Factors and Behavioural Intent to Use at 58.5%.

5.2.2.4 Relation Between Learning & Teaching Styles and Behavioural Intent to Use Learning Style and the Behavioural Intent to Use

In order to assess the testing of hypothesis H_{11}: "Students with Different Learning Styles have Different Intentions to Use ECG in the Classroom," and H_{12}: "Lecturers with Different Teaching Styles Have Different Behavioural of Intent to Use Educational Computer Games," ANOVA is used to test these hypotheses. The mean (M), standard deviation (SD), minimum (Min), and maximum (Max) scores of four learning styles are shown in Table 5.35.

Table 5.35: Mean, Standard Deviation, Minimum and Maximum Score of Learning Styles (Rapeepisarn, et al., 2008d)

Learning Styles	M	SD	Min	Max
Activist	3.98	.88	1	5
Reflector	3.84	.86	2.5	5
theorist	3.91	.87	1	5
Pragmatic	3.93	.84	1	5

To determine whether there are significant differences between the mean among the four learning style group, an ANOVA was applied. The ANOVA results presented in Table 5.36 show an F value as F (3, 394) = .28, p<.05. This revealed that there was no statistical significant difference among the four types of learning styles towards the Behavioural Intent to Use. This test result failed to validate hypothesis H_{11}: "Students with Different Learning Styles Have Different Intentions to Use ECG in the Classroom." In other words, the different learning styles of students do not affect their behavioural intent to use ECG.

Table 5.36: ANOVA Test of Learning Styles

	SS	*df*	*MS*	*F*	*Sig.*
Between Groups	*.625*	*3*	*.208*	*.280*	*.840*
Within Groups	*293.288*	*394*	*.744*		
Total	*293.913*	*397*			

Teaching Style and Behaviour Intent to Use

To answer the research question: "What Teaching Styles of Thai Lecturers Will Benefit from Using Educational Computer Games?" The hypothesis H_{12} was tested. The results of the hypothesis test show the mean (M), standard deviation (SD), minimum (Min), and maximum (Max) scores of five teaching styles in Table 5.37.

Table 5.37: Mean, Standard Deviation, Minimum and Maximum Score of Teaching Styles (Rapeepisarn, Wong, Fung, & Khine, 2008d)

Teaching Styles	M	SD	Min	Max
Expert	4.16	1.04	3	5
Formal authority	3.00	.81	2	4
Personal	4.16	.28	4	4.5
Facilitator	4.32	.60	3	5
Delegator	3.31	1.22	1	5

To determine whether there are significant differences among the five teaching style groups mean, an ANOVA was applied. The ANOVA results presented in Table 5.38, show an F value as $F(4, 27) = 3.06$, $p < .05$. This test result supports hypothesis H_{12}: "Lecturers with Different Teaching Styles Have Different Intentions to Use ECG in the Classroom." This revealed that there are significant differences among the five teaching styles towards the Behaviour of the Intent to Use.

Table 5.38: ANOVA Test of Teaching Styles

	SS	*df*	*MS*	*F*	*Sig.*
Between Groups	*8.89*	*4*	*2.224*	*3.06*	*.033*
Within Groups	*19.60*	*27*	*.72*		
Total	*28.50*	*31*			

To test which teaching style among the five affect behavioural intent to use, the Post Hoc Test can be applied. However, the sample size of the lecturers is too small (n=31). Consequently, this test is not appropriate because it might illustrate statistical error. Nonetheless the Post Hoc Test can show the mean difference between each pair among the five teaching styles as shown in Table 5.39:

Table 5.39: The Significant Mean Difference in the Comparisons of Teaching Styles**

	Expert	Formal	Personal	Facilitator	Delegator
Expert		.084	1.000	.777	.150
Formal	.084		.084	**.011***	.554
Personal	1.000	.084		.777	.150
Facilitator	.777	**.011***	.777		**.013***
Delegator	.150	.554	.150	**.013***	

* The mean difference is significant at the .05 level

** Fisher's LSD

Table 5.39 illustrates the significant mean difference comparisons of teaching styles by Fisher's Least Significant Difference (LSD) method. It shows that there are two pairs of teaching styles that have a statistical significant difference at .011 and .013.

The first pair is Facilitator and Personal, and the second pair is Facilitator and Delegator.

The fifth research question**:** "Are There Any Relationships Between Learning Style, Teaching Style and Gender with Game Playing Behaviour?"

In order to answer this question, proposition 4 and 5 were suggested and the associated hypotheses H_{15} to H_{20} were formulated to provide statistical assessments of this proposition and ultimately answer the fourth question. Proposition 4, 5 and related hypotheses are illustrated in Table 5.40

Table 5.40: Proposition 4, 5 and Related Hypotheses

Hypotheses	Proposition
H_{15}: *"There Is Correlation Between Learning Styles and Game Playing"* **H_{16}**: *"There Is Correlation Between Teaching Styles and Game Playing"* **H_{17}**: *"There Is Correlation Between Learning Styles and Level of Experience"* **H_{18}**: *"There Is Correlation Between Teaching Styles and Level of Experience"*	**Proposition 4:** *"Different Learning Styles and Teaching Styles Affect Different Game Play Behaviour"*
H_{19}: "There Is Correlation Between Gender and Playing Game" H_{19a}: *"There Is Correlation Between Students' Gender and Playing Game"* H_{19b}: *"There Is Correlation Between Lecturers' Gender and Playing Game"* **H_{20}: "There Is Correlation Between Gender and Level of Experience"** H_{20a}: *"There Is Correlation Between Students' Gender and Level of Experience"* H_{20b}: *"There Is Correlation Between Lecturers' Gender and Level of Experience"*	**Proposition 5:** *"Different Gender Affects Different Game Play Behaviour"*

The results of testing hypotheses $H_{15} - H_{20}$ are described in Sections 5.2.2.5 and 5.2.2.6.

5.2.2.5 Relation Between Learning & Teaching Style and Game Play Behaviour

Learning Styles and Game Playing

Table 5.41: Cross-Tabulation Between Leaning Styles and Games Playing

Playing Game	Learning Styles								Total	
	Activist		Reflector		Theorist		Pragmatist			
	f	(%)	f	(%)	f	(%)	f	(%)	**F**	**(%)**
Yes	73	(18.3)	55	(13.8)	81	(20.4)	161	(40.5)	**370**	**(93.0)**
No	3	(0.8)	3	(0.8)	10	(2.50)	12	(3.0)	**28**	**(7.0)**
Total	**76**	**(19.1)**	**58**	**(14.6)**	**91**	**(22.9)**	**173**	**(43.5)**	**398**	**(100.0)**

f = frequency

Table 5.41 shows the cross-tabulation between Learning Styles and Game Playing of students. The results show that the percentages of students who play games arranged by learning style in descendent order are: Pragmatist (40.5), Theorist (20.4), Activist (18.3) and Reflector (13.8). Likewise the percentages of students who do not play games are in the same order: Pragmatist (3.0), Theorist (2.5), Activist and Reflector. The last two learning styles have the same percentage at 0.8.

Table 5.42: Chi Square Analysis Between Learning Styles and Game Playing

Correlation Between	**Pearson Chi-Square Value**	**df**	**Sig.**
1. Learning Styles and	3.593	3	.309
2. Game Playing			

Table 5.42 shows a Chi Square analysis between Learning Styles and Game Playing. It reveals that the percentage of game playing did not differ by students Learning Style, $\chi 2$ (3, N=398) = 3.593, p > .05. This means the test result failed to confirm hypothesis H_{15}: "There Is a Correlation Between Learning Styles and Game Playing." It can be implied that the different learning styles of students did not affect their game playing.

Teaching Style and Game Playing

Table 5.43: Cross-Tabulation Between Teaching Styles and Game Playing

Playing Game	**Teaching Styles**										**Total**	
	Expert		Formal		Personal		Facilitator		Delegator			
	f	(%)	f	(%)	F	(%)	f	(%)	f	(%)	**f**	**(%)**
Yes	2	(6.5)	4	(12.9)	3	(9.7)	12	(38.7)	8	(25.8)	**29**	**(93.5)**
No	1	(3.2)	-	-			1	(3.2)	-	-	**2**	**(6.5)**
Total	**3**	**(9.7)**	**4**	**(12.9)**	**3**	**(9.7)**	**13**	**(42.9)**	**8**	**(25.8)**	**31**	**(100.0)**

f= frequency

Table 5.43 shows the cross-tabulation between teaching styles and the game playing of lecturers. The result shows most lecturers play games (93.5%). The percentages of lecturers who play games arranged by their teaching style in descendent

order are: Pragmatist (38.4), Delegator (25.8), Formal Authority (12.9), Personal Model (9.7%) and Expert (6.5). Only 1 Expert and 1 Facilitator do not play games.

Table 5.44: Chi Square Analysis Between Teaching Styles and Game Playing

Correlation Between	**Pearson Chi-Square Value**	**df**	**Sig.**
1. Teaching Styles and 2. Playing Game	4.660	4	.324

Table 5.44 shows a Chi Square analysis between Teaching Styles and Game Playing. It reveals that the percentage of game playing did not differ by a lecturers' teaching style, $\chi 2$ (4, N=31) = 4.66, p > .05. This means the test results reject hypothesis H_{16}: "There Is Correlation Between Teaching Styles and Game Playing." It can be implied that the different teaching styles of lecturers did not affect their game playing.

Learning Style and Level of Experience

Table 5.45: Cross-Tabulation Between Learning Styles and Level of Experience

Learning Styles	**Level of Experience**						**Total**	
	Beginner		Intermediate		Advance			
	f	(%)	f	(%)	f	(%)	**f**	**(%)**
Activist	14	(3.8)	39	(10.5)	20	(5.4)	**73**	**(19.7)**
Reflector	10	(2.7)	33	(8.9)	12	(3.2)	**55**	**(14.9)**
Theorist	17	(4.6)	46	(12.4)	18	(4.9)	**81**	**(21.9)**
Pragmatist	25	(6.8)	80	(21.6)	56	(15.1)	**161**	**(43.5)**
Total	**66**	**(17.8)**	**198**	**(53.5)**	**106**	**(28.6)**	**370**	**(100.0)**

f = frequency

Table 5.45 is a cross-tabulation between learning styles and level of experience. Most students have experience playing games at the intermediate level (53.5%). Among those at the intermediate level, the Pragmatist is the highest proportion (21.6%), and the least is the Reflector (8.9%). The percentage at the advanced level is 28.6 with the most proportion of the Pragmatist (15.1%) and the least is the Reflector (3.2%).

Likewise, the Beginner level includes Pragmatist as the highest proportion (6.8%) and the Reflector the least proportion (2.7%).

Table 5.46: Chi Square Analysis Between Learning Styles and Level of Experience

Correlation Between	Pearson Chi-Square Value	df	Sig.
1. Learning Style and	6.262	6	.394
2. Level of Experience			

Table 5.46 shows a Chi Square analysis between Learning Styles and Level of Experience. It reveals that the percentage of the level of experience in game playing did not differ by a students' learning Style, $\chi 2$ (6, N=370) = 6.262, p > .05. This means the test result rejects hypothesis H_{17}: "There Is a Correlation Between Learning Styles and Level of Experience" It can be implied that the different learning styles of students did not affect their level of experience in game playing.

Teaching Style and Level of Experience

Table 5.47: Cross-Tabulation Between Teaching Styles and Level of Experience

Teaching Styles	Level of Experience						Total	
	Beginner		Intermediate		Advance			
	f	(%)	f	(%)	f	(%)	**f**	**(%)**
Expert	-	-	1	(3.4)	1	(3.4)	**2**	**(6.9)**
Formal	-	-	3	(10.3)	1	(3.4)	**4**	**(13.8)**
Personal	-	-	3	(10.3)	-	-	**3**	**(10.3)**
Facilitator	5	(17.2)	5	(17.2)	2	(6.9)	**12**	**(41.4)**
Delegator	3	(10.3)	5	(17.2)	-	-	**8**	**(27.6)**
Total	**8**	**(27.6)**	**17**	**(58.6)**	**4**	**(13.8)**	**29**	**(100.0)**

f = frequency

Table 5.47 illustrates a cross-tabulation between teaching styles and the level of experience in game playing. In general, most of the lecturers have experience at the intermediate level. Facilitator and Delegator are the highest proportion with 17.2%. The percentage at the beginner level is 27.6, including 17.2 percent of Facilitator and

10.3 percent of Delegator. Only 13.8 percent are at an advance level. There are 6.9 percent at Facilitator, 3.4 percent at Expert and 3.4 at Formal Authority.

Table 5.48: Chi-Square Analysis Between Teaching Styles and Level of Experience

Correlation Between	**Pearson Chi-Square Value**	**df**	**Sig.**
1. Teaching Styles and	9.178	7	.328
2. Level of Experience			

Table 5.48 shows a Chi Square analysis between Teaching Styles and Level of Experience. It reveals that the percentage of level of experience in game playing did not differ by a lecturers' teaching style, $\chi 2$ (7, N= 29) = 9.178, p > .05. This means the test result failed to confirm hypothesis H_{18}: "There Is a Correlation Between Teaching Styles and Level of Experience." It can be implied that the different teaching style of lecturers did not affect their level of experience in game playing.

5.2.2.6 Relation Between Gender and Game Play Behaviour

Gender and Playing Games

Table 5.49: Cross Tabulation Between Gender and Game Playing

Gender	**Students' Game Playing**						**Lecturers' Game Playing**					
	Yes		No		**Total**		Yes		No		**Total**	
	f	(%)	f	(%)	**f**	**(%)**	f	(%)	f	(%)	**F**	**(%)**
Male	226	(56.8)	7	(1.8)	**233**	**(58.5)**	15	(48.4)	1	(3.2)	**16**	**(51.6)**
Female	144	(36.2)	21	(5.3)	**165**	**(41.5)**	14	(45.2)	1	(3.2)	**15**	**(48.4)**
Total	**370**	**(93.0)**	**28**	**(7.0)**	**398**	**(100.0)**	**29**	**(93.5)**	**2**	**(6.5)**	**31**	**(100.0)**

f = frequency

Table 5.49 shows a cross-tabulation between Gender and Game Playing by both students and lecturers. As for students, it can be seen that males play games more than females with the proportion at 56.8% and 36.2%. Conversely, the proportion of males who do not play game is less than female at 1.8% and 5.3% respectively. However, the

proportion of male and female lecturers who play games is closer at 48.4% and 45.2% respectively. There is only one male and one female lecturer who do not play games.

Table 5.50: Chi Square Analysis Between Gender and Game Playing

	Student			Lecturer		
Correlation Between	Pearson Chi-Square Value	df	Sig.	Pearson Chi-Square Value	df	Sig.
1. Gender and 2. Playing Game	13.868	1	.000	.002	1	.962

Table 5.50 shows a Chi Square analysis between Gender and Game Playing. It reveals that the percentage of game playing differs by students' gender, $\chi 2$ (1, N= 398) = 13.868, $p < .05$. This means the test result validates the hypothesis H_{19a}: "There Is a Correlation Between Students' Gender and Game Playing." It can be implied that the different genders of students affects the different behaviour of game playing.

Table 5.50 also shows a Chi Square analysis of lecturers' gender and game playing. It reveals that the percentage of game playing did not differ by a lecturers' gender, $\chi 2$ (1, N= 31) = .002, $p > .05$. This means the test result reject hypothesis H_{19b}: "There Is a Correlation Between a Lecturers' Gender and Playing Game." It can be concluded that different gender of the lecturers did not affect their behavioural of game playing.

Students' Gender and Level of Experience

Table 5.51: Cross-Tabulation Between Students' Gender and Level of Experience

Gender	**Level of Experience**						**Total**	
	Beginner		Intermediate		Advance			
	f	(%)	f	(%)	f	(%)	**F**	**(%)**
Male	22	(6.0)	115	(31.2)	88	(23.8)	**225**	**(61.0)**
Female	44	(11.9)	83	(22.5)	17	(4.6)	**144**	**(39.0)**
Total	**66**	**(17.9)**	**198**	**(53.7)**	**105**	**(28.5)**	**369**	**(100.0)**

f = frequency

Note: One respondent who does not play games did not respond

Table 5.51 illustrates a cross-tabulation between students' gender and level of experience in game playing. Most of the students have playing game experience at the intermediate level. The proportion of males is more than females at 31.2% and 22.5%. Likewise the proportion of males (23.8%) is more than females (4.6%) in the advanced level. At the beginner level, the proportion of males (6.0%) is less than females (11.9%).

Table 5.52: Chi Square Analysis Between Students' Gender and Level of Experience

Correlation Between	**Pearson Chi-Square Value**	**df**	**Sig.**
1. students' gender and	44.897	2	.000
2. level of experience			

Table 5.52 shows a Chi Square analysis between students' Gender and Level of Experience in Game Playing. It reveals that the percentage of level of experience in playing games differs by a students' gender, $\chi 2$ (2, N= 369) = 44.897, $p < .05$. This means the test result accepted hypothesis H_{20a}: "There Is a Correlation Between a Students' Gender and Level of Experience." It can be implied that the different gender of a student affects their level of experience in playing games.

Lecturer's Gender and Level of Experience

Table 5.53: Cross-Tabulation Between Lecturers' Gender and Level of Experience

Gender	**Level of Experience**						**Total**	
	Beginner		Intermediate		Advance			
	f	(%)	f	(%)	f	(%)	**F**	**(%)**
Male	1	(3.4)	10	(34.5)	4	(13.8)	**15**	**(51.7)**
Female	7	(24.1)	7	(24.1)	-	-	**14**	**(48.3)**
Total	**8**	**(27.6)**	**17**	**(58.6)**	**4**	**(13.8)**	**29**	**(100.0)**

f = frequency

Table 5.53 shows a cross-tabulation between a lecturers' gender and the level of experience in playing games. Most lecturers are at the intermediate level (58.6%). The

proportion of males is more than females (34.5%, 24.1%). 13.8% of male lecturers are in the advanced level, but none of the female lecturer is in this level. As for the beginner level, the proportion of males is less than females (3.4%, 24.1%).

Table 5.54: Chi Square Analysis Between Lecturers' Gender and Level of Experience

Correlation Between	Pearson Chi-Square Value	df	Sig.
1. Lecturers' Gender and	9.006	2	.011
2. Level of Experience			

Table 5.54 shows a Chi Square analysis between Lecturers' Gender and Level of Experience in game playing. It reveals that the percentage in level of experience in playing games differs by lecturers' gender, $\chi 2$ (2, N= 29) = 9.006, $p < .05$. This means the test result confirm hypothesis H_{20b}: "There Is a Correlation Between Lecturers' Gender and Level of Experience." It can be implied that different gender of the lecturers affects their level of experience in playing games.

5.3 QUALITATIVE DATA

5.3.1 OPEN-ENDED QUESTIONS

The respondents have been asked with two open-ended questions: 1) What is Your Concern if the Policy of Your University is to Adopt ECG as Part of a Learning Tool?, and 2)What are Other Comments about the Use of ECG in the Classroom You Would Like to Add?

There is a diversity of comments. Content analysis has been used on these comments. The content of comments is classified into three categories (Agree, Neutral and Disagree). The results are illustrated in Table 5.55 and Table 5.56

Table 5.55: Respondents' Opinion

	Student						Lecturer					
	University				Total		University				Total	
	1	2	3	4	(f)	(%)	1	2	3	4	(f)	(%)
Agree	82	80	54	51	267	82.4	4	1	3	9	17	65.4
Neutral	11	10	16	5	42	13.0	1	4	1	-	6	23.1
Disagree	6	3	4	2	15	4.6	1	1	1	-	3	11.5
	99	93	74	58	324	100.0	6	7	5	9	26	100.0

f = frequency

* 74 students did not respond

** 6 lecturers did not respond

From Table 5.55, it can be seen that most of the students and lecturers agree, with percentages of 82.4 and 65.4 respectively, whilst 13.0 % of the students are neutral and 4.6 % of student disagree. As for lecturers, 23.1 % are neutral and 11.5 % disagree.

Table 5.56: The Comments and Elements Support the Lecturers' and Students' Opinion (Rapeepisarn, et al., 2008d)

	Comments/ Elements support
Agree	*Interesting, stimulation, motivate, enjoyable, support teaching, more understandable, relax, not boring, good teaching & learning atmosphere, new technology contribution for Thai education*
Neutral	*Use this tool as carefully as possible, students don't need to take responsibility to be interactive, depends on how the game genre is related to subject area, good for some subjects, more suitable for young children rather than college students*
Disagree	*Not sure this can provide a good result, there are many other methods to develop the understanding of students, might affect the personal health (eyesight, etc.),hard to use in some theoretical subjects, hard to design learning content in games*

Table 5.56 is a summarisation of the comments and elements that support the lecturers' opinions.

Table 5.57: Supportive Elements from Students Who Agree with This Idea

Supportive Elements	*f*	%
Interesting	*53*	*19.00*
Fun, entertain, enjoyable, not boring	*34*	*12.19*
Develop student's brain	*30*	*10.75*
Alternative way of learning	*27*	*9.68*
Exciting, enthusiasm	*18*	*6.45*
Innovation, novel	*15*	*5.38*
Atmosphere	*14*	*5.02*
Relax, release stress, reduce tension	*12*	*4.30*
Stimulate, motivate	*9*	*3.23*
Easier-lesson	*8*	*2.87*
Pay more attention	*8*	*2.87*
Understanding & comprehend	*8*	*2.87*
Teenagers' life	*5*	*1.79*
Trial, no harm	*5*	*1.79*
Attractive	*4*	*1.43*
Entertain & knowledge	*4*	*1.43*
Others	*25*	*8.96*

*respondents can response more than one element

Table 5.57 illustrated the supportive elements from students who agree with the idea of adopting ECG for classroom learning. The 5 top supportive elements include: Interesting (19.00 %), Fun, Entertainment, Enjoyable, Not Boring (12.19 %), Develop Students' Brain (10.75 %), Alternative Way of Learning (9.68 %) and Exciting and Enthusiasm (6.45 %). Other supportive elements (8.96 %) which do not appear in the table include: Competition (3), Bring into curriculum as soon as possible (3); concentrate, contiguous, adjoining (3); Creative thinking (3); Easier-teaching (3); Assisted the learning (2); Engagement (2); Memorise (2); Self-learning (2) and visible, animation (2).

Table 5.58: Some Concerns from Lecturers

Concerns
Subject Areas, Learning Content and Learning Objective
Suitable Game Genre
Potential and Talent of Lecturers
Suitable for Other Levels
Use as a Supportive Tool

For other concerns and additional comments see Appendix C (Open-ended Question)

5.3.2 INTERVIEW QUESTIONS

There were 18 interviewees who voluntarily participated in this survey including lecturers and students. Seven questions were asked. In order to answer research question 4 "What Genre of Computer Games is Suitable for Creating Educational Computer Games in the Educational Environment of Thai Undergraduate Courses?," interview question 2 "What Types of Computer Games do You Think are Appropriate for the Educational Environment?" have been asked. In addition, some other interview questions, both directly and indirectly, support the answers to these research questions. In this section, the results from the interviewees' points of view and comments were analysed and categorised according to the interview questions. The questions from the survey can be summarised in the following topics:

- The university's policy to use ECG in the classroom
- Types of computer games appropriate for the educational environment
- Subject areas ECG can best support
- New things learnt while playing ECG
- Educational tools, instruments, environments which would support ECG learning
- Teachers' preparation for ECG usage in the classroom
- Additional comments.

5.3.2.1 The University's Policy to Use ECG in the Classroom

16 out of 18 interviewees agreed with the question, "What Is Your Opinion on the University's Policy to Use ECG in the Classroom?" Their comments are illustrated in Table 5.59.

Table 5.59: Opinion on the University's Policy to Use ECG in Classroom

Agree (number=16) • Learning is dynamic, new technology should be adopted • Children like to play, it is a good way to attract students' attention • Making the classroom less boring, games help student remember topics longer • Pictures, sounds, animations, and plotted-plays make lessons more understandable • Students have grown up with IT in society, they live in a game-playing culture • ECG boosts thinking, analysing, and synthesizing, can make learning more concrete • Playing ECG is harmless, low risk, produces happiness during playing, no conflict with prior experience, challenging & exciting • Improve learners' concentration, the interactions in games help creativity
Disagree (number = 2) • A number of teachers in Thailand think this kind of education media is an unnecessary use to support learning • It should not be used yet, let's see other's methods first

However, there are some additional comments concerning with the obstacles and difficulties if this kind of education tool is adopted (see Appendix C)

5.3.2.2 Types of Computer Games Appropriate for the Educational Environment

There are a variety of comments from the interviewees; however some of the game genres they recommended for designing educational game are summarised in Table 5.60.

Table 5.60: Game Genres which Appropriate for Educational Environment:

What game genres do you think are appropriate for the educational environment?	Frequency	Percentage
Action Games	1	5.2
Adventure Games	6	31.6
Puzzle Games	3	15.8
Racing Games	2	10.5
Role-Playing Games	5	26.3
Simulation Games	8	42.1
Sports Games	6	31.6
Every game genres	10	52.6
Depend on content & subject areas	5	26.3

*Participants can give more than one opinion

5.3.2.3 Subject Areas ECG Can Best Support

Five interviewees though that almost every subject area can use ECG to support learning. Three of them did not answer the question. Other comments from interviewees can be categorised into three aspects: memorised-based subject; experimental-based subject; and subject vs. game genre. The summaries of subject areas they think ECG can best support are shown in Table 5.61.

Table 5.61: Subject Areas which ECG Can Best Support

Learning Content	Subject areas
Communication	Journalism, new report, Advertising, Tourism
Experiment & Risk	Human anatomy, Medical Science, Surgery, Chemistry
Fact	Laws, Political Science
Language	Vocabulary, Grammar, Foreign language
Management	Planning, Business, Accountant
Memory	History, Archaeology
Motor skill	Sports, Physical Education
Procedure	Cookery Science, subjects related to 'How to'
Reasoning & Logic	Mathematics, Arithmetic, geometry

5.3.2.4. New Things Learnt While Playing Games

The things interviewees learn when playing games can be classified as follows: Fun and amusing; rules and regulations**;** new knowledge; working as a team; socialisation; and the thinking process. Table 5.62 summarised what they learned.

Table 5.62: New Things Learnt While Playing Games

Things they learned	Frequency	Percentage
Fun and amusing	18	100.0
Rules and regulations	10	55.5
New knowledge (vocabulary, new content etc.)	2	11.1
Team working, determining, endeavor	1	5.55
Socialisation (meet new people in the virtual world)	2	11.1
Thinking process (planning, memorising & analytical skill)	3	16.6
Nothing special	1	11.1

* Interviewee can learn more than one thing

** There were 4 interviewees did not answer and 3 of them have never played games.

5.3.2.5. Educational Tools, Instruments, Learning Environments which Would Support ECG Learning

Interviewees provided a variety of opinions. They suggested that classroom styles, classroom conditions, necessary education tools and instruments can be supplemented based on contexts/subjects, game genres or game platforms. Additional factors noted were the game-play style, such as individually or by a team (See Appendix C: Question 5). However, most of them agreed that the classroom has to be fully equipped. Apart from the computer, peripheral tools – mouse, keyboard, joystick, head phone sets may also needed. There were three interviewees who do not answer this question.

5.3.2.6. Teachers' Preparation for ECG Usage in the Classroom

From the respondents' point of view, it can be summarised that teachers need to know the followings in order to prepare themselves to use ECG effectively in the class:

1) Have a good attitude towards game playing.
2) Study and prepare course content for a game developer
3) Selection of game style/ game genre
4) Classify the level of learners
5) Be able to play games (prepare themselves by studying each kind of game, game devices, game basics playing)
6) Train and/ or seminar programmes on game-play in order to build up their readiness.
7) In conclusion, the preparation includes: attitude, content, type of game, game selection, game design. It is necessary that teachers know how to play games.

5.3.2.7 Additional Comments

The respondents offered some other additional comments apart from the comments concerning the use of ECG in the classroom.

Game Access in Primary school, Secondary School, and university

The respondents proposed a comparison of three education levels: primary school, secondary school and university and which level is easier for game access in the classroom environment. Most interviewees gave their viewpoints that secondary school is the easiest and most suitable level for game accessibility. Their opinions are illustrated in Table 5.63:

Table 5.63: Game Access in Primary School, Secondary School and University

	Primary School	Secondary School	University
Accessible/ Adoptability	easier	not easy	not easy
Complexity	Lower	high	Higher
Content Design	Easier	moderate	harder,
Education Game	More	moderate	less,
Frequency of Playing	High	highest	Moderate
Game Productivity	higher	moderate	Lower
Interest of User	Higher	high	Lower
Subject Areas	all subjects	almost all	selective subject
The Usage	Harder	moderate	Easier
Usefulness	High	higher	Highest

The Use of Games as a Direct Teaching Tool (Substitute Lecturer), Indirect Teaching tool (support Lecturer), and out of the Classroom

When asked where they think ECG should best be used as a direct-teaching-tool (substitute lecturer), an indirect-teaching-tool (support lecturer) or out of classroom (use

to support after class), most interviewees supported the idea as an indirect teaching tool. Their viewpoints are illustrated in Table 5.64.

Table 5.64: Use of Game as Direct-Teaching-Tool, Indirect-Teaching-Tool, and out of Classroom.

Direct-teaching-tool	Indirect-Teaching-Tool	Off-Classroom
• Should not be used as a direct teaching tool • Should not be used to replace lecturers • Not suitable as a substitute for lecturer	• Suitable to support learning • Support lecturers is the most suitable method • Can be complementary	• Alternative learning out of class • Unsuitable because of lack of control • Fit for ones who cannot catch up in the class • Product should be good enough for self-learning

Trends in Using Computer Games for Education in University:

In conclusion, the summary from the interviewees is that it is possible for the adoption of ECG to classroom learning; however there should be some pioneer studies such as a comparison of experienced game players and first-time players. Some difficulties might be faced, such as the costs of hardware and software, lack of game personnel, and lack of interest from game companies. As for people involved in this adoption, games are not accepted by most lecturers. The attitude towards games by executives and parents is still negative. Attitude by most people in the government sector towards games is still negative. Also, the mass media portrays games in negative ways. It can be drawn from this conclusion that further studies need to be conducted. Studies include the association between lecturers, university administrators, parent of students, and government sector towards the use of ECG (see detail in Section 6.5 in Chapter 6)

5.4 CONCEPTUAL FRAMEWORK PROPOSITION

The results from the survey have answered all the research questions. Most of the hypothesis testing results have clearly answered research questions 1, 2, 3, 5, and 6.

However, the result of research question 4, "Which Computer Game Genres Will Be Appropriate for ECG in the Educational Environments of Thai Undergraduate Courses?", came from the opinions of 18 interviewees as shown in Table 5.60. Can these opinions be used as inductive reasoning, or can these results be used to generalise? The answers might not be sufficient to generalise to the wider population. Thus, there should be further study carried out for towards this question. The researcher formulated "the answering research question process" as shown in Figure 5.2

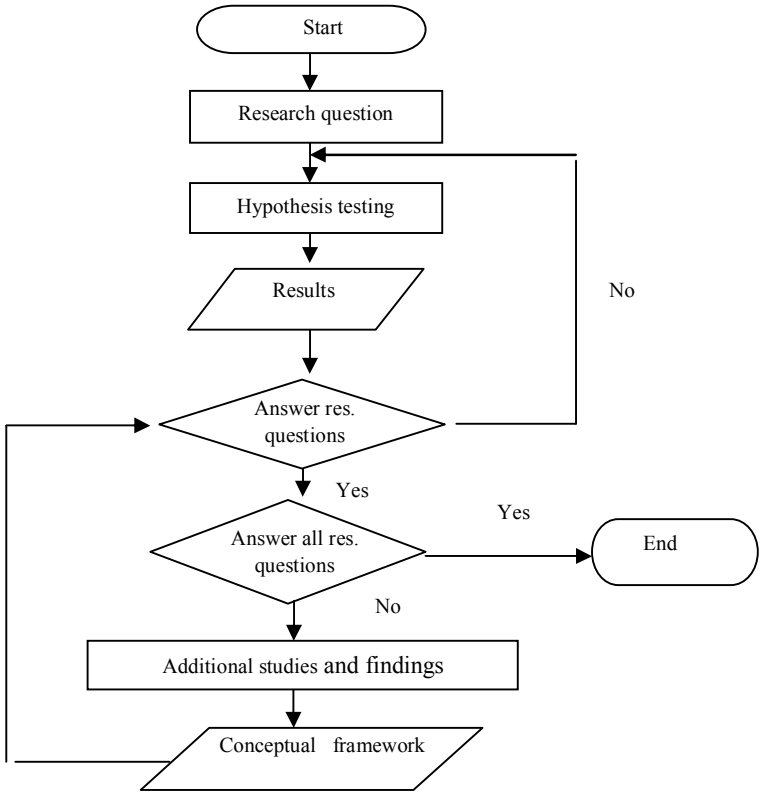


Figure 5.2: Answering Research Questions Process

From the flowchart in Figure 5.2, this research assumed that the opinions from the respondents concerned with research question 4 are insufficient for generalisation. The researcher has reviewed a number of learning theories which are associated with game genres. There are learning styles, learning contents, learning objectives and

learning capabilities. From these studies (Rapeepisarn, Wong, Fung, & Khine, 2008b, 2008e) they proposed three related conceptual models which are as follows.

5.4.1 RELATIONSHIP BETWEEN GAME GENRE WITH LEARNING STYLES AND LEARNING CONTENTS

To decide which game genre is appropriate for the learning environment, several factors can be considered. Most studies focus on several variables when selecting game genre (Rapeepisarn, et al., 2008b). This includes age level, gender, racial diversity, number of players, and the role of lecturers. Unfortunately, not so many previous studies have focus on learning style. Why is learning style an important variable to consider? As different people learn and process information differently, it is important to understand individual learning styles which predict the way learners react and feel in different situations. One research focused on the impact of learning styles using digital games Chong et al. (2005). In addition, Prensky (2005a) has also discussed how to combine game play and learning. The studies of both Chong and Prensky are detailed in the following sections.

5.4.1.1 The Study of Chong et al: Learning Styles and ECG (Rapeepisarn, et al., 2008e)

Chong et al. have conducted research on "*The Impact of Learning Styles on the Effectiveness of Digital Games in Education.*" They conducted the survey based on the Honey and Mumford four types of learning styles on 50 undergraduate students at INTI College in Malaysia. They selected three different genres of games namely: Counter Strikes, Championship Manager and Bookworm which represented action role-playing games, strategy games and puzzle games respectively. The results show the student's preferences for the games vary, with respect to the learning styles. Chong et al. concluded that they need to conduct further studies on different kinds of learning styles

as well as different game genres. The findings of Chong's study can be summarised in Table 5.65.

Table 5.65: Relationship Between Learning Styles and Educational Games (Chong et al., 2005)

	Role-playing games (Counter Strike)	Strategy games (Championship Manager)	Puzzles (Bookworm)
Activists	Enjoy playing this game	Discard the instructions given before the start of the game	Use their brainstorming to solve the problem
Reflectors	Prefer not to lead the game	Observed to follow the instructions given to them earlier	Not able to draw strong conclusion
Theories	Not able to draw strong conclusion	Reacted very similar to the reflectors	Did not learn and play well
Pragmatists	Dislike this game	Copied the strategy given during the briefing	Great interest in this game

5.4.1.2 Prensky's Study: Learning Techniques and Learning Activities in ECG (Rapeepisarn, et al., 2008e)

Different learning activities and learning techniques may use different genres of games. In his paper "*Computer Games and Learning: Digital Game-Based Learning*," Prensky (2005a) shows the activities and learning techniques used in ECG are: 1) practice and feedback, 2) learning by doing, 3) learning from mistakes, 4) goal-oriented learning, 5) discovery learning and guided discovery, 6) task-based learning, 7) question-led learning, 8) situated learning, 9) role playing, 10) constructivist learning, 11) multi-sensory learning, 12) learning objectives, 13) coaching, and 14) intelligent tutors. Prensky discussed how to combine gameplay and learning. He claimed that a teacher has to understand the types of learning content. With different kinds of learning content, teachers can see what kinds of learning are really going on such as learning facts, skill, judgement, theory, reasoning, process, procedure, creativity, language, system, observation, or communication. Additionally, a teacher can choose different learning activities according to the particular types of content. Prensky proposed the

relationship of learning content, learning activities and possible game styles as shown in Figure 5.3 and Table 5.66.

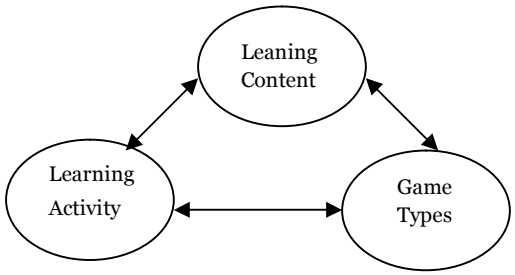


Figure 5.3: **Model of Relationship of Learning Content, Learning Activities and Possible Game Styles**

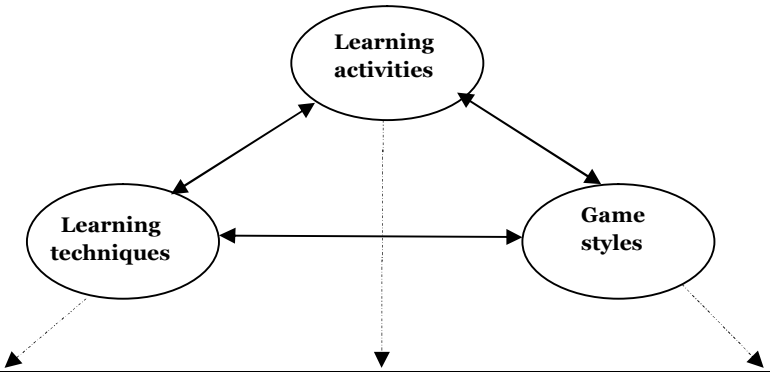
Table 5.66: Learning Content, Leaning Activities and Possible Game Styles (Prensky, 2005a)

Learning Content	Learning Activities	Possible Game Styles
Facts : laws, policies, product	Questions, memorisation, drill, association	Game show competitions, flashcard types game, mnemonics
Skills: interviewing, teaching, management	Imitation, feedback, coaching, continuous practice	Persistent state games, role-play game, detective games
Judgment: management, decisions, timing, ethics	Reviewing cases, asking questions, feedback, coaching	Role-play games, multiplayer interaction, adventure game, strategy game, detective game
Behaviours: supervision, self-control, setting example	Imitation, feedback, coaching, practice	Role-play game
Theories: marketing rationales, how people learn	Logic, experimentation, questioning	Open ended simulation games, building game, construction games
Reasoning: strategic & tactical thinking, quality analysis	Problems, examples	Puzzles
Process: Auditing, strategy creation	System analysis & deconstruction, practice	Strategy games, adventure games
Procedure: assembly, bank teller, legal	Imitation, practice, play	Timed games, reflex games
Creativity: invention, product design	Play	Puzzles, invention games
Language: acronyms, foreign language	Imitation, continuous practice, immersion	Role-play games, reflex games, flashcard games
Systems: health care, markets, refineries	Understanding principles, graduated tasks	Simulation games
Observation: moods, morale, inefficiencies, problems	Observing, feedback	Concentration games, adventure games
Communication: appropriate language, involvement	Imitation, practice	Role-play games, reflex games

5.4.1.3 Bridging the Gap Between Prensky and Chong's Studies (Rapeepisarn, et al., 2008e)

After reviewing the studies of Prensky and Chong et al., the researcher realised that more needs to be done in order to provide a better framework to designing good education games. In other words what was suggested is a framework for considering appropriate game genres for different learning environments. Prensky focused on learning techniques, learning contents, and learning activities, but lacks learning styles. Whereas, Chong et al. focused on learning styles but uses only three different game genres as an example. Therefore, the gap in these two studies was bridged by establishing the linkage between them. Two conceptual models are proposed in this study.

First, as mentioned in Section 5.4.1.2, Prensky proposed the relationship of learning content, learning activities and game styles. He also suggested 14 essential learning techniques which he claimed should be considered and used when designing learning materials and game genre in his study. In order to make the use of all those learning techniques in learning with ECG, the relationships between each learning techniques and game genres should be studied. Hence, the researcher has compared and matched Prensky's 14 learning techniques to learning activities and game genres. The new model and the results of this matching are illustrated in Figure 5.4.



Learning techniques		Leaning activities		Possible game styles
Practice & feedback		Questions, memorisation, association, drill, imitation		Game show competition, flashcard type game, mnemonics, action, sports game
Learning by doing		Interact, practice, drill, imitation		Strategy game, action game, role playing game
Learning from mistake		Feedback, problem		Role-play game, puzzle game
Discovery learning & guided discovery		Feedback, problem, creativity play		Adventure game, puzzle game
Task-based learning		Understand principle, graduated tasks		Simulation game, puzzle game
Question-led learning		Question/ questioning, problem		Quiz or trivia game, game show competition, construction game
Situated learning		Immersion		Immersive style game such as role-playing game, flashcard game
Role playing		Imitation, practice, coaching		Role-playing game, strategy game , reflex game, adventure game
Constructivist learning		Experimentation, questioning		Building game, constructing game
Multisensory learning		Imitation, continuous practice, immersion		Game which introduces new technologies such as locatable sound or force feedback, reflex game
Learning object		Logic, questioning		Games become object-oriented
Coaching		Coaching, feedback, questioning		Strategy game, adventure game, reality testing game
Intelligent tutors		Feedback, problem, continuous practice		Strategy game, adventure game, puzzle game, reflex game

Figure 5.4: Model of Relationship of Learning Techniques, Learning Activities and Possible Game Styles

Secondly, as addressed in Section 5.4.1.1 Chong et al. studied the impact of learning styles on computer games in education. They use three genres of games in their study as an example to prove that different learning styles favour different types of games. From the findings of their study, the behaviours of each learning style of the learners while playing games were also described. However, they did not match the behaviour of each style of learners with learning techniques. Additionally, only three different genres of games were studied. While the study of Prensky chose all the

standard categories of computer games matched with learning activities, it lacked a comparison of learning styles of users. Thus, in this thesis the researcher has proposed a new conceptual model of the relationship between learning styles, learning activities and possible game genres based on these two studies (Chong, et al., 2005; Prensky, 2005a). Figure 5.5 illustrates the conceptualisation of this model.

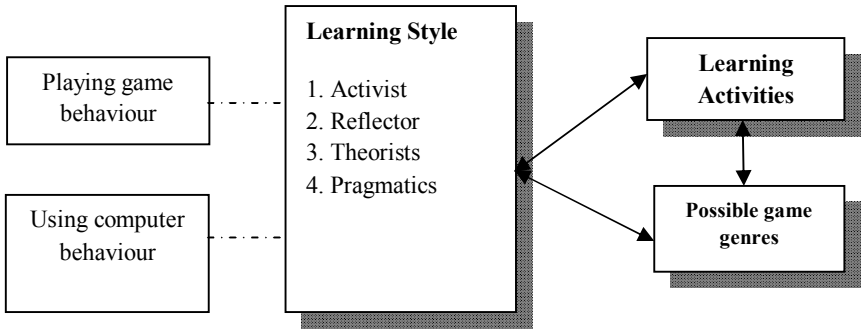


Fig. 5.5 Conceptual Model of Relationship between Learning Styles, Learning Activities and Possible Game Genres

The process that led to the new conceptual model was proceeded by: 1) exploring the behaviour when playing games for each type of learner based on Chong's study, 2) matching the behaviour of each type of learner to learning activities based on Prensky's study, 3) finding the possible game genres which can relate to each learning activity. As an example, the results from this study found that the possible game genres for the activist learners could be multiplayer interaction, action games, and role-playing games. Accordingly, the results of matching learning styles, behaviour when playing game, behaviour when using computer, learning activities, and possible game genres are shown in Table 5.67.

Table 5.67: The Relationship of Learning Styles, Behaviours when Playing Games, Behaviours when Using IT, Learning Activities and Possible Game Styles

Leaning styles	Behaviour when playing game	Behaviour when using IT	Learning activities	Possible game style
Activists	Prefer working as a team, being a group leader, be able to brainstorm to solve a problem	Like to use shortcut key-combinations but will also find the toolbar buttons useful.	• Practice • Imitation • Work with Other • Tackle problem 'head on'	Multiplayer interaction, action game, role-playing game
Reflectors	Go through the important data in a game, follow the instructions, spend a long time before making a decision, not be led by a game	Prefer to use dropdown menus but will soon discover what is best for themselves, like to browse through SEARCH FOR HELP in the HELP menu	• Observing • Feedback • Graduated task • Work alone at their own pace	Concentration game, adventure game, simulation game
Theorists	Go through the data and follow the instructions before starting the game, be able to give careful thought when choosing the game elements, Formulate good strategy to defeat the enemy	Often use dropdown menus to see what else the application can do, like to browse through the INDEX or SEARCH FOR HELP in the HELP menu	• Logic • Understanding Principle • Analyse & develop plan • Explore relationship between things	Strategies game, simulation game
Pragmatists	Follow closely the instructions & strategies that were mentioned in the briefing, believe they can play better if they were given proper instruction, Show a great interest in puzzle game and dislike role-playing game	Probably use the toolbar buttons to get things done, often use HELP menu to get things done	• Experimentation • Asking question • Try things out • Structure plan with definable purpose	Puzzle game, building game, constructing game, reality testing game, detective game

5.4.1.4 Section Summary and Discussion

This section proposes the conceptual framework for choosing the appropriate game genre for a learning environment. Two variables concerned in this model are learning styles and learning activities. Additionally, two other implicit variables, behaviour when playing games and behaviour when using IT, were also included. Most studies were concerned about age, gender, racial diversity, and the role of the teacher. Little research has focused on learning styles when designing the appropriate game genres for each learning style of the learner. Different people have different styles of learning. No single learning preference is better than any other. In fact, individual

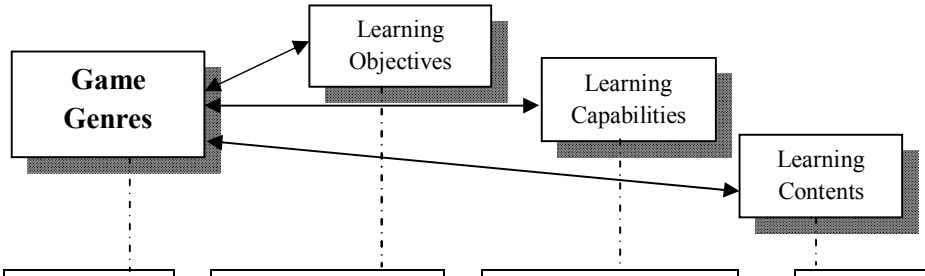
students may have more than one single learning style. One learner has an active type of learning or he/ she may have a theory or pragmatic style of learning in another learning situation. Therefore, there are many possible ways in choosing appropriate game genres for one particular student. However, the game genre can be determined by looking at a learner's dominate learning style. In other words, the most preferred learning style depends on the learner. The model relationship of learning styles, learning activities and possible game genre presented in this section is only a potential proposal. To understand ECG, many factors have to be examined. These include design, pedagogy, and literacy. It should also focus on classroom use, what is learned and what can be taught with educational computer games (Fisch, 2005). Moreover, some variables such as the learning content, learning objectives, and learning capabilities should also be examined.

5.4.2 GAME GENRE WITH LEARNING CONTENT, LEARNING OBJECTIVES, AND LEARNING CAPABILITIES (Rapeepisarn, et al., 2008b)

Apart from learning activities and learning style, to design effective ECG with the appropriate game genre, several pedagogy theories need to be emphasised and examined. Different researchers on game-based learning use different pedagogical concepts to analyse game use in the learning environment. One of these is Prensky (2005a) who claimed that teachers have to understand the type of learning content. Prensky proposed the relationship of learning content, learning activities and possible game style as shown in Table 5.66. Boop (2006) proposed a framework to answer three main questions that are important to educational game design. These questions are: 1) What actually is the learning purpose? 2) What is and should be the material used to reach these goals? and 3) How should this learning content be learned? Boop (2006) proposed three subfields of didactic analysis which are analysis of learning goals,

analysis of learning content, and analysis of learning and teaching methods to answer the above three questions. The other researchers in this area are Gikas and Van Eck (2004). In their research: "*Integrating Video Game into the Classroom: Where to Begin?*", they used theories of Gagné's learning capabilities and Bloom's taxonomy to compare with Bate's (2004).

From the above literature review, it reflects back to research question 4 "Which Computer Game Genres Will Be Appropriate for Educational Computer Games in the Educational Environments of Thai Undergraduate Courses?" Prior to addressing this question there are three sub-queries concerned with learning theories which will relate to, and be supported by, game genre. They are: 1) What should learners learn from each particular genre (learning objective)? 2) What levels of a learner's intellectual skills reach these objectives (learning capability)? 3) What should be the matter or subject to reach these objectives and match the characteristic of a particular genre (learning content)? Consequently, the theory of Bloom's Taxonomy (learning objectives), Gagné's Intellectual Skills of Learning Capabilities and Prensky's Learning Contents need to be examined. These three theories have been detailed in Sections 3.3.3, 3.3.4 and 3.3.5 in Chapter 3. From these mentioned theories, the researcher proposes another conceptual model by using these three theories to support the appropriate game genre used in the learning environment as shown in Figure 5.6.



Game Genres	Learning Objectives	Learning Capabilities	Learning Contents
Action	Application Comprehension Knowledge	Defined Concepts Concrete Concepts Discriminations	Facts, Skills
Adventure	Evaluation Synthesis Analysis Application Comprehension Knowledge	Problem Solving Higher Order Rules Defined Concepts Concrete Concepts Discriminations	Judgment, Process, Observation, Skills
Fighting	Application Comprehension Knowledge	Defined Concepts Concrete Concepts Discriminations	Facts, Skills
Puzzle	Comprehension Knowledge	Concrete Concepts Discriminations	Reasoning, Creativity
Role Playing	Evaluation Synthesis Analysis Application Comprehension Knowledge	Problem Solving Higher Order Rules Defined Concepts Concrete Concepts Discriminations	Skills, Judgment, Behaviour, Language, Communication
Simulation	Evaluation Synthesis Analysis Application Comprehension Knowledge	Problem Solving Higher Order Rules Defined Concepts Concrete Concepts Discriminations	Theories, Systems
Sports	Application Comprehension Knowledge	Defined Concepts Concrete Concepts Discriminations	Facts, Skills
Strategy	Evaluation Synthesis Analysis Application Comprehension Knowledge	Problem Solving Higher Order Rules Defined Concepts Concrete Concepts Discriminations	Judgment, Process

Figure 5.6: Conceptual Model of the Relationships between Game Genres and the Three Learning Theories

The process that led to this new conceptual model was conducted by 1) matching the characteristics of game genres with Prensky's learning content and

learning activities, 2) analysing learning activities of each genre with Bloom's taxonomy, and 3) analysing learning activities of each genre with Gagné's intellectual skills.

5.4.2.1 Section Summary and Discussion

Supplementing the last section, this section proposes another conceptual framework for choosing the appropriate game genre for the learning environment. Three learning theories have been used to associate the game genre. The analysis results will be a tangible framework for choosing the game genre for designing an effective ECG (Rapeepisarn, et al., 2008b). This framework can also be used as a criterion to answer research question "What Is the Appropriate Game Genre for Designing Effective ECG?" However, this framework may be used as an example, since the categories of game genre may vary from this model. The numbers of genres are based on the survey from four Thai universities which classified 13 genres. Those genres somewhat overlap and some can be classified as sub-genre of another. Thus, game genres in this model are regrouped into eight categories.

From the analysis results, Adventure, Role-Playing, Simulation and Strategy Games reach all levels of learning objectives and capabilities. All of these four game genres were also mentioned in the findings of most researchers (Gee, 2003; Ju & Wagner, 1997; Quinn, 1994; Roberts, 2006) that they were a good foundation for the development of teaching resources. On the contrary, puzzle games fall into the lowest levels of learning objectives and capabilities, but are widely used as educational games. One of the survey participants suggested the use of puzzle games for novice game players. This genre of game involves solving logic puzzles or navigating complex locations such as a maze. Most puzzles are without time pressures, and it is extremely important that the rules be clear. The interface should be simple and allows for trial and

error without penalties, making it easy to reset the problem or undo a particular move (Schiffer, 2006). As for action games, generally the most well-known and popular genre, it reaches three levels of learning objectives and capabilities, the same as fighting and sports games. While in adventure games players must have patience and requires a great deal of thinking. Action games have to be fast and keep the players moving all the time.

5.4.3 EDUCATIONAL USE OF DIGITAL GAME PLATFORMS IN THAI UNIVERSITIES (Rapeepisarn, et al., 2008a, 2008c)

Digital games can play on many platforms including a personal computer on-line or off-line; on game consoles which use a television as the display; on handheld consoles which run software on cartridges or memory devices and on handheld units such as mobile phones which use the machine's communication channel to download software (ELSPA, 2006). In the 21st century, digital games are no longer only in the domain of home entertainment, they are increasingly being incorporated into the classrooms of schools and colleges. Most digital games in the classroom are played on a personal computer. However, research showed that other game platforms, such as the handheld game consoles of mobile systems, have been tried for use in the classroom in many places (Field, 2007; FINDcollegecards.com, n.d.).

In terms of educational uses, the PC has been mostly used as a game machine, even if people purchased it for other tasks. Game consoles are less commonly used for school learning, although there are some game console manufactures producing educational games as personal trainers or brain training programmes (Kirriemuir, 2002). Handheld game consoles such Nintendo DS and PlayStation Portable have been increasingly accepted and used as trial learning tools in many settings (Kane, 2007;

Kroy, 2008). Also some top mobile phone venders such as Nokia and Sony Ericsson support several developers who produce software applications for e-learning and mobile learning.

Even though these digital game platforms are used widely for educational purposes in many places as mentioned, they are still unpopular to be used in Thai colleges and universities due to the negative image associated with games. Besides, the wider community is unaware of the potential of the game industry. Therefore, the game industry in Thailand, the educational use of digital games, the survey of preferred game platforms by Thai gamers and the results of preferred game platforms in this survey need to be examined. The potential of the game industry in Thailand and the educational use of digital games have already been detailed in Chapter 2. Figure 5.7 illustrates the results from the SIPA survey on preferred game platforms used by Thai gamers.

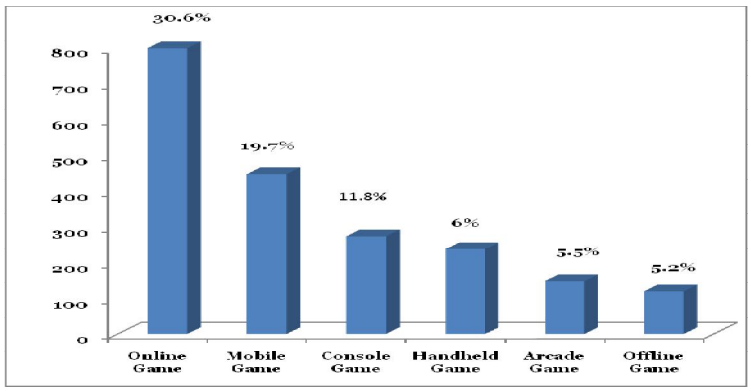


Figure 5.7: Preferred Game Platforms (SIPA 2007)

Figure 5.7 illustrates that out of 1,224 respondents (SIPA, 2007), PC platforms, including on-line and off-line are the highest preferred game platform. Mobile games (19.7%) is the second preference followed by console games (11.8%) and handheld games (6%).

According to the results of this thesis, it reveals that students and lecturers regularly play digital games on various platforms. As can be seen from Table 5.8, the percentage of students and lecturers who play on PC platforms are 92.2% and 89% respectively. In the case of students, the rank of preferred game platforms shown is similar to the SIPA survey. The PC game platform has the highest preference (92.2%). The second preference is mobile games (65.3%) followed by console games (57.8%) and handheld games (40.7%) respectively. Table 5.68 illustrates the proportion of respondents in this survey play on various digital game platforms.

Table 5.68: Proportion of Thai Students and Lecturers who Play Games on Various Digital Game Platforms

Computer Game Platform	Number of students who play games		Number of lecturers who play games	
	frequency	%	frequency	%
PC	367	92.2	26	89.7
Console	230	57.8	15	51.7
Handheld	162	40.7	9	31.0
Cell Phone	260	65.3	4	13.8

Note: respondents can answer more than one item

In terms of the Thai game market value by game platform, the statistics since 2003 to 2006 shows the figures of all game platforms have gone up every year. Figure 5.8 shows the market value in million bahts from year 2003 to 2006.

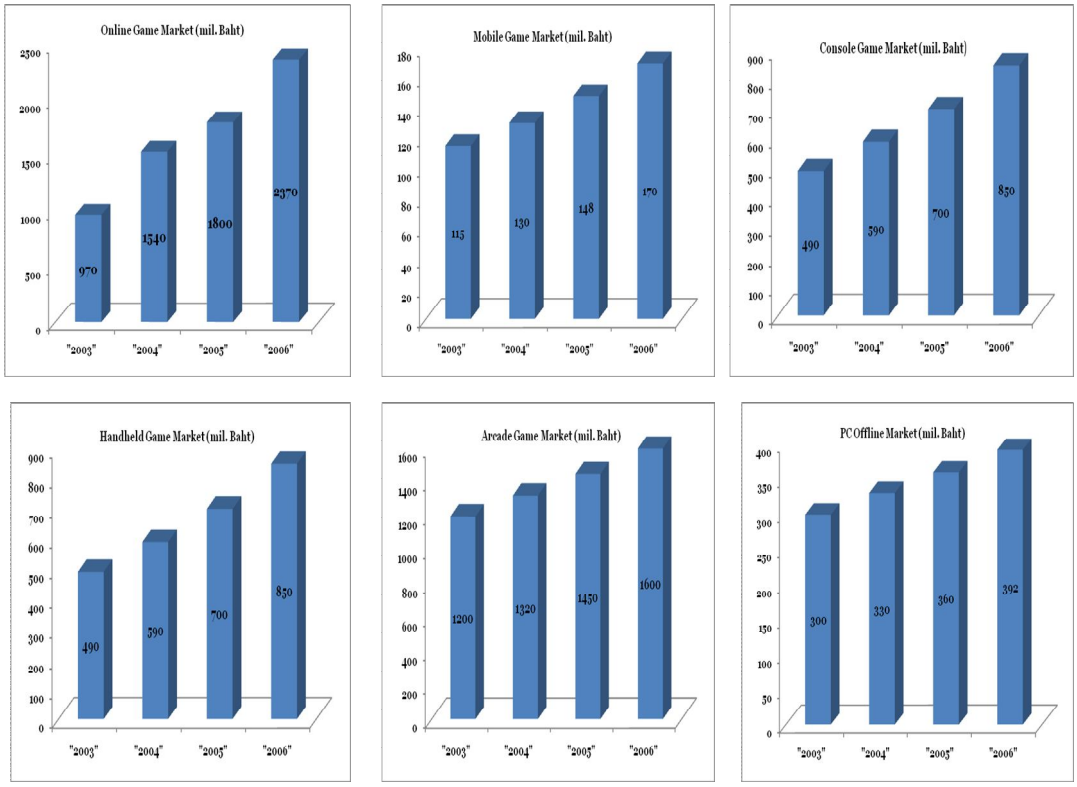


Figure 5.8: Thai Game Market Value by Game Platforms 2003 to 2006 (SIPA, 2007)

5.4.3.1 Section Summary and Discussion

From the preceding discussion, it might be inferred that the educational use of digital game platforms can support learning environments. There are several reasons why these kinds of digital game platforms can be applied in tertiary curriculum courses for Thai students:

1) The potential of Thai game industry development is soaring with the government's support under the national IT plan. Even though Thailand remains in the early stages relative to Japan, Korea, Australia, and other Asian countries, Thailand's game industry has grown substantially during the past year (SIPA, 2007).

2) The market for digital game platform software also registered a noticeable growth from the year 2003 to 2006 (see Figure 5.8).

3) Apart from PC platforms which are mostly used as game machine, the practical features of handheld game platforms include portability, weightless, low cost, easy to use, etc., are all potential factors for the acceptance of the devices for classroom use.

3) According to the Reform Education Act 1999 (ONEC, 2002), Thai universities have adopted student-centred learning as the main focus in learning. It might be feasible that the educational use of digital game platforms can support this learning environment.

4) The educational use of digital game platforms can fulfil the features of student-centred learning (SCL). Those features of SCL are: a focus on the student's experience and interest, learning by doing, tasks that are open-ended, students have choices and make decisions about learning, focus on confidence building for real-world skills, encourage to think critically and develop problem-solving skills, etc. (G. Rogers, 2002). This assumption is supported by the Federation of American Scientists (2006) which claimed that games could teach skills including: strategic thinking, interpretive analysis, problem solving, forming and executing plans and adapting to rapid change. Figure 5.9 illustrates the comparison of ECG and SCL features.

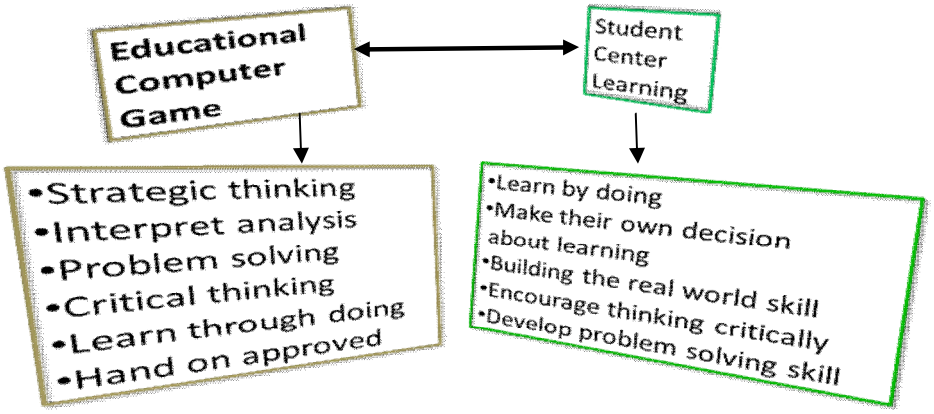


Figure 5.9: Comparison ECG & SCL Features

5) The results from the survey of this thesis on the adoption of ECG by Thai students and lecturers shows that almost all of the ECG acceptance factors have positive influence on the Behavioural Intent to Use ECG. (See results of hypothesis 1 to 8 in

Table 5.12 to 5.22 and open-ended questions in Table 5.56) It can be implied that both students and lecturers readily accept the use of ECG for classroom learning.

Thus, in order to make use of digital game platforms in the learning environment of Thai universities, the researcher would recommend three stages for study. Firstly, a survey should be conducted to examine the acceptance of ECG with each digital game platform used by concerned stakeholders. This includes students, lecturers, university administrators and students' parents. Secondly, set up criteria of the potentially beneficial use of digital game platforms by matching the features of SCL and the advantages of each type of game platforms. Thirdly, incorporate the criteria into the curriculum. Lecturers can use curriculum criteria as a guideline to set up an SCL environment with digital game platforms. When students participate in this learning situation, they have to give feedback after each session of learning to the lecturer for assessment. The lecturer will evaluate, amend and updates the curriculum. Figure 5.10 illustrates all stages of this conceptual framework.

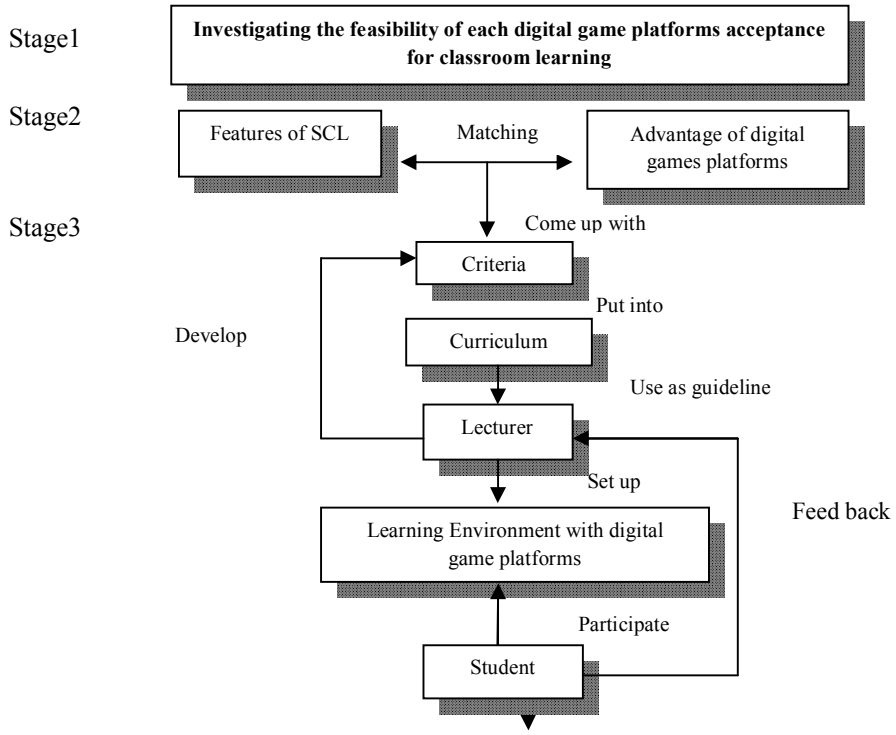


Figure 5.10: Three Stages of Adopting Digital Games Platforms for Learning in Classroom

5.5 SUMMARY

The presentation and analysis of data in this chapter are based on the survey of students and lecturers in four Thai Universities. Data was analysed in both quantitative and qualitative fashion. In the quantitative part, data was categorised in descriptive and inferential statistics. Also part of the qualitative, open-ended questions from the questionnaire and interview questions were content analysed. In brief, it can be summarised as follow:

5.5.1 QUANTITATIVE DATA

5.5.1.1 Descriptive Data

Participants: Participants were students and lecturers from four universities located both in metropolitan and regional areas. In addition, they were from either private or public universities.

Educational Technology Use: Both students and lecturers use the World Wide Web the most at 87.7 % and 87.5 % respectively.

ECG Acceptance: The results show that every ECG Acceptance Factor (PU, PEOU, AU, SN, PE and UESF) affect both students' and lecturers' Behavioural Intent to Use ECG. In other words, both students and lecturers agree that ECG Acceptance Factors have an effect on the adoption ECG in the classroom. The results of the agreement on ECG Acceptance Factors are illustrated in Table 5.69:

Table 5.69: The Agreement on ECG Acceptance Factors

	Student			Lecturer		
	Mean	**S.D.**	**Interpretation**	**Mean**	**S.D.**	**Interpretation**
PU	3.77	0.72	Agree	3.75	0.71	Agree
PEOU	3.44	0.48	Neutral	3.44	0.63	Agree
AU	3.78	0.96	Agree	3.74	0.73	Agree
SN	37.7	0.71	Agree	3.60	0.77	Agree
PE	4.03	0.66	Agree	3.94	0.65	Agree
UESF				3.88	0.73	Agree

It can be seen from Table 5.69 that both students and lecturers agreed on all the ECG acceptance factors. Only one factor, perceived ease of use (PEOU), was the opinion of students' neutral.

Learning Styles: Most students' perceptual learning style was Visual (n=173, 43.5%) while their preferred learning style was Pragmatist (n=173, 43.5%).

Teaching Styles: Most of the lecturers' teaching style was Facilitator (n=12, 41.4%).

Game Playing Behavioural:

- Both students and lecturers play games (students: n=370, 93%) and (lecturers: n=29, 74.2%)
- Both students and lecturers had an intermediate level of experience in playing games.
- On average, students play games everyday, whilst most of the lecturers play games less than once a week.
- Most of the students play more than 2 hours each time, whereas most of the lecturers play up to 1 hour each time.
- Both students and lecturers play games at home.

Game Platform:

- Among the four game platforms, students and lecturers prefer to play on the Microsoft PC rather than a MAC at 92.2% and 89.7% respectively. The second preference was a game console. Students and lecturers play a percentage of 57.8 and 51.7 respectively. Both students and lecturers prefer PlayStation (49.7% and 31.1%).
- As for handheld devices, most of the students prefer the Gameboy (23.9%) while lecturers prefer both PSP and NDS (13.8%).

- Most of the students and lecturers prefer playing games on a Nokia with the percentage at 56 and 31 respectively.

Game Preference and Expectation:

- Both students and lecturers rank "Enjoyment" the highest with a percentage of 32.9 and 50.9 respectively.
- As for students, the ranking of the preference and expectation from games followed from the story line, graphic design, character design, mode of play, educational value, sound effect and ease of winning. While the lecturers' followed from the mode of play, story line, graphic design, character design, and educational value.

5.5.1.2 Inferential Data and Hypothesis Testing

ECG Acceptance

ECG Acceptance factors (PU, PEOU, AU, SN, PE, and UESF) were used to predict the respondents' behavioural intent to use ECG by using a Regression Technique. The results found that every predictor variable (PU, PEOU, AU, SN, and PE) had a linear correlation with students' Behavioural Intent to Use at a statistical significant level: R^2 ($R^2 = .335$, $p < .05$); ($R^2 = .520$, $p < .050$); ($R^2 = .520$, $p < .05$); ($R^2 = .248$, $p < .05$); and ($R^2 = .419$, $p < .05$) respectively. As for lecturers the results found that every predictor variables (PU, PEOU, AU, SN, PE and UESF) had a linear correlation with lecturers' Behavioural Intent to Use with statistical significant level: R^2 ($R^2 = .554$, $p < .05$); ($R^2 = .282$, $p < .050$); ($R^2 = .558$, $p < .05$); ($R^2 = .625$, $p < .05$); ($R^2 = .590$, $p < .05$) and ($R^2 = .609$, $p < .05$) respectively.

ECG Acceptance Measured by Learning Style

When the correlation of ECG Acceptance Factors (PU, PEOU, AU, SN, PE) and Behavioural Intent to use was measured by learning styles, results showed that there is

still a linear correlation between ECG Acceptance Factors and Behavioural Intent to Use, statistical significant at the R Square of the Activist (R^2 = .638, p < .05); Theorist (R^2 = ..594, p < .05); Reflector (R^2 = .464, p < .05); and Pragmatist (R^2 = .585, p < .05).

University Location & University Type VS. Behavioural Intent to Use

Results of the hypothesis test shows that the difference in University Location and University Type did not affect the students' and lecturers' Behavioural Intent to Use.

Learning & Teaching Style vs. Behavioural Intent to Use

The results of the hypothesis test found that the different learning styles by students do not affect their behavioural intent to use ECG. The different teaching styles of lecturers do not influence their behavioural intent to use ECG.

Learning & Teaching Style vs. Game Play Behaviour

Hypothesis testing revealed that there is a difference in students' learning styles and lecturers' teaching styles but this did not affect their game playing behaviour or level of experience.

Gender vs. Game Playing Behaviour

It can be concluded from the hypothesis test that both the students' and lecturers' gender did not affect the behaviour of game play and level of experience except the students' gender on level of experience. This means the level of experience between male and female students is different.

5.5.2 QUALITATIVE

5.5.2.1 Open-Ended Questions

When the respondents were asked "What is Your Opinion if the University Has a Policy of Employing ECG into the Curriculum as a Learning Tool in the Classroom?", most of them have positive comments on accepting this type of education technology.

After analysing their comments and classified them into three categories (agree, neutral and disagree), it showed that 82.4% agree, 4.6% were neutral and 11.5% disagree.

5.5.2.2 Interview Questions

There were eight interview questions. Question 2: "What Types of Computer Games Do You Think Are Appropriate for the Educational Environment?" was asked in order to answer the fifth research question: "What Genre of Computer Games is Suitable for Creating Educational Computer Games in the Educational Environment of Thai Undergraduate Courses?" However, other interview questions also both directly and indirectly supported the answer of these research questions. They recommended the following genres which are suitable for ECG design: Adventure, Puzzle, RPG, Simulation, and Sport. However six of the interviewees (33.3%) think that any genre of game is suitable for ECG.

5.5.3 CONCEPTUAL FRAMEWORK PROPOSITION

In order to support the research finding in this thesis, further studies or relevant literature have been carried on. From previous research papers related with game genre and learning theories, they have been reviewed, analysed, matched, applied to bridge gaps, synthesised and, subsequently three conceptual frameworks are proposed as follow:

5.5.3.1 Conceptual model of the relationships between learning styles, learning activities and possible game genres

5.5.3.2 Conceptual model of the relationships between game genre and three learning theories.

5.5.3.3 Three stages of adopting digital game platforms for learning in the classroom.

CHAPTER 6
CONCLUSIONS

The purposes of this final chapter are to summarise the findings of the study, interpret the results, provide implications and implementation, propose a conceptual framework as a guideline for ECG using in the classroom, and suggest future research. This chapter is divided into six sections

6.1 Introduction

6.2 Research findings and interpretation

6.3 Implication and implementation

6.4 Conceptual framework: Guidelines for ECG use in the classroom

6.4 Suggestions for future research

6.5 Final remark

6.1 INTRODUCTION

This thesis focuses on the adoption of ECG in undergraduate courses at Thai universities for learning and teaching. Study aims are to investigate the factors which impact Thai lecturers and students in their use of ECG in the classroom, to identify the various learning and teaching styles which may make use of ECG, and to determine the genres of computer games which are most appropriate for development as effective ECG. For the purpose of the thesis, six research questions were formulated and 20 subsequent hypotheses were generated. In order to study the adoption of ECG for teaching and learning in Thai undergraduate courses, three main theoretical frameworks were investigated. They are Technology Acceptance Theories, ECG Conceptualisation, and Teaching and Learning Styles. The thesis combined both qualitative and

quantitative research. The methodological approach for this study is survey research. The main data collection methods were self-administered questionnaires and interviews. Both descriptive and inferential statistics were used for data analysis. Statistics included: Regression Analysis, ANOVA, t-Test, Chi-Square, mean, standard deviation, and percentage. The research findings and interpretations are described in the subsequent section.

6.2 RESEARCH FINDINGS AND INTERPRETATION

KEY FINDINGS

The key findings were the result of 20 hypothesis tests. These 20 hypotheses were classified into six parts based on six research questions.

6.2.1 RESEARCH QUESTION 1

The results from hypotheses 1 to 6 and hypotheses 13 to 14 answered research question 1 "What Factors Will Influence the Successful Introduction of ECG into the Classrooms by Thai Lecturers and Students?" Table 6.1 illustrated the hypothesis results (H_1 to H_6).

Table 6.1: Summary of Hypothesis Testing Results (H_1 to H_6)

Hypothesis #	Independent Variable	Dependent Variable	Hypothesis Result	Explanation
H1: H_{1a}	Students' PU	Students' BI	**Accepted**	PU significantly influences students' behavioural intent to use ECG
H_{1b}	Lecturers' PU	Lecturers' BI	**Accepted**	PU significantly influences lecturers' behavioural intent to use ECG
H2: H_{2a}	Students' PEOU	Students' BI	**Accepted**	PEOU significantly influences the behaviour students' intent to use ECG
H_{2b}	Lecturers' PEOU	Lecturers' BI	Rejected	PEOU does not significantly influence lecturers' behavioural intent to use ECG
H3: H_{3a}	Students' AU	Lecturers' BI	**Accepted**	AU significantly influences students' behavioural intent to use ECG
H_{3b}	Lecturers' AU	Lecturers' BI	**Accepted**	AU significantly influences lecturers' behavioural intent to use ECG
H4: H_{4a}	Students' SN	Students' BI	**Accepted**	SN significantly influences students' behavioural intent to use ECG
H_{4b}	Lecturers' SN	Lecturers' BI	**Accepted**	SN significantly influences lecturers' behavioural intent to use ECG
H5: H_{5a}	Students' PE	Students' BI	**Accepted**	PE significantly influences students' behavioural intent to use ECG
H_{5b}	Lecturers' PE	Lecturers' BI	**Accepted**	PE significantly influences lecturers' behavioural intent to use ECG
H_6	UESF	Lecturers' BI	Rejected	UESF does not significantly influence behavioural intent to use ECG

A summary of hypotheses H_1 to H_6 in Table 6.1 shows that most of the ECG Acceptance Factors influence Behavioural Intent to use ECG for both students and lecturers. Only Hypothesis 2b and Hypothesis 6 were rejected. The results imply that:

1) Respondents think that ECG might increase, support and enhance the effectiveness of learning & teaching, engage students during learning, and all students progress at their own pace.
2) Students think that it is simple to learn to operate ECG in a classroom.
3) Respondents feel positive towards the use of ECG.
4) Positive influence from colleagues, friends, supervisors and superiors regarding the use of ECG in the classroom affects both students and lecturers.
5) Respondents think that the ECG use is enjoyable, amusing, pleasing, gratifying, exciting, stimulating, challenging and offers competition.
6) Only lecturers think that overall ECG is not easy to use. (Hypothesis H2b was rejected -- R^2=.282, p>.05) However, according to Table 5.18, two out of five items (which are items 6 and 9) are statistical significant at 0.05. It can be inferred that lecturers believe learning to operate ECG will be easy and it won't be time consuming to become familiar with.
7) University Environment Support Factors do not have effects on the behavioural intent to use ECG by lecturers.

The results from hypotheses 13 to 14 also answered question 1 and supported proposition 2: "The Different University Type and University Location of Respondents Will Affect the Use of ECG in the Classroom" Table 6.2 illustrated the hypothesis results (H_{13} and H_{14}).

Table 6.2: Summary of Hypothesis Testing Result (H_{13} and H_{14})

Hypothesis #	Independent Variable	Dependent Variable	Hypothesis Result	Explanation
H_{13}:(H_{13a})	Students' UL	Students' BI	Rejected	UL does not significantly influence students' behavioural intent to use ECG
(H_{13b})	Lecturers' UL	Lecturers' BI	Rejected	UL does not significantly influence lecturers' behavioural intent to use ECG
H14: (H_{14a})	Students' UT	Students' BI	Rejected	UT does not significantly influence students' behavioural intent to use ECG
(H_{14b})	Lecturers' UT	Lecturers' BI	Rejected	UT does not significantly influence lecturers' behavioural intent to use ECG

Table 6.2 shows the hypothesis testing results for both H_{13} and H_{14} were rejected. It can be interpreted from the summary of hypothesis testing in this table that respondents from the different university locations and the different university types do not affect their behavioural intent to use ECG.

6.2.2 RESEARCH QUESTION 2

The results from Hypotheses 7 to 11 answered research question 2: "Which Learning Styles Will Derive Benefits from the Use of ECG?" Table 6.3 summarised the hypothesis results (H_7 to H_{11}).

Table 6.3: Summary of Hypothesis Testing Results (H_7 to H_{11})

Hypothesis #	Independent Variable	Dependent Variable	Hypothesis Result	Explanation
H_7	Activist LS	Students' BI	**Accepted**	Activist LS significantly influences students' behavioural intent to use ECG
H_8	Theorist LS	Students' BI	**Accepted**	Theorist LS significantly influences students' behavioural intent to use ECG
H_9	Reflector LS	Students' BI	**Accepted**	Reflector LS significantly influences behavioural students' intent to use ECG
H_{10}	Pragmatist LS	Students' BI	**Accepted**	Pragmatist LS significantly influences students' behavioural intent to use ECG
H_{11}	Students' LS	Students' BI	Rejected	The different learning styles do not affect a student's behavioural intent to use ECG

From Table 6.3, hypothesis testing results of H_7 to H_{10} were accepted. H_7 to H_{10} were formulated to test the learning styles which most influence ECG adoption. By Regression Analysis with the "enter" method, each learning style Activist, Theorist,

Reflector, and Pragmatist were used to test the linear correlation between ECG Acceptance Factors with Behavioural Intent to Use (BI). It can be interpreted that every learning styles influenced a student's BI. However, when comparing the R Square of each learning style which influences BI, it can be seen that Activist Learners are the most influenced group for ECG adoption (R^2 = .638, p <.05). The relation of each learning style which influences BI is illustrated in Figure 6.1.

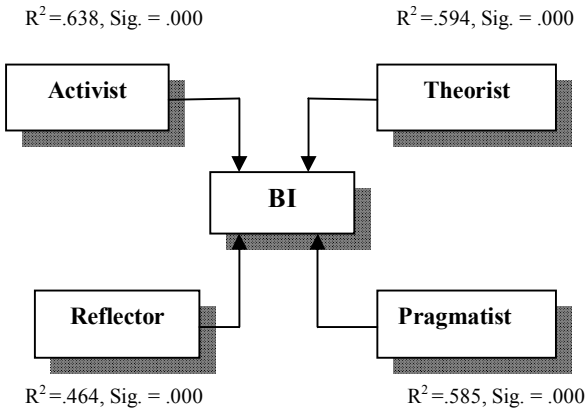


Figure 6.1: Learning Style with Behavioural Intent to Use

From Figure 6.1, the R Square of the Activist Learning Style is close to 1 at 0.638, implying that The Activist has a rather strong influence on ECG adoption with a statistical significance at 63.8%. These influences are followed by Theorist, Pragmatist and Reflector in descending order.

As can be seen that the R Square for each learning style is very close, so ANOVA was then used to test H_{11} "Student with Different Learning Style Has Different Behavioural Intent to Use ECG." The hypothesis test shows that H_{11} was rejected. It can be interpreted that there is no different among these four types of learning styles which affect the behavioural intent to use ECG.

6.2.3 RESEARCH QUESTION 3

The results from Hypothesis 12 answered research question 3: "Which Teaching Styles Will Derive Benefits from the Use of ECG?" Table 6.4 summarised the hypothesis result (H_{12}).

Table 6.4: Summary of Hypothesis Testing Results (H_{12})

Hypothesis #	Independent Variable	Dependent Variable	Hypothesis Result	Explanation
H_{12}	Lecturers' TS	Lecturers' BI	Rejected	The different teaching styles do not affect lecturers' behavioural intent to use ECG

From Table 6.4, H_{12} was rejected. This implies that there is no different teaching style that will affect the lecturer's behavioural intent to use ECG.

6.2.4 RESEARCH QUESTION 4

To answer research question 4: "Which Computer Game Genre Will Be Appropriate for Educational Computer Games in the Educational Environment of Undergraduate Courses?", interview question 2 was asked. The summaries of game genres the respondents think are appropriate for ECG are illustrated in Table 5.60. Most of them think every game genre is appropriate (52.6%). 42.1% think the Simulation Game, 31.6% think the Adventure and Sports Game, 26.3% think the Role-Playing Games. Most of them think that it depends on the content & subject areas. The rest are Action, Puzzle, and Racing Games.

The findings from the interview implied that there is no exact answer for this research question. If every game genre is appropriate, it should or might depend on subject areas and learning contents. Consequently, this would impact on some learning theories. Further study regarding this research question has been conducted, and the findings will be discussed in Section 6.4.

6.2.5 RESEARCH QUESTION 5

The results from Hypotheses 15 to 18 answered research question 5: "Are There Any Relationships Between Learning and Teaching Styles with Computer Game Play Behaviour?" Table 6.5 summarised the hypothesis results (H_{15} to H_{18}).

Table 6.5: Summary of Hypothesis Testing Results (H_{15} to H_{18})

Hypothesis #	Independent Variable	Dependent Variable	Hypothesis Result	Explanation
H_{15}	Students' LS	Playing Games	Rejected	Different LS does not affect students' game playing
H_{16}	Lecturers' TS	Playing Games	Rejected	Different TS does not affect lecturers' game playing
H_{17}	Students' LS	Level of Experience	Rejected	Different LS does not affect students' level of experience in playing games
H_{18}	Lecturers' TS	Level of Experience	Rejected	Different TS does not affect lecturers' level of experience in playing games

From Table 6.5, H_{15} to H_{16} were rejected. It can be inferred that the different learning styles of students and the different teaching styles of lecturers does not affect their game playing and their level of experience in playing games.

6.2.6 RESEARCH QUESTION 6

The results from Hypotheses 19 to 20 answered research question 6: "Are There Any Relationships Between Gender and Computer Game Play Behaviour?" Table 6.6 summarised the hypothesis results (H_{19} and H_{20}).

Table 6.6: Summary of Hypothesis Testing Results (H_{19} to H_{20})

Hypothesis #	Independent Variable	Dependent Variable	Hypothesis Result	Explanation
H_{19}				
H_{19a}	Students' Gender	Playing Game	**Accepted**	Different gender of student results in different behaviour in playing games
H_{19b}	Lecturers' Gender	Playing Game	Rejected	Different gender of lecturer does not result in a different behaviour in playing games
H_{20}				
H_{20a}	Students' Gender	Level of Experience	**Accepted**	Different gender of students results in a different level of experience in playing games
H_{20b}	Lecturers' Gender	Level of Experience	**Accepted**	Different gender of lecturer results in a different level of experience in playing games

The summary of hypothesis testing results from Table 6.6 shows that H_{19a}, H_{20a} and H_{20b} were accepted but H_{19} was rejected. It can be interpreted that the different

gender of students affect the behaviour in games playing; the different gender of students also results in a different level of experience in playing games. Likewise, the different gender of lecturer results in a different level of experience in playing games, but there is no difference in game playing behaviour. In other words, most lecturers, both male and female, are playing computer games.

These findings implied that gender is an important variable when correlated with game playing behaviour. The results of this thesis are also supported and in accordance with a large number of studies on gender and computer games as discussed in section 3.5.3.3 in Chapter 3: " Gender is One of the Controversial Variables Include in Many Research in Computer Games." A number of gender studies on computer games, as reviewed in Chapter 3, confirmed that boys and men play and have more experience in computer and video games than girls and women (Hartmann & Klimmt, 2006; Kramer & Lehman, 1990; Mohood, et al., 2000; Nzegwu, 2000).

6.3 IMPLICATIONS AND IMPLEMENTATIONS

The implications and implementations of these findings are based on the objectives of this thesis. Therefore, the implications will focus on the results of investigating the factors which impact Thai lecturers and students in their use of ECG, the identification of the various types of learning and teaching styles which may make use of ECG, and the determination of the game genres of computer games which are most appropriate for effective ECG development.

6.3.1 ECG ACCEPTANCE FACTORS

In terms of the first objective, research question 1 and the related hypotheses presented in Chapter 5, the findings point to the factors which influence the successful introduction of ECG in the classroom which are almost all ECG acceptance factors. From a theoretical perspective, the ECG Acceptance Model provides an understanding

about the relationships of determinants and BI. BI was significantly influenced by PU, PEOU, AU, SN, and PE. Figure 6.2 illustrated the relationships of ECG Acceptance Factors which influence Behavioural Intent to Use ECG by students and lecturers.

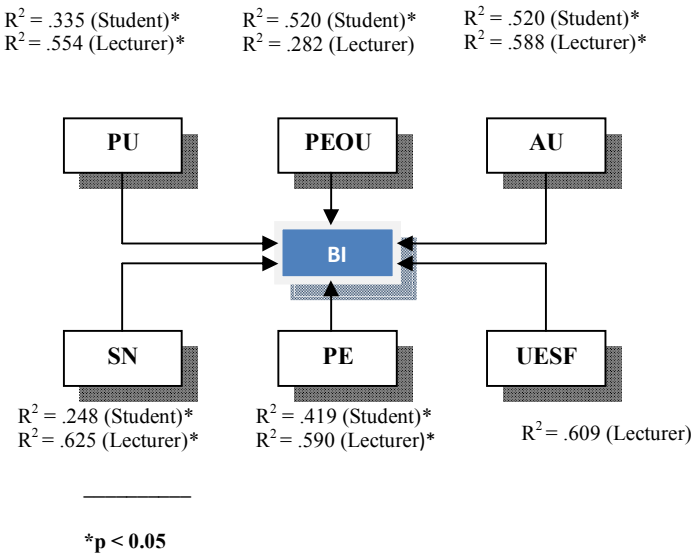


Figure 6.2: ECG Acceptance Model with R^2 of each factor

The findings of each ECG Acceptance Factors can be interpreted as follows:

1) Perceived Usefulness (PU) is defined here as "the degree to which a person believes using a particular system would enhance his or her job performance" (Davis, 1989). The results of this thesis show that Perceived Usefulness by students and lecturers influenced their Behavioural Intent to Use ECG. (Student R^2 = .335, $p < .05$; Lecturer R^2 = .554, $p < .05$). This implies that students and lecturers tend to use ECG to the extent that they believe it will help them better perform their job.

2) Perceived Ease of Use (PEOU) refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). In contrast to Perceived Usefulness, the results of this study show that only Perceived Ease of Use by the student (R^2 = .520, $p < .05$) influenced their intent to use, however Perceived Ease of Use of lecturers (R^2 = .282, $p > .05$) was not statistically significant to influence their intent to use ECG. This might infer that lecturers are not assured that they can learn to

operate ECG easily. Naturally, lecturer needs to deliberately prepare his/her lessons and assure that he/she has confidence in the subject before class. Integrating ECG into the lesson might not be an easy task. Lecturer must be familiar with the software in order to make best use of it as a teaching tool. The study of ELSPA (2006) also found that even where teachers believe digital games can be a constructive and useful learning tool, they often feel they aren't able to recognise these skills while remaining within the boundaries of the national curriculum.

3) Perceived Enjoyment (PE) refers to the extent to which the activity of using a computer is perceived to be enjoyable in its own right (Davis, et al., 1992). Some studies have focused on perceived fun and perceived playfulness (Igbaria, Schiffman, & Wieckowski, 1994; Moon & Kim, 2001). The results from this thesis show that Perceived Enjoyment of the respondents was statistically significant and influenced their intent to use (Student $R^2 = .419$, $p < .05$; Lecturer $R^2 = .590$, $p < .05$). This finding is supported and is accordant with Moon and Kim (2001) and Teo et al. (1999). They also found that Perceived Enjoyment and Perceived Playfulness had a significant impact on the intention to use the Internet. It is noted that among ECG acceptance factors, the R^2 of PE was the highest. This can imply that the perception of respondents mostly focuses on "Enjoyment". It can be said that this finding may support the concept of "learn through play" and supports the reason "why play is so important" as mentioned in Chapter 2. This also maintains the idea that people learn best when they play and children learn better when they can choose their own activities. They will enjoy and gain more benefit under the generous scope to access materials and determine their own play (Lindon, 2002; Trister & Bickart, 1998; Wasserman, 1990) for example, when they choose to play on a computer or video games. Among the reasons people play games include fun/ enjoyable, health benefits, skill development, team building, to

develop social skills, relaxation, competition, recreation, and to win, fun and enjoyable which are the major reasons as shown in the survey of Interaction Design (2006) that 88 % of people play games due to the enjoyment and fun.

4) Subjective Norm (SN) is an individual's judgment about whether most people who are important to the individual will approve of a particular behaviour under consideration (Franzoi, 2003). The results of this thesis show that Subjective Norms of students and lecturers influenced their Behaviour Intent to Use ECG. (Student R^2 = .248, $p < .05$; Lecturer R^2 = .6, $p25 < .05$). This implies that colleagues, friends, a student's parent, supervisor or superior at work have influence and are important toward the intent to use ECG by respondents. From other related research, some found that SN had no significance on intent to use, while others found significance. For example, Mathieson (1991) found no significant effect of SN on intention, whereas Taylor and Todd (1995) did find a significant effect. Davis (1989) found that SN had no significant effect on intentions over and above PU and PEOU.

5) Attitude Towards Use (AU) is whether an individual feels positive or negative about using a particular system (Davis, 1989). The results of this thesis show that students' and lecturers' Attitude Towards Use influenced their Behavioural Intent to Use ECG. (Student R^2 = .520, $p < .05$; Lecturer R^2 = .588, $p < .05$). This implies that the respondents have a positive attitude about using ECG in the classroom. They have confidence, and find ECG is useful and enjoy using it as well.

6) University Environment Support Factors (UESF) refers to elements which influence a lecturer's beliefs and a university's support for technology integration into classrooms (Ford, 1992). The findings of this thesis show that UESF had no statically significant influenced on lecturers' Behavioural Intent to Use ECG. (R^2 = .609, $p > .05$). This means UESF do not have an effect on the behavioural intent to use. However,

when considered in each item among these factors, it was found that the quality of the software is the only item which had statistical significance.

Theoretical implementation

In most information systems research, the user's attitude in using, and the actual use of a technology are addressed in TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and TAM (Davis, 1989) which is the extension and is rooted in TRA. The theoretical importance of PU and PEOU as determinants of user behavioural intent to use is indicated by several diverse areas of research (Davis, 1989). Subjective Norms are also included as a direct determinant of behavioural intent to use in TRA (Fishbein & Ajzen, 1975). The results of this study suggest that when technology acceptance is investigated in ECG, it is quite commendable for researchers to access technology acceptance longitudinally. It is also advisable that enjoyment is an important antecedent to the TAM and TRA, and implies that game developers and educators must consider the element of enjoyment if they are to provide students with attractive products. Therefore, the ECG Acceptance Model would be recommended for future study in the adoption of educational computer games. The model of predicting and explaining ECG adoption can be shown by the following expression:

$$BI = PU + PEOU + AU + SN + PE$$

Even though this expression lacks one factor, UESF, as proposed previously in the conceptualisations of research constructs in Chapter 3. UESF is the determinant which has no statistical significance influencing BI in this study. However, the author retains a belief that UESF is one of the important ECG Acceptance Factors. Future study may include this determinant as a predictor of the adoption from a study on a different target group.

6.3.2 LEARNING AND TEACHING STYLES

The second objective of this thesis states: "To Identify the Various Learning and Teaching Styles which May Make Best Use of Educational Computer Games." Learning Style in this thesis is based on Honey & Mumford which classified into four types: Activist, Theorist, Reflector and Pragmatic. The findings from the hypothesis testing of H_7 to H_{10} show that every Learning Style has a linear correlation between ECG Acceptant Factors and Behavioural Intent to Use ECG. It can be implied that the different styles of learners do not affect the intent to use ECG. These findings were also supported by hypothesis testing of H_{11} when using ANOVA. Similarly, with the ANOVA test, the result of hypothesis testing of H_{12} also showed that the different teaching styles do not affect a lecturer's behavioural intent to use ECG. However, among the four styles of learners, the R^2 value (close to 1 at 0.638) of Activist Learning Style is the highest. This implies that Activist has a rather strong influence on ECG adoption at 63.8%.

6.4 CONCEPTUAL FRAMEWORK: GUIDELINE FOR ECG USING IN CLASSROOM

From the survey results and the literature review of this thesis, it is confirmed that ECG should be introduced into Thai classrooms. It is also suggested to establish a framework for University policy toward educational digital games in the Thai context. The following aspects should be taken into consideration:

(1) Because the Thai National Education Act and National IT policy are important forces to push ICT into learning and teaching in Thai higher education, ECG is one of the educational tool alternatives for university decision making on using it in the classroom.

(2) **Learners:** Learners should have a perceptual ability, and interest for game for learning. Learners can learn from ECG anywhere, in a classroom, a laboratory, or out of class.

(3) **Lecturers:** It is not necessary that lecturers be expert in gaming software and hardware, but they have to know the courseware. Teaching with games may require lecturers to become familiar with the titles intended for use in their classroom. Lecturers have to provide instructions to use games, draw the content from games, discuss, test and evaluate.

Content + Games+ Discussion+ Test+ Evaluate

However, applying ECG for educational use is not accepted by all lecturers. A good attitude toward games is important. In order to prepare them to use ECG effectively in the class, lecturers need to know the followings:

(a) Be positive, starting with a good attitude toward game playing.

(b) Study and prepare course content for game developers; classify and analyse content.

(c) Select game styles or game genre.

(d) Classify the level of learners.

(e) Being able to play games. Those who do not have this skill should start with simple games such as board, puzzle, Brain Age, adventure or casual games.

(f) Training or attending seminar programmes in order to build up readiness, to gain information about using and playing games, to change behaviours, to provide good attitudes toward games, etc.

(4) **Educational personnel:** They should facilitate software development, provide technical training, and construct learning content (possibly in cooperation with

lecturers). Three related interested parties include 1) content experts, 2) game designers and 3) game developers.

(5) **Appropriate game genre for effective ECG:** Recommendations for the implementation and design of appropriate game genre for effective ECG should bring together the idea of "Learning Activities" and "Learning Style" into consideration. The conceptual model of "Relationship Between Learning Style, Learning Activities and Possible Game Genre" illustrated in Figure 6.3 (as proposed in Figure 5.5 from Chapter 5) might be used as an example or guideline in this purpose.

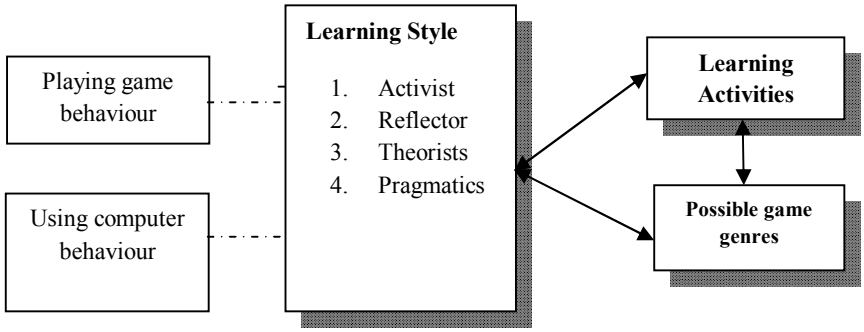
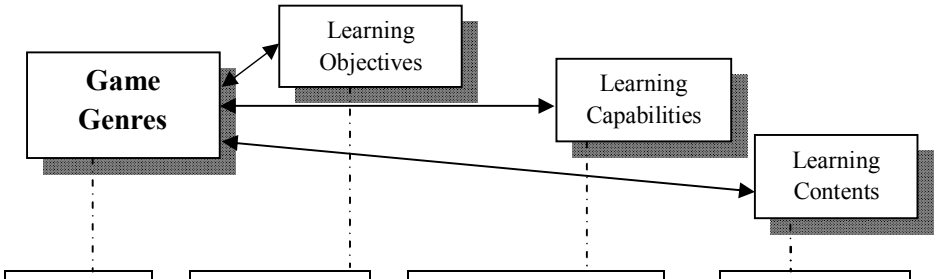


Fig. 6.3: Conceptual Model of the Relationship between Learning Styles, Learning Activities and Possible Game Genres

(6) **Conceptual model of the relationships between game genres and three learning theories:**

The study of Rapeepisarn et. al. (2008e) found that in order to design effective ECG, various pedagogical theories need to be emphasised and examined. The conceptual framework from this model suggests that to design the appropriate game genre for effective ECG needs to take learning content, learning objective, and learning capabilities into consideration. For instance, according to the model (as mentioned in Figure 5.6, Chapter 5), if the learning content is reasoning and creativity, learning objectives need comprehension and knowledge; and if learning capabilities are concrete

concepts and discriminations, the appropriate genre should be a Puzzle Game. Figure 6.4 illustrates this conceptual model.



Game Genres	Learning Objectives	Learning Capabilities	Learning Contents
Action	Application Comprehension Knowledge	Defined Concepts Concrete Concepts Discriminations	Facts, Skills
Adventure	Evaluation Synthesis Analysis Application Comprehension Knowledge	Problem Solving Higher Order Rules Defined Concepts Concrete Concepts Discriminations	Judgment, Process, Observation, Skills
Fighting	Application Comprehension Knowledge	Defined Concepts Concrete Concepts Discriminations	Facts, Skills
Puzzle	Comprehension Knowledge	Concrete Concepts Discriminations	Reasoning, Creativity
Role Playing	Evaluation Synthesis Analysis Application Comprehension Knowledge	Problem Solving Higher Order Rules Defined Concepts Concrete Concepts Discriminations	Skills, Judgment, Behaviour, Language, Communication
Simulation	Evaluation Synthesis Analysis Application Comprehension Knowledge	Problem Solving Higher Order Rules Defined Concepts Concrete Concepts Discriminations	Theories, Systems
Sports	Application Comprehension Knowledge	Defined Concepts Concrete Concepts Discriminations	Facts, Skills
Strategy	Evaluation Synthesis Analysis Application Comprehension Knowledge	Problem Solving Higher Order Rules Defined Concepts Concrete Concepts Discriminations	Judgment, Process

Figure 6.4: Conceptual Model of the Relationships between Game Genres and Three Learning Theories

(7) **Additional Suggestion for Implementation:** The additional suggestions for implementation refer to the educational use of digital game platforms. The studies of Rapeepisarn et. al. (2008a, 2008c) proposed a model for three stages of adopting digital game platforms for learning in the classroom for further study. The rationale behind this conceptual framework (see Figure 5.10 in Chapter 5) are:

- Educational use of digital games can support the learning environment.
- A Student-Centred Learning (SCL) approach is the main focus of the Thai National Educational Act of 1999. The Thai ICT Master Plan for education (2007 to 2011) also supports the employment of ICT for the education environment. ECG, as an ICT tool for learning, can fulfill the features of SCL.
- The educational use of every digital game platform (PC, Console, Handheld and Mobile Devices) is beneficial and presents a potential teaching and learning tool (Rapeepisarn, et al., 2008c). The use of digital game platforms for educational purposes is also gaining more attention in many places (Rapeepisarn, et al., 2008a). Moreover, the Thai market for digital game platform software registered noticeable growth from the year 2003 to 2006 (see Table 2.8 in Chapter 2).
- The results from the survey of this thesis show that almost every ECG acceptance factor has a positive influence on the respondents' behavioural intent to use ECG. The findings also show that the attitude and opinion of respondents strongly support the acceptance of ECG in the classroom (see Table 5.55 in Chapter 5).

From these results, a model consisting three stages for adopting ECG platforms for teaching and learning in the classroom for any further study in this area is

recommended. The three stages include: 1) investigating the acceptance feasibility of each digital game platform in classroom learning; 2) matching the criteria of the potential beneficial use of digital game platforms with the features of SCL; and 3) incorporating the criteria into curricula. Lecturers can use this as a guideline and set up learning environments with digital game platforms. Meanwhile students who participate in this learning environment can give feedback to lecturers. Subsequently, lecturer can evaluate, amend, and develop criteria and put it back in to the curriculum.

6.5 SUGGESTION FOR FUTURE RESEARCH

This section suggests related areas of research where additional investigation may be fruitful. According to the implications and implementation, including the proposed concept framework as a guideline for ECG using in the classroom in this study, there are many opportunities for further research.

Firstly, one direction for further research would be to expand the ECG Acceptance Factors model to include other variables. The variables included in this research model were those found in the literature and theories of TRA and TAM. Additional theories related to technology acceptance should be included. Therefore, future researchers may pursue a number of different options such as introducing other external variables that may affect the adoption of ECG. This study used Behavioural Intention (BI) as a dependent variable (as have many other studies). However some researchers have argued for more behaviourally-oriented measures (Szajna, 1994). The future study of ECG adoption can also be investigated to broaden the subject to include respondents from every field of study.

Secondly, not only students and lecturers, but all stakeholders in the education sector including university administrators, educators, academicians, parents of students, as well as game developers should be surveyed. Additionally, further study can include

more types of universities such as open universities, autonomous universities, higher education institute etc.

Thirdly, according to a guideline proposed here as a conceptual model of the relationship between learning styles, learning activities and possible game genres, experimental research studying on the impact of learning activities, learning styles associated with game genre can be conducted. Moreover, investigation of determining suitable game genres for classroom learning may be conducted to indicate different learning theories as had been proposed as a concept model for the relationships between game genre and three learning theories.

Finally, investigating the feasibility of different game platform acceptable for classroom learning as the one similar to the propose model with three stages for adopting digital game platforms for learning in the classroom can be conducted.

6.6 FINAL REMARKS

This study is important because it is one of the few studies in the field of Educational Computer Games in Thailand. This study also investigated the factors to adopting ECG for Thai education. It is also the first study exploring and focusing on the adoption and implementation of this education technology in Thai undergraduate courses. According to the findings of this thesis, the author believes that computer games can be a most powerful learning technology and it is also possible to integrate this into the Thai classroom.

The author agrees with the statement of Lord Puttnam of Queensgate, President of UNICEF UK: *"...we need to think creatively about what education and gaming might look like in the future. We need to acknowledge those changes to assessment techniques and the curriculum might be required…"* ECG can be used as a learning tool for young people for the reason that playing computer games has become the

culture of children today. They are growing up by playing with this technology almost every day. Stephen Heppell, Founder of Ultralab, supports this idea. He observed: *"...people love to learn, people love to play. It should not have taken quite so long to make progress towards putting those two together seamlessly..."* (ELSPA, 2006). ECG might be one of the powerful teaching and / or learning tools in the future. However, this tool cannot replace the lecturer. According to the interview findings of this thesis, ECG may work best as an indirect teaching tool, or an alternative tool to support learning out of the classroom. This finding also supports by the outcome of the study carried out by McFarlane et al. (2002). They claim that most games are embedded within a wider set of activities relating to the context or subject under discussion. It is argued that they work best when integrated into the lesson plan, rather than when they replace it (McFarlane, et al., 2002).

In conclusion, this research has provided foundational data to assist in establishing frameworks for the designing of educational computer games in Thailand. It is hopeful that the contribution and proposals in this thesis will benefit Thai educators, students, lecturers, university administrators, as well as Thai software game developers. It is also anticipated that ECG will be offered and supported to implement and enhance educational developments in Thailand.

REFERENCE

ACER. (2002). Rural and urban differences in Australian Education. *Longitudinal Study of Australian Youth*. Retrieved from http://research.ace.edu.au/lasy_briefs/4

Adam, M., & Moussouri, T. (2002). *The interactive experience: Linking research and practice.* Paper presented at the Proceedings of International Conference on Interactive Learning in Museums of Art and Design, London.

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS Quarterly, 16*, 227-247.

Addis, M. (2006a). *Teachers discovering computers: Integrating technology and digital media in the classroom.* Boston, Mass.: Thomson.

Addis, M. (2006b). *Teachers discovering computers: Intergrating technology and digital media in the classroom*. Boston, Mass.: Thomson.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ.: Prentice Hall.

Aldrich, C. (2005). *Learning by doing: A comprehensive guide to simulations, computer games, and pedagogy in e-learning and other educational experiences*. San Francisco, CA.: Wiley, John & sons.

Amory, A., Naicker, K., Vincent, J., & Adams, C. (1999). The use of computer games as an educational tool: Identification of appropriate game types and game elements. *British Journal of Educational Technology, 30*(4), 311-321.

Anderson, C. A., & Bushman, B. J. (2001). Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *American Psychological Society, 12*(5), 353-359.

Anderson, C. A., & Dill, K. E. (2000). Video games and aggressive thoughts, feelings and behaviour in the laboratory and in live. *Journal of Personality and Social Psychology, 78*(4), 772-790.

Babbie, E. (1998). *The practice of social research* (8th ed.). Belmont, CA.: Wadsworth.

Baharuddin, A. (1999). *The use of information technology in education: Using an interactive multimedia courseware package to upgrade teachers' knowledge and change their attitudes.* Unpublished Ph.D., The Robert Gordon University, UK.

Banduru, A. (1982). Self-efficacy: Toward a unifying theory of behavioural change. *American Psychologist, 37*, 122-147.

Bandura, A. (1977). *Social learning theory.* New York: General Learning Press.

Barab, S., Thomas, M., Dodge, T., Carteaux, R., & Tuzun, H. (2005). Making learning fun: Quest Atlantis, A game without guns. *Educational Technology Research and Development, 53*(1), 86-107.

Baranich, K., & Currie, C. (2004). Come play! Using games to teach, motivate and engage. *Intercom Magazine, (September/ October)*. Retrieved from http://www.stc.org/intercom/PDFs/2004/20040910_06-09.pdf

Bates, B. (2004). *Game design*. Boston: Thomson.

BBCNews. (2006). Video games have 'Role in School'. Retrieved from http://news.bbc.co.uk/2/hi/technology/5398230.stm

Beak, Y., Ed. (2010). *Gaming for classroom-base learning: Digital role playing as a motivator of study.* Hershey, PA: Information Science Reference.

Beard, C., & Wilson, J. (2002). *The power of experiental learning: A handbook for trainers and educators*. London: Kogan.

Begg, M., Dewhurst, D., & Ellaway, R. (2003). *Process, truth and consequences: informal reflections on games, game communities and their use within higher education*: College of Medicine and Veterinary Medicine, University of Edinburgh.

Bloom, R. (1956). *Taxonomy of education objectives: The classification of education goal*. New York: Longman.

Blunt, R. D. (2006). *A causal-comparative exploration of the relationship between game-based learning and academic achievement: Teaching management with video games.* Unpublished Ph. D. Dissertation, Walden University, Minneapolis, MN.

Bookin-Weiner, J. (n.d.). Urban campus. *American Graduate Education*. Retrieved from http://www.americangraduateeducation.com/folder1/subfolder1/ruralvsurban.htm

Boop, M. (2006). Didactic analysis of digital games and game-based learning. In M. Pivec (Ed.), *Affective and emotional aspects of human-computer interaction. Game-Based and Innovative Learning Approaches*. Amsterdam: IOS Press.

Boylan, A. (2005). Educational computer games. Retrieved from http://www.newman.ac.uk/StudentsWebsites/a.n.casas/edu.htm#educationalvalue

Bradford, U. o. (2006). Games on mobile phones could improve science education across Europe. Retrieved from http://www;bradford.ac.uk/admin/pr/pressreleases/2005/grod/php

Bransford, J., Brown, A., & Cocking, R. (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC.: National Academic Press.

Bredemeier, M., & Greenblatt, C. (1981). The education effectiveness of games: A synthesis of findings. *Simulation & Gaming, 12*(3), 307-332.

Brown, R. M., Hall, L. R., Holtzer, R., Brown, S. L., & brown, N. L. (1997). Gender and video game performance. *Sex Roles, 36*(11-12), 793-812.

Brown, T., Cosgriff, T., & French, G. (2008). Learning style preferences of occupational therapy, Physiotherapy and speech pathology studies: A

comparative study. *The Internet Journal of Allied Health Sciences and practice, 6*(3), 1-12.

Bryce, J., & Rutter, J. (2002). *Killing like a girl: Gendered gaming and girl gamers' visibility.* Paper presented at the CGDC Conference Proceedings, Tampere, Finland.

Cantor, J. (1995) Experiential learning in higher education: Linking classroom and community. *ASHE-ERIC Higher Education Report No. 7*: ERIC Clearinghouse on Higher Education, Graduate School of Education and Human Development, The George Washington University.

Cassell, J., & Jenkins, H. (Eds.). (1998). *From Barbie to Mortal Kombat: Gender and computer games*. Cambridge, MA.: MIT Press.

Cavalli, E. (2008). Standford: Gender is key in love of videogames. Retrieved from http://bloglwired.com/games/2008/02/stanford-study.html

CCL. (2006). The rural-urban gap in education. *Canadian Council on Leaning*. Retrieved from http://www.ccl-cca.ca/CCL/Reports/LessonsInLearning/LiL1March2006.htm

Chaichana, S. (2003). *A comparative study of learning achievementon "Art Composition" through computer-assisted instructional games with and without a cue in serial summaries.* Unpublished Master of Education, Ramkhamhaeng, Bangkok.

ChinaTechNews. (2007). Nokia to host mobile Chinese learning platform. Retrieved from http://www.chinatechnews.com/2007/05/29/5443-nokia-to-host-mobile-chinese-learning-platform

Chong, Y., Wong, M., & Thomas, F. E. (2005). *The impact of learning styles on the effectiveness of digital games in education.* Paper presented at the Proceedings of Symposium on Information Technology in Education, KDU College, Patailing Jave, Malaysia.

Clark, D. (2000). Learning style. Retrieved from http://www.nwlink.com/~donclark/hrd/learning/style.htm

Cockerton, T., Naz, R., & Sheppard, S. (2002). Factorial validity and internal reliability of Honey and Mumford's learning styles questionnaire. *Psychological Report, 91*(2), 503-519.

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). Learning styles and pedagogy in post-16 learning: A systematic and critical review. *www.LSRC,ac.uk: Learning and Skills Research Centre*. Retrieved from http://www.lsda.org.uk/files/PDF/1543.pdf

Compeau, D. R., & Huggins, C. A. (1995). Application of social cognitive theory to training for computer skills *Information Systems Research, 6*(3), 118-143.

Compeau, D. R., Huggins, C. A., & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: A longitudinal study. *MIS Quarterly, 23*(2), 145-158.

Conti, G. J. (1989). Assessing teaching style in continuing education. In E. R. Hayes (Ed.), *New directions for adult and continuing education* (Vol. 43, pp. 3-16). San Francisco: Jossey-Bass.

Converse, J. M., & Presser, S. (1986). *Survey questions: Handcrafting the standardized questionnaire*. Newbury Park, CA.: Sage.

Corn, J. (2007). Where did the Likert Scale come from? Retrieved from http://jcsoftwaresales.blogspot.com/2007/08/where-did-likert-scale-come-from.html

Cowell, J., & Payne, J. (2000). Negative correlates of computer game play in adolescents. *British Journal of Psychology, 91*, 295-310.

Cox, M., & Preston, C. (1999). What factors support or prevent teachers from using ICT in their classroom? Retrieved from http://www.leeds.ac.uk/educol/documents/00001304.htm

Crotty, M. (1998). *The foundation of social research: Meaning and perspective in the research process*. Thousand Oaks, CA.: Sage.

Cruickshank, D. R. (1980). Classroom games and simulations. *Theory into Practice, 19*(1), 75-80.

Cumming, D. (2008). Study address positive aspects of video games. Retrieved from http://www.findingdulcinea.com/news/technology/September-October-08/Study-Addresses-Positive-of-Video-Games.html

Czaja, R., & Blair, J. (1996). *Designing survey: A guide to decisions and procedures*. Thousand Oaks, CA.: Pine Forge Press.

Danish-Embassy, D. R. (2007). *The software industry in Thailand*. Bangkok: Danish Trade Council.

Darkenwald, G. G. (1989). Enhancing the adult classroom environment. In E. R. Hayes (Ed.), *Effective teaching styles. New Directions for Adult and Continuing Education* (Vol. 43). San Francisco: Jossey-Bass.

Davis, F. D. (1986). A Technology acceptance model for empirically testing new end-user information systems: Theory and results *Sloan school of management*. Cambridge, MA.: Massachusetts Institution of Technology.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340.

Davis, F. D., Bogozzi, R. P., & Warshow, P. R. (1992). Extrinsic and intrisic motivation to use computers in the workplace. *Journal of Applied Development Psychology, 22*(14), 1111-1132.

de Freitas, S., & Maharg, P. (Eds.). (2010). *Digital games and learning* London: Continuum Press.

Deggs, D. M., Machtmes, K. L., & Johnson, E. (2008). The significant of teaching perspective among academic disciplines. *College Teaching Methods & Style Journal, 4*(8), 1-8.

Design, I. (2006). Why people play games. Retrieved from http://interactiondesign.wordpress.com/2006/02/03/why-people-play-games

Dexter, S. L., Anderson, R. E., & Becker, H. J. (1999). Teachers' views of computers as catalysts for changes in their teaching practice. *Journal of Research on Computing in Education, 3*, 221-239.

Draper, N., & Smith, H. (1998). *Applied regression analysis*. New York: Wiley.

Dreyfous, R. (1994). Cognitive and affective variables involved in recreational computer-generated games. *Dissertation Abstracts International, 55*(07), 1807A.

Dunn, R. S., & Dunn, K. J. (1979). Learning styles/ Teaching styles: Should they...can...they...be matched? *Educational Leadership, 36*(4), 319-340.

Dziorny, M. (2005). *Is digital game-based learning situated learning?* . Dallas, TX.: University of North Texas.

Egenfeldt-Nielsen, S. (2005). *Beyond edutainment: Exploring the educational potential of computer games*. Copenhagen: IT-University.

Egenfeldt-Nielsen, S. (2006). Overview of research on the educational use of video games. *Digital Kompetnase, 3-2006*(1), 184-213.

ELSPA. (2005). computer and video games: Important facts at your fingertips. Retrieved from http://www.elspa.com/docs/Fact_Card_01.pdf

ELSPA. (2006). *Unlimited learning: Computer and video games in the learning landscape*. London: Entertainment and Leisure Software Publishers Association.

ESA. (2005). Essential facts about the computer and video games industry. *Entertainment Software Asssociation*. Retrieved from http://www.theesa.com

Farne', R. (2005). Pedagogy of play. *Topai, 24*, 169-181.

FAS. (2006). *Summit on education game*. Washington D.C: Federation of American Scientists.

Ferdig, R. (2007). Preface: Learning and teaching with eletronic games. *Journal of Educational Multimedia and Hypermedia, 16*(3), 217-223.

Field, A. (2007). PSP in education. Retrieved from http://www.effectiveict.co.uk/forum/index.php?showtopic=1487education

FINDcollegecards.com. (n.d.). Nintendo DS games for college students. Retrieved from http://www.findcollegecards.com/blog/nintendo-ds-games-for-college-students

Fisbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction theory and research*. Reading, MA.: Addison-Wesley.

Fisch, S. M. (2005). *Making educational computer games "Educational"* Paper presented at the Proceedings of the 2005 Conference on Interaction Design and Children, Boulder, Colorado.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA.: Addison-Wesley.

Fisher, E. M. (2008). USA stratified monopoly: A simulation game about social class stratification. *Teaching Sociology, 36*(3), 272-282.

Flemming, N. D. (2001). *Teaching and learning style: VARK strategies*. Christchurch, New Zealand: N. D. Flemming.

Flemming, N. D., & Mills, C. (1992). *Helping students understand how they learn.* (Vol. 7/4). Madison, WI.: Magma Publications.

Flick, U. (2002). *An introduction to qualitative research* (2nd ed.). London: Sage.

Foote, C. J., Vermette, P. J., & Battaglia, C. F. (2001). *Constructivist strategies: Meeting standards and engaging adolescent minds*. Larchmont, NY.: Eye on Education.

Ford, M. E. (1992). *Motivating humans: Goals, emotions, and personal agency beliefs*. Newbury Park, CA.: Sage.

Foreman, J. (2004b). Video game studies and the emerging instructional revolution. *Innovate. Journal of Obnline Education, 1*(1).

Foss, B. A., K., S. O., Eikaas, T. I., & Jakobsen, F. (2006). *Game play in vocational training and engineering education.* Paper presented at the Proceedings of 7th International Federation Automatic Control (IFAC) Symposium. Advances in Control Education (ACE) June 2006, Madrid, Spain

Fowler, F. J. J. (1993). *Survey research methods* (2nd ed.). Newbury Park, CA.: Sage.

Franzoi, S. (2003). *Social psychology*. New York: McGraw-Hill.

Frazer, L., & Lawley, M. (2000). *Questionnaire design & Administration*. Brisbane: John Wiley & Son.

Gagne', R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of instructional design*. Fort Worth, TX.: Harcourt Brace Jovanovich.

Garcia, G. (2005). Digital game learning. In B. Hoffman (Ed.), *Encyclopedia of educational technology*.

Gardner, H. (1993). *Frames of mind: The theory of multiple intelligences*. New York:: Basic Books.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy?* : Palgrave MacMillan.

Gee, J. P. (2004). Learning by design: Games as learning matchines. *Interactive Education Multimedia*(8 (April 2004)), 15-23.

Gentile, D. A., & Walsh, D. A. (2002). A normative study of family media habits. *Journal of Applied Development Psychology, 23*, 157-178.

Gikas, J., & van Eck, R. (2004). *Integrating video game into the classroom: Where to begin?* Memphis, TN: The University of Memphis.

Grasha, A. F. (1994). A matter of style: The teacher as expert, formal authority, personal model, facilitator, and delegator. *College Teaching, 42*(4), 12.

Grasha, A. F. (1996). *Teaching with style*. Pittsburg, PA.: Alliance Publishers.

Grasha, A. F. (2002). *Teaching with style*. San Bernadino, CA.: Alliance Publishers.

Green, M., & McNeese, M. N. (2007). Using edutainment software to enhance online learning. *International Journal on ELearning, 6*(1), 5-16.

Grimm, L. G. (1993). *Statistical applications for the behavioral sciences*. New York: John Wiley.

Gros, B. (2006). The impact of commercial games, peer-review. *Journal on Internet*. Retrieved from htpp://www.firstmonday.org/issues/issues8-7xyzgros

Guild, P. B., & Garger, S. (1985). *Marching to different drummers*. Alexander, VA.: Association for Supervision and Curriculum.

Gupta, S., & Mandal, J. M. (1996). Effects of education, Location and sex martal status on values of an individual. *Journal of the Indian Academy of Applied Psychology, 22*(1-2), 101-105.

Hadded, W., & Jurich, S. (2002). ICT for education: Potential and potency. In W. Haddad & A. Deaxler (Eds.), *Technologies of education: Potential, parameters*

and prospecdts (pp. 28-40): UNESCO and Academy for Educational Development.

Hague, P. (1993). *Questionnaire design*. London: Kagan Page.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1995). *Multivariate data analysis with readings*. Englewood Cliffs, NJ.: Prentice-Hall.

Hakkarainen, K., Muukkonen, H., Lipponen, L., Ilomaki, L., Rahikaimen, M., & Lehtinen, E. (2001). Teachers' information and communication technology (ICT) skills and practices of using ICT and their pedagogical thinking. *Journal of Technology and Teacher Education, 9*, 180-197.

Hartmann, T., & Klimmt, C. (2006). Gender and computer games: Exploring females' dislikes. *Journal of Computer-Mediated Communication, 11*(4), article 2.

Harvey, J. (1995). *The market for educational software*. Santa Monica, CA.: Rand Corp.

Hawk, T. F., & Shah, A. J. (2007). Using learning style instruments to enhance student learning. *Decision Sciences Journal of Innovative Education, 51*(1), 1-19.

Hawkridge, D. (1983). *New information technology in education*. London: Croom Helm.

Haywood, J., Haywood, D., Macleod, H., Mogey, N., & Alexander, W. (2004). The student view of ICT in education at the University of Edinburgh: Skills, attitude and expectationl. In J. Cook (Ed.), *Blue skies and pragmatism: Learning technologies for the next decade* (pp. 229-245): Research proceedings fo the 11th Association for Learning Technology Conference (ALT-C 2004).

Honey, P., & Mumford, A. (1992). *The manual of learning styles*. Maidenhead: Peter Honey.

Hoyt, D. P., & Lee, E. J. (2002). *Teaching 'Style' and learning outcomes*. Kansas State University, Manhattan: IDEA Center.

Hussain, H., & Eshaq, A. (2001). The design framework for edutainment environment. In R. Behesthi (Ed.), *Advances in Design Science & Technology* (pp. 81-90). France: Europia Pubication.

IAU. (2008). Richmond added to the International Association of Universities database. Retrieved from http://www.unesco.org/iau/onlinedatabases/list.html

Igbaria, M., Schiffman, S., & Wieckowski, T. (1994). The respective roles of perceived usefulness and perceived fun in the acceptance of microcomputer technology. *behaviour & Information Technology, 14*(6), 349-361.

IGDA. (2006). Game company listing in Thailand. Retrieved from http://www.igda.org/bangkok/comlist.htm

Jackson, S. L. (2003). *Research methods and statisitcs: A critical thinking approach*. Belmont, CA.: Wadsworth.

Jakiyamani, A. (2008). Private universities in rural Bangladesh. Retrieved from http://www.independent-bangladesh.com/features/private-universities-in-rural-bangladesh.html

Jansiewicz, D. (2005). *The game of politics simulation: Applications for the classroom and civic education*. Paper presented at the Annual meeting of the Southwestern Political Science Association. Retrieved from http://www.allacademic.com/meta/p89077_index.html

Jayakanthan, R. (2002). Application of computer games in the field of education. *The Electronic Library, 20*(2), 98-102.

Jenkins, H. (1998). Voices from the combat zone: GameGrriz talk back. In J. Cassell & H. Jenkins (Eds.), *From Barbie to Mortal Combat: Gender and computer games* (pp. 328-339). Cambridge, Mass.: MIT Press.

Johnson, S. (2006). *Everything bad is good for you: How today's popular culture is actually making us smarter*. New York: Riverhead Books.

Ju, E., & Wagner, C. (1997). Personal computr adventure games: Their structure, principles and applicability for training. *Data Base for Advances in Information Systems, 28*, 78-92.

Kafai, Y. B. (1995). *Minds in play: Computer game design as a context for children's learning*. Hillsdale, NJ.: Lawrence Erlbaum Associates.

Kafai, Y. B. (2006). Playing and making games for learning: Instructionist and constructionist perspectives of game studies. *Gamea and Culture, 1*(1), 36-40.

Kane, Y. I. (2007). Beyond Pok'emon: Nintendo DS goes to school in Japan. *The Wall Street Journal, P. A1*(Jul 2007).

Kaplan, E. J., & Kies, D. A. (1995). Teaching styles and learning styles: which came first? *Journal of Instructional Psychology, 22*(1), 29.

Kashibuchi, M., & Sakamoto, A. (2001). The educaational effectiveness of a simulation: Game in sex education. *Simulation & Gaming, 32*(3), 331-343.

Kato, M., & Ricci, V. (2006). Mobile learning in Japan: Why the future has already arrived in Asia. *The eLearning Guild's Learning Solutions*. Retrieved from http://www.elearningguild.com/pdf/2/091196mgt-h-pd

Kcroy. (2008). Nintendo DS as a learning Tools in schools. Retrieved from http://wirededucator.wordpress.com/2008/06/30/nintendo-ds-as-a-learning-tool-in-schools

Keefe, J. W. (1989). *Learning style theory and practice*. Reston, VA.: National Association of Secondary School Principles.

Kirriemuir, J. (2002). Video gaming, education and digital learning: Relevace and opportunities. *D-Lib Magazine, 8*(2). Retrieved from http://www.dlib.org/dlib/february02/kirriemuir/02kirriemuir.html

Kirriemuir, J., & McFarlane, A. (2003). *Use of computer and video games in the classroom.* Paper presented at the Proceedings of the Level of Digital Games Research Conference, Universtiteit Ultrecht, Netherlands.

Kirriemuir, J., & McFarlane, A. (2004). Literature review in games and learning. Retrieved from http://www.futurelab.org.uk/download/pdf8/research/lit_reviews/Games_Review1.pdf

Kirriemuir, J., & McFarlane, A. (2005). Literature reviews in games and learning. Retrieved from http://www.futurelab.org.uk/download/pdf8/research/lit_reviews/Games_Review1.pdf

Klassen, K. J., & Willoughby, K. A. (2003). In-class simulation games: Assessing student learning. *Journal of Information Technology Education, 2*, 1-13.

Koster, R. (2003). *A theory of fun for game design*. Pheonix, AZ: Paraglyph Press.

Kozma, R. B. (2003). Technology and classroom practices: An international study. *Journal of Research on Technology in Education, 36*(1), 1-14.

Kramer, P. E., & Lehman, S. (1990). Mismeasuring women: A critique of research on computer ability and avoidance. *Signs: Journal of Woment in Culture and Society, 16*(1), 158-172.

Krippendorff, K. (2004). *Content Analysis: An Introduction to Its Methodology*. (2nd ed.). CA: Sage: Thousand Oaks.

Krotoski, A. (2005). Learning from games and games in learning. *Guardian Newspaper Limited*(Jan. 28, 2005).

Kroy. (2008). Nintendo DS as learning tools in schools. Retrieved from http://wireeducator.wordpress.com/2008/06/30/nintendo-ds-as-a-learning-tool-in-schools

LaBillois, J. M., & Lagace-Seguin, D. G. (2007). Does a good fit matter? Exploring teaching styles, emotion regulation, and child anxiety in the classroom. *Early Child Development and Care*. Retrieved from http://www.informaworld.com/terms-and-conditions-of-access.pdf

Lambert, L. (2002). *The constructivist leader*. New York: Teacher College Press.

Laohasurayodhin, R. (1993). *A study of English learning achievements in using "-ing" of grad 5 students through three type of computer-assisted instruction.* Unpublished Master Thesis, Khon Kaen University, Khon Kaen.

Leedy, P. (1997). *Practical research*. Upper Saddle River, NJ.: Prentice-Hall.

Levin-Brown, P., Bonham, B. S., Saxon, D. P., & Boylan, H. R. (2008). Affective assessment for developmental student, part 2. *Researcg in Developmental Education, 22*(2).

Lindon, J. (2002). *What is play*. London: Natioanal Children Bureau.

Longstreet, C. (2005). Why learning how you learn is important. *Society for Hospitality Management*. Retrieved from http://www.4hoteliers.com/4hots_fshw.php?mwi=812

Lucas, K., & Sherry, J. (2004). Sex differences in video game play: A communication-based explanation. *Communication Research, 31*(5), 449-523.

Lumpe, A. T., & Chambers, E. (2001). Assessing teacher's context beliefs about technology use. *Journal of Research in Education, 34*(1), 93-107.

MacDonald, K. (2008). Compute games are put to the test. Retrieved from http://news.bbc.co.uk/2/hi/uk_news/scotland/7295039.htm

Mathieson, K. V. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research, 2*(3), 173-191.

McDivitt, D. (2008). Do gamers score better in school? *Serious Game* Retrieved from http://seriousgamessource.com/features/feature_051606.php

McFarlane, A., Sparrowhawk, A., & Heald, Y. (2002). Report on the educational use of games. *TEEM*. Retrieved from http://www.teem.org.uk/publications/teem_gamesined_full.pdf

Merrium, S., & Caffarella, R. (1991). *Learning in adulhood: a comprehensive guide*. San Francisco, CA.: Jossey-Bass.

Miller, D. & Robertson, D. (2011). Using a games-console in the primary classroom: Effects of 'Brain Training' programme on computation and self-esteem. *British Journal of Educational Technology,* 42(5): 850-864

Miller, J. (1999). TASEP Science program-computing subprogram needs analysis and subprogram. *Plan-S21& 57*(Februry 1999).

Mitchell, A., & Savill-Smith, C. (2004). *The use of computer and video games for learning: A review of literature*. London: Learning and Skills Development Agency.

Mohood, C., Oliver, M. B., & McGrath, J. (2000). *The effects of home video game violence and fantassy portrayals upon enjoyment and emotional state: A gender comparison*. Paper presented at the The 50th Annual Conference of the International Communication Association (ICA).

Moon, J., & Kim, Y. (2001). Extending the TAM for a World-Wide-Web context. *Information & Management, 38*, 5-15.

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research, 2*(3), 292-222.

Nafisah, K. M. K., & Nurhaiza, A. W. (2005). *Learning styles of form four electrical engineering students in three technical schools in Malaysia*. Paper presented at the AARE National Conference: 2005, Sydney.

Nation, T. (2007). Public and private intiatives building greater infrastructure. Retrieved from http://www.nationmultimedia.com/2007/12/25/technology/technology_30060156

NECTEC. (2007). Truehit Statistics. Retrieved from http://truehits.net/monthly/iir.html

Newser. (2008a). Competitive, social aspects make video games addictive. Retrieved from http://www.newser.com/story/25307/competitive-social-aspects-make-video-games-addictive.html

Newser. (2008b). Study: video game addicts aren't nerds. Retrieved from http://www.newser.com/story/26307/competitive-social-aspects-make-video-games-addictive.html

Ngaosumarng, C. (2006). *Factors related to behavior of computer games playing of lower secondary school students in Bangkok Metropolis.* Unpublished Master Thesis, Kasetsart University.

Nicoll, J., & Kieffer, K. M. (n.d.). *A review of the empirical research*. Paper presented at the The 113th Annual Convention of the American Psychological Association.

Niedderhauser, D. S., & Stoddart, T. (2001). Teachers' instructional perspectives and use of educational software. *Teaching and Teacher Education, 17*, 15-31.

Nikulin, M., & Greenwood, P. (1996). *A Guide to Chi-square Testing*. New York: Wiley.

Nilsson, E. M. (2008). Games and learning: Experimenting with computer games and mobile technology in Swidish school settings. Retrieved from http://www.isv.liu.se/content/1/c6/05/89/41/Abstracts%20kull%203/abstract_elisabet_nilsson.doc

Nzegwu, U. (2000). Gender and computer/ Video games. Retrieved from http://fubini.swarthmore.edu/~WS30/WS30F2000/compvideo.html

O'Rourke, M., Papasimeon, T., & Custance, J. (2008). *Developing a vocational training computer game working simulator: The VU Vocational Game Project.* Paper presented at the Proceedings on International Conference and Symposium on Computer Games, Animation, Multimedia, 28th-30th April 2008, Singapore.

Ochoa, M. (2007). Using games & team activities for test review: Preparing for elementary grade tests. Retrieved from http://www2.scholastic.com/browse/article.jsp?id=3748836

OHEC. (2010). *Annual report 2553 B.E.* Bangkok: Office of the Higher Education Commission.

ONEC. (2000). *Learning reform: A learning centred approach*. Bangkok: Office of the National Education Commission Press.

ONEC. (2002). *National education act B.E. 2542 (1999)*. Bangkok: Office of the National Education Commission.

Ormrod, J.(1999). *Human learning.* 3rd ed. Upper Saddle River, N. J.: Prentice-Hall.

Oxford, K. (2004). *Gameplay and design*. London: Pearson Education.

Oyan, A., & Bebko, J. (1996). The effects of computer games and lesson contexts on children's mnemonic strategies. *Journal of Experimental Child Psychology, 62*(2), 173-189.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Education Research, 62*(3), 307-332.

Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers & Education, 52*(1).

Pikkarainan, T., Pikkarainan, K., Karjaluoto, H., & Pahnila, S. (2004). Consumer acceptance of online banking: An extension of the technology acceptance model. *Internet Research, 14*(3), 224-235.

Pillay, H. (2002). *Teacher development for quality learning: The Thailand education reform project.* Paper presented at the Consulting report prepared for ONEC and the ADB.

Pitiyanuwat, S., & Anantrasirichai, A. (2002). *Curriculum and learning reform in Thailand*. Paper presented at the Invitational Curriculum Policy Seminar: School Based Curriculum Renewal for the Knowledge Society Developing Capacity for New Times.

Pivec, M. (2010). Engage catalogue of games for learning 2009-2010 Available from http://www.engagelearning.eu/?p=99

Pornwasin, A. (2009). Sipa given funds to push creative economy software. *The Nation, Deceber 7, 2009*. Retrieved from http://www.nationmultimedia.com/2009/12/07/business/business_30118088.php

Prensky, M. (2001a). *Digital game-based learning*. New York: McGraw-Hill.

Prensky, M. (2001b). True believers: Digital game-based learning in the military. *Learning Circuits*. Retrieved from http://www.learningcircuits.org/2001/feb2001/prensky.html

Prensky, M. (2005a). Computer games and learning: Digital game-based learning. In J. Raessens & J. Goldstein (Eds.), *Handbook of Computer Game Studies*. Cambrige, MA.: MIT.

Prensky, M. (2005b). Mobile phone imagination-using devices kids love for their education. *Receiver Magazine, 14*, 1-4.

PublicTechnology.net. (2004). Computer games can motivate young people to learn says new research. Retrieved from http://www.publictechnology.net/modules.php?p=modload&name=News&file=article&sid=2031

Punch, K. F. (1998). *Introduction to social research: Quantitative and qualitative approaches*. London: Sage.

Quinn, C. N. (1994). Designing educational computer games. In K. Beattie, C. McNaught & S. Wills (Eds.), *Interactive multimedia in university education: Designing for change in teaching and learning* (pp. 45-57). Amsterdam: Elsevier Science BV.

Rakes, C. G., & Casey, H. B. (2002). *An analysis of teacher concerns toward instructional technology*. Monroe, LA.: University of Louisiana at Monroe.

Randel, J., Morris, B., Watzel, C., & Whitehill, B. (1992). The effective of games for educational purposes: A review of the research. *Simulation & Gaming, 25*, 261-276.

Rapeepisarn, K., Pongpankae, S., Wong, K., & Fung, C. (2008a). *A comparative study of digital game platforms for educational purpose*. Paper presented at the The 9th Postgraduate Electrical Engineering and Computing Symposium.

Rapeepisarn, K., Pongpankae, S., Wong, K., & Fung, C. (2008c). *Educational use of handheld game consoles-PSP and NDS in Thai colleges*. Paper presented at the The 7th International Conference on e-Business 2008.

Rapeepisarn, K., Wong, K., & Fung, C. (2007). *Issues for consideration to adopt educational computer games for learning and teaching*. Paper presented at the The 8th Postgraduate Electrical Engineering and Computing symposium.

Rapeepisarn, K., Wong, K., Fung, C., & Cole, P. (2006a). *Entertainment is a form of learn through doing?* Paper presented at the 4th Annual International Conference in Computer Game Design and Technology.

Rapeepisarn, K., Wong, K., Fung, C., & Depickere, A. (2006b). *Similarities and differences between 'learn through play' and 'edutainment'*. Paper presented at the Proceedings of the 3rd Australian Conference on Interactive Entertainment.

Rapeepisarn, K., Wong, K., Fung, C., & Khine, M. S. (2008b). Creating effective educational computer games for undergraduate classroom learning: A conceptual model. *i-Manager's Journal of Educational Technology, 5*(2), 22-31.

Rapeepisarn, K., Wong, K., Fung, C., & Khine, M. S. (2008d). *How teaching and learning styles affect adoption of educational computer games in classroom?*

Paper presented at the The 6th Internation Conference in Game Design and Technology.

Rapeepisarn, K., Wong, K., Fung, C., & Khine, M. S. (2008e). The relationship between game genre, learning techniques and learning styles in educational computer games. In Z. Pan, et al (Ed.), *Techologies for E-learning and Digital Entertainment* (Vol. 5093/2008): Springer-Verlag Berlin Heidelbertg.

Rapeepisarn, K., Wong, K. K., & Fung, C. C. (2006c). *Distinctions and generalities between "Learn through doing" and "Edutainment"*. Paper presented at the The 7th Postgraduate Electrical Engineering and Computing Symposium.

Raybourn, E. & Waern, A. (2004). Social learning through gaming. *Proceeding CHI EA 04 extended aspects on human factors in computing system*, New York, ACM

Rauterberg, M. (2004). Positive effects on entertainment technology of human behavior. In R. Jacquart (Ed.), *Building the information society*. Boston, Mass.: IFIP, Kluwer Academic Press.

Rawstorne, P. (2005). *A sytematic analysis of the theory of reasoned action, the theory of planned behaviour and the technology acceptance model when applied to the prediction and explanation of information systems use in mandatory usage contexts.* Unpublished A thesis of Doctor of Philosophy, University of Wollongong.

Rea, L., & Parker, R. (1997). *Designing and conducting survey research: A comprehensive guide*. San Francisco: Jossey-Bass.

ReportLinker. (2005). China mobile game market & industry chain report, 2005. Retrieved from http://www.reportlinker.com/p018294/Mobile-Game-Market-and-Industry-China-in-China-2005.html

Riding, R. L. (1991). *Cognitive styles analysis*. Birmingham: Learning and training technology.

Roberts, N. (1976). *Simulation gaming: A critical review.*

Roberts, N. (2006). *Simulation games: A critical review.*

Roe, K., & Muijs, D. (1998). Children and computer games: A profile of the heavy user. *European Journal of Communication, 13*(2), 181-200.

Rogers, C. S., & Sawyer, J. K. (1995). *Play in the lives of children*. Washington, D.C.: National Association for the Education of Young Children.

Rogers, G. (2002). *Student-centred learning- A practical guide for teachers*. Bangkok: British Council.

Ronan, N. J. (1996). *Learning styles and academic performance in an African university*. England: Manchester University Press.

Roschelle, J., Pea, R., Hoadley, C., Gordin, D., & Means, B. (2000). Changing how and what children learn in school with computer-based technologies. *The Future of Children, 10*(2), 76-101.

Rumpagaporn, M. W., & Darmawan, I. G. N. (2007). Students' critical thinking skills in a Thai ICT Schools pilot project. *International Education Journal, 8*(2), 125-132.

Sacher, W. (1993). Is there a dangerous to youth from video and computer games? *Zeitschrift fur Padagogik, 39*, 313-333.

Sakurai, Y. (2004). A comparative study of higher education in Thailand and Japan: Several issues regarding the independent state university administrative corporations. Retrieved from http://www.hucc.hokudai.ac.jp/~n16260/pdf2004/educom2002thaihighereducation.pdf

Sanford, R., Ulicsak, M., Facer, K., & Rudd, T. (2006). *Teaching with games: Using commercial off-the-shelf computer games in formal education*. Entertaiment Arts: FutureLab.

Sapianchai, P., & James, P. T. J. (2005). ICT in Thai Education: Ideological and structural determinants that support its development, introduction and use. Retrieved from http://www.bu.ac.th/knowledgecenter/epaper/july_dec2005/pote.pdf

Schiffer, A. (2006). A heuristic taxonomy of computer games. Retrieved from http://www.ferzhopp.net/joomla/content/view/77/15

Scoville, H. (2006). How to determine your teaching style. Retrieved from http://www.howtodothings.com/node/1800/print_on_30/06/2007

SEAMEO. (2005). *Your partner in higher education/ SEAMEO RIHED Government Board Members*. Bangkok: SEAMEO Regional Centre for Higher Education and Development Thailand.

SEAMEO. (2009). Thailand higer education system. Retrieved from http://www.rihed.seameo.org/index.php?option=com_content&task=view&id=31&Itemid=41

Shaffer, D. (2006). *How computer games help children learn*. New York: Palgrave MacMillan.

Sheff, D. (1994). *Video games: A guide to savvy parents*. New York: Random House.

Shelly, G. (2006). *Teachers discovery computers: Integrating technology and digital media in the classroom*. Boston, Mass.: Thomson.

Shih, C. (1998). Conceptualizing consumer experiences in cyberspace. *European Journal of Marketing, 32*(7/8), 655-663.

Shuell, J. T., & Farber, L. S. (2001). Students perceptions of technology use in college courses. *Journal of Educational Computing Research, 24*(2), 119-138.

Shuler, C. (2007). D is for digital: An anlysis of the children's interactive media environment with a focus on mass marketed products that promote learning. Retrieved from http://www.joanganzcooneycenter.org

Silbutra, S. (2006). *Learning achievement on computer role-playing game for practising 'Reading for Main Idea' for Mathayomsuksa 1 students.* Unpublished Master Thesis, Kasetsart University.

Singapore, G. o. (2009). Singapore invests $6 million to promote games in education & learning. Retrieved from http://thegovmonitor.com/education_and_skills/singapore-invests-6-million-to-promote-games-in-education-learning-10200.htm

Singhal, A., Cody, M. J., Roger, E., Sabido, M. (2008). *Entertainment-education and social change: History, research, and practice.* New Jersey: Lawrence Erlbaum.

SIPA. (2007). *Animation and games 2997*. Bangkok: SIPA.

Smerdon, B., Cronen, S., Lanahan, L., Anderson, J., Iannotti, N., Ageles, J., et al. (2002). *Teachers' tools for the 21st century: A report on teachers' use of technology*. Washington, D.C.

: US Department of Education, National Center for Education Statistics.

Smith, G. E. (2002). Student perceptions of technology in the classroom: The good, the bad, and the ugly. *American/ ACI Teaching, Learning, and Sharing*. Retrieved from http://faculty.mckendree.edu/ATLAS/student_perceptions.htm

SPOTPLUS. (2002). Spot plus survey: Students' perspective on technology in teaching and learning in European Universities- Perspection and learning of university students. Retrieved from http://www.spotplus.odl.org/downloads/Survey_report_final.pdf

Sqcribd. (n.d.). What they say about play: Quotable quotes about play and other pertinent to pic. Retrieved from http://www.scribd.com/doc/22929/play-quotes

Squire, K. (2004). Replaying history. *PhD Thesis*. Retrieved from http://website,education,wisc,edu/kdsquire/dissertation.html

Srinaprom, S. (1998). *The comparison of English spelling achievement of grade 6 between traditional game and computer game.* Unpublished Master Thesis, Mahasarakham University.

Srinutapong, S., Laohajaratsang, T., & Suwannatthachote, P. (2005). *Empower ICTtm: In-service teacher's learning to teacher with technology.* Paper presented at the Proceedings of the Second International Conference on eLearning for Knowledge-Based Society, August 4-7, 2005, Bangkok.

Stupak, N. J. (2008). Positive effects of video games on development. Retrieved from http://www.personalityresearch.org/papers/kooijmans.html

Sun, L. (2010). Economic transformation and urban-rural diparity in China, 2002-2008. *Undergraduate Economic Review, 6*(1), 1-25.

Swailes, S., & Senior, B. (1999). The dimensionality of Honey and Mumford's learning styles questionnaire. *International Journal of Selection and Assessment, 7*(1), 1-11.

Szajna, B. (1994). Software evaluation and choice: Predictive evaluation of the technology acceptance instrument. *MIS Quarterly, 80*(3), 319-324.

Taylor, S., & Todd, P. A. (1995). Assessing IT usage: The role of prior experience. *MIS Quarterly, 19*(2), 561-570.

Teo, T., Lim, V., & Lai, R. (1999). Intrinsic and extrinsic motivation in internet usage. *International Journal of Management Science, 27*(1), 25-37.

Tesvisal, T. (2006). *A Comparison of learning achievement between computer assisted instruction through a game and traditional instruction in English on the lesson entitled "School" of grade 4 students.* Unpublished Master thesis, Chandrakasem Rajabhat University, Bangkok.

Thammatong, R. (1998). *The effect of computer games on scientific creativity of lower secondary school students* Unpublished Master Thesis, Khon Kaen University, Khon Kaen.

Thomas, R. M. (2003). *Blending qualitative and quantitative research methods in theses and dissertations*. Thousand Oaks, CA.: Corwin Press.

Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal computing: Toward a conceptual model of utilization. *MIS Quarterly, 15*(1), 124-143.

Thuvasethkul, C., & Koanantakool, T. (2002). *National ICT policy in Thailand*. Paper presented at the Africa-Asia Workshop: Promoting Co-operation in Information and Communication Technologies Development, 25-29 March 2002.

Tobin, K., Tippins, D. J., & Gallard, A. J. (1994). Research on instructional strategies for teaching science. In D. L. Gabel (Ed.), *Handbook of research on science teaching and learning* (pp. 45-93). New York: Macmillan.

Trister, D., & Bickart, T. (1998). *Preschool for parents: What every parent need to know about preschool*: Sourcebook, Inc.

UNESCO. (2003). *Strenthening ICT in Schools and SchoolNet Project in the ASEAN Setting*. Paper presented at the Experts' Meeting for Documenting Experiences in the Use of ICT in Education ans SchoolNet Operation, 7-8 July 2003.

UNESCO. (2009). ICT changing the face of higher education. *Communication and Information Resources*. Retrieved from http://portal.unesco.org/ci/en/ev.php-URL_ID=28936&URL_DO=DO_TOPIC&URL_SECTION=201.html

Universities, p. p. (2008). Private university versus public university, pro and cons. Retrieved from http://topuniversity.clicknsmart.com/2008/10/private-university-versus-public-university-pro-and-cons/

van Eck, R. (2005). What are we playing at?: What it means to integrate games into the curriculum, and why we should. *Presentation & Game Analysis Project*. Retrieved from http://udt.und.edu

van Schie, E. G. M., & Wiegman, O. (1997). Children and video games: Leisure activities, aggression, social integration, and social performance. *Journal of Applied Development Psychology, 27*, 1175-1194.

Vaszily, B. (2008). Violent video games: Do they lead to aggressive behaviour or not? Retrieved from http://ezinearticles.com/?Violent-Video-Games:-Do-They-Lead-to-Aggressive-Behavior-or-Not?&id=88268

Venkatesh, V., et al. (2003). User acceptance of information technology: Toward a unified views. *MIS Quarterly, 27*(3), 425-478.

Verkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186-204.

Waite, S. (2004). Tools for the job: a report of two surveys of information and communications technology training and for literacy in primary schools in the West of England. *Journal of Computer Assisted Learning, 20*(1), 11-21.

Wannaprapa, T. (2004). *Addicting path way and program attributes of massive multiplayer online role play game in making playes' addiction.* Burapha University, Chonburi.

Warachai, J. (2003). *Learning object oriented programming concept with warrior code.* Unpublished B.Sc. Senior Project, King Mongkut's Institute of Technology North Bangkok.

Warshow, P. R., & Davis, F. D. (1985). Disentangling behavioral intention and behavioral expectation. *Journal of Experimental Social Psychology, 21*, 213-228.

Wasserman, S. (1990). *Serious players in the primary classroom*. New York: Teacher College Press.

Wellhousen, K., & Kieff, J. E. (2000). *Constructivist approach to block play in early childhood*. New York: Thomson Delmar Learning.

WHED. (2011). *World Higher Education Database 2011, IAU*. Palgrave: Macmillan's Global Academic.

White, R. (2003). *That's edutainment*. Kansas City, MO.: White Hutchinson Leisure & Learning Group.

Whitton, N. (2009). Learning and teaching with computer games in higher education In T. Connolly, M. Stansfield & L. Boyle (Eds.), *Games-based learning advancements for multi-sensory human computer interfaces*. Hershey, PA: IGI Global.

Wilson, B. G. E. (1996). *Constructivist learning environments: Case studies instructional design*. Englewood Cliffs, NY: Educational Technology Publications.

Wolf, M. J. P. (2001). Chapter 6: Genre and the video game

In M. J. P. Wolf (Ed.), *The medium of the video game* (pp. 113-134). Austin: University of Texas Press.

Wong, P.-K. (2002). ICT production and diffusion in Asia: Digital dividends or digital divide? *Information Economics and Policy, 14*(2), 167.

Wright, J. C., Huston, A. C., Vandewater, E. A., Bickham, D. S., Scantlin, R. M., Kotler, J. A., et al. (2001). American children's use of electronic media in 1997: A national survey. *Journal of Applied Development Psychology, 22*(1), 31-47.

Yamane, T. (1967). *Statistics: An introductoty analysis*. New York: Harber and Row.

Yu, X. , et al. (2010). Experimental developmet of competitive digital educational games on multi-touch screen for young children. *The 5th International Conference on E-learning and game edutainment 2010.* Changchun, China.

Zhao, Y., & Cziko, G. A. (2001). Teacher adoption of technology: A perceptual control theory perspective. *Journal of Technology and Teacher Education, 9*(1), 5-30.

Zibit, M., & Gibson, D. (2005). simSchool: The game of teaching. *Innovate1 (6)*. Retrieved from http://www.innovateonline.info/index.php?view=article%id=173&action=article

Zoney, J. (2005). The misunderstood learning activity: Play. *Teacher Magazine, 17*(5), 1-2.

APPENDIX A:
LEARNING AND TEACHING STYLES

VARK Learning Styles

In this thesis VARK Learning Styles is defined as "Perceived Learning Style". The classification of VARK, illustrated in Table A1, has been termed as visual learning, auditory learning, verbal learning (read/ write) and kinesthetic learning.

Table A1: Perceived Learning Style

Auditory learners	Visual learners	Verbal learners (read/write)	Kinesthetic learners
Need to learn information from lectures, tapes and discussion.	Need to see information and watch presentations involving pictures, graphs, diagrams and visual media.	Need information displayed as words.	Need to feel and experience objects and concepts by handling, modelling or building.
Like to listen to others talk about ideas, concepts and objects.	Like to view and inspect material.	Like to read and write in all forms	Like to move round while completing tasks.
Learn through auditory repletion-remember what they heard.	Learn by forming pictures of objects and concepts remember what they have seen.	Learn by reading and taking note.	Learn by utilising fine muscle skills and/ or a whole body response-remember what they have done.
Favour the sequential presentation of information.	Favour holistic presentation of information.	Favour organising any diagrams and graphs into statements.	Favour hand-on approaches and direct involvement.
Often repeat to themselves what they are trying to learn.	Often close their eyes to reconstruct a picture of what they remember.	Often turn reactions, actions, charts, and flows into words.	Often exhibit a strong emotive response to what they are trying to learn.

(Adapted from: Flemming & Mills, 1992; Keefe, 1989; and Midkiff & Thommasson, 1993)

Honey & Mumford Learning Styles

Table A2 illustrated the characteristics and behaviour when using IT of Honey & Mumford four styles of learning.

Table A2: Honey & Mumford Learning Style

Characteristics			
Activists	**Reflectors**	**Theorists**	**Pragmatists**
- Immerse in new experience - Enjoy here and now - Open minded, enthusiastic, flexible - Seek to centre activity around themselves	- Stand back and observe. - Cautious, take a back seat - Collect and analyse data about experience and events, slow to react conclusion - Use information from experience to maintain a big picture perspective	- Think in a logical manner, rationally and objectively. - Assimilate facts into coherent theories. - Fit things into rational order. - Keen in basic assumptions, principles, theories, models.	- Keen to put ideas, theories and techniques into practice. - Search new ideas and experimental - Act quickly and confidently on ideas, get straight to the point. - Are impatient with endless discussion
Using IT			
Likes to use shortcut key-combinations but will also find the toolbar buttons useful.	Prefers to use drop-down menus but will soon discover what is best for themselves, likes to browse through SEARCH FOR HELP in the HELP menu.	Often use drop-down menus to see what else the application can do, likes to browse through the INDEX or SEARCH FOR HELP in the HELP menu	Probably uses the toolbars buttons to get things done, often find HELP menu to get things done

Table A3 illustrated the strength and weakness in each type of Honey & Mumford Learning Styles.

Table A3: Strength and Weakness in Each Type of Honey & Mumford Learning Styles

	Strength	Weakness
Activists	o Flexible and open-minded o Happy to "have a go" o Enjoys new situation o Optimistic about anything new-therefore unlikely to resist change	o Gets bored with implementation o Goes into action without sufficient preparation o Often take unnecessary risks o Tendency to do much themselves
Reflectors	o Rarely jumps to conclusion o Good at listening & assimilating information o Thorough and methodical o Thoughtful & careful	o Not usually assertive o Too cautious and not take enough risks o Reluctance & slow to reach a decision o Hold back from direct participation
Theories	o Disciplined approach o Good at asking probing questions o Rational & objective o Logical, "verbal" thinking	o Full of "should", "ought" and "must" o Intolerant of subjective or intuitive things o Low tolerant for uncertainty of disorder o Restricted in lateral thinking
Pragmatics	o Down to earth, get straight to the point o Technique oriented o Practical & realistic o Keen to test things out in practice	o Reject anything without an obvious application o Uninterested in theory or basic principles o Seize on the first method solution to a problem o Task-oriented rather than people-oriented

Teaching Styles

The Grasha-Riechmann teaching style is illustrated in Table A4

Table A4 Grasha-Riechmann Teaching Style

Teaching style	The Approach	Characteristics
Expert	Instructor-centred	- Possessed knowledge & expertise that students need - displaying detailed knowledge by challenging students to enhance their competence - Concerned with transmitting information & insuring that students are well prepared
Formal Authority	Instructor-centred	- Responsible for providing & controlling the flow of content - Not given a lot of time for student participation during class
Demonstrator	Instructor-centred	- Demonstrates & models what is expected - Acts as coached - Encourage student participate as important facet of lesson
Facilitator	Student-centred	- Facilitates & focuses on activities - Embrace group projects with peer-to-peer tutoring and learning group
Delegator	Student-centred	- Delegates & places much control for learning on individuals or group - Allow students to explore and design their own learning project

BLOOM'S TAXONOMY (LEARNING OBJECTIVES)

Bloom's hierarchy of six levels, description (learner action), and key verbs associate with each cognitive domain, and some potential IT activities are illustrated in Table A5:

Table A5: Bloom's Cognitive Objectives Group by Level, Description, Key Verbs and Potential IT activities (Bloom, 1956; Dalton, 1986)

Level	Description (Learner action)	Key verbs	Potential IT activities
Knowledge	Recall previously learned material	Define, repeat, identify, list, label	Find answers to quiz question from Internet
Comprehension	Grasp meaning, explain, restate ideas	Describe, pick, choose, review, discuss, pick	Use *PowerPoint* to make a cartoon, or make a newspaper report
Application	Use learned material in new situations	Apply, use, solve, interpret, employ	Use *Publisher* to create a board game, make a storyboard of book using *PowerPoint*
Analysis	Separate material into component parts & show relationship between parts	Analyse, detect, compare, inter, test, conclude	Identify relationships between information using the charting features of *Excel*
Synthesis	Pull together separate ideas to form a whole	Arrange, create, collect, predict, combine, plan,	Use *Dreamweave*r to construct a web site which helps solve an everyday problem
Evaluation	Makes judgements about the value of materials or methods	Assess, decide, judge, revise, select, test	Use *email* to engage in an online forum debating the issues

GAGNÉ INTELLECTUAL SKILLS OF LEARNING CAPABILITIES

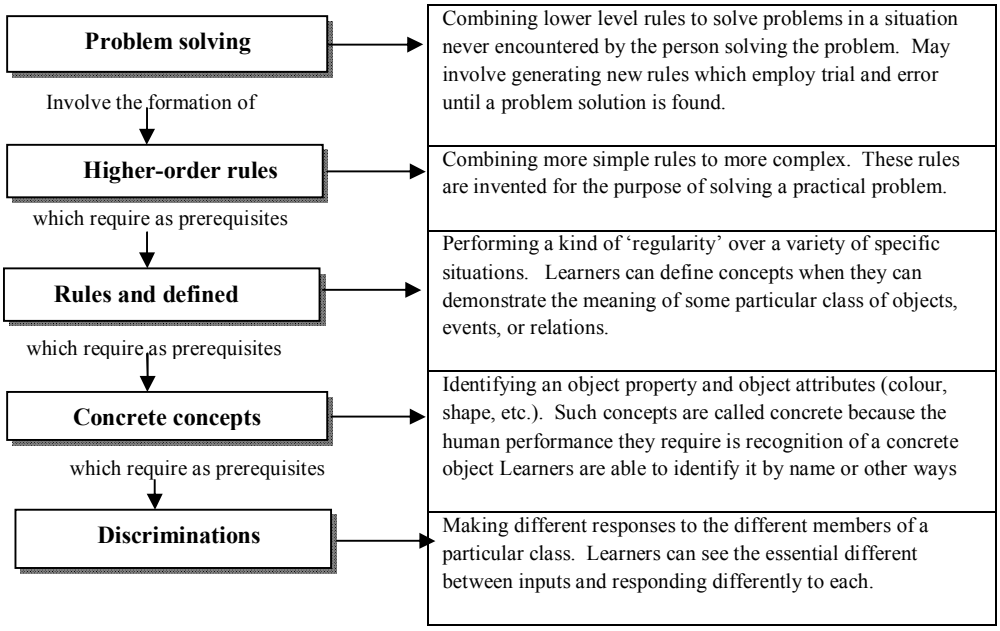


Fig. A1 Gagne's Intellectual Skills of Learning Capabilities

PRENSKY'S LEARNING CONTENT AND LEARNING ACTIVITIES

Prensky proposes the relationship of learning content, learning activities and possible game type as illustrate in Table A6:

Table A6: Summary of Prensky's Learning Content, Learning Activities and Possible Game Styles

Learning content	Learning Activities	Possible Game Styles
Facts: Law, politics, product	Questions, association, memorisation, drill	Game show competitions, flashcard type game, mnemonics
Skills: interviewing, teaching, management	Imitation, feedback, coaching, continuous practice	Persistent state games, role-play game, detective game
Judgment: management, decisions, timing, ethics	Reviewing cases, asking questions, feedback, coaching	Role-play games, multiplayer interactive, adventure game, strategy game, detective game
Behaviors: supervision, self-control, setting example	Imitation, feedback, coaching, practice	Role-play games
Theories: marketing rationales, how people learn	Logic, experimentation, questioning	Open ended simulation games, building game, construction games
Reasoning: strategic & tactical thinking, quality analysis	Problems, examples	Puzzle
Process: Auditing, strategy creation	System analysis & deconstruction, practice	Strategy game, adventure games
Procedure: assembly, bank teller, legal	Imitation, practice, play	Timed games, reflex games
Creativity: invention, product design	Play	Puzzle, invention games
Language: acronyms, foreign language	Imitation, continuous practice, immersion	Role-play games, reflex games, flashcard games
Systems: health care, markets, refineries	Understanding principles, graduated tasks	Simulation games
Observation: models, morale, inefficiencies, problems	Observing, feedback	Concentration games, adventure games
Communication: appropriate language, involvement	Imitation, practice	Role-play games, reflex games

APPENDIX B:
ECG ACCEPTANCE FACTORS

The descriptive results of mean and standard deviation in the detail of every ECG Acceptance factors (PU, PEOU, AU, SN, PE, UESF and BI) of both students and lecturers are shown in Table B1-B13

ECG Acceptance factors which affect the behaviour intent to use of students

Table B1: Students' Perceived Usefulness of Educational Computer Games

Usefulness	Mean	SD.	Interpretation
1. Using educational computer games as a tool for learning in classrooms increase/ will increase my learning and academic performance	3.86	0.88	Agree
2. Using educational computer game enhances/ will enhance the effectiveness on my learning	3.81	0.84	Agree
3. Educational computer games engage/ will engage me during my learning	3.70	0.97	Agree
4. Educational computer games allow/ will allow me to progress at my own pace	3.63	0.93	Agree
5. Educational computer games do not support my learning	2.10	1.07	Disagree
Total	**3.77**	**0.72**	**Agree**

Table B1 shows the descriptive results of the mean and standard deviation of items concerning the perceived usefulness of education computer games. It can be seen that students mostly agree with the items except item 5. The mean in those 4 items that agree are of slight difference. The highest agreement in perceived usefulness is "using ECG as a tool for learning in the classroom increase/ will increase my learning and academic performance" (3.86, 0.88). Followed by "enhance/ will enhance the effectiveness on my learning" (3.81. 084). Students disagree with item 5 "ECG does not support my learning" (2.10, 1.07). In summary, students agree with the usefulness of ECG for classroom use (3.77, 0.72).

Table B2: Students' Perceived Easy to Use Educational Computer Games

Easy to Use	Mean	SD.	Interpretation
1. Learning to operate educational computer games in classrooms is/ will be easy for me	3.67	0.84	Agree
2. It is/ will be convenient to use educational computer games for learning in classrooms	3.59	0.80	Agree
3. Learning how to play educational computer games in classes is/ will be too complicated and difficult for me	2.69	0.93	Neutral
4. It is/ will be time consuming to familiarise myself with educational computer games	3.35	1.03	Neutral
5. Overall, I think educational computer games are/ will be easy for me	3.77	1.04	Agree
Total	**3.34**	**0.48**	**Neutral**

Table B2 shows the agreement of students' perceived ease of use of ECG. Generally, perceived ease of use from the student is neutral at (3.34, 0.48). However, regarding each item, students agree with items 1, 2 and 5; and are neutral to items 3 and 4. The highest agreement is with the overall concept that ECG is easy to use (3.77, 1.04).

Table B3: Students' Attitude toward the Use of Educational Computer Games

Attitude	Mean	SD.	Interpretation
1. I think I have/ may have self-confidence in using educational computer games in class	3.76	0.84	Agree
2. I think I feel/ may feel anxiety when using educational computer games in the classroom	2.44	1.03	Disagree
3. I think it is hard to learn a new educational computer game	3.35	1.05	Neutral
4. I think the use of educational computer games in the classroom is useful	3.95	0.87	Agree
5. I dislike the idea of using educational computer games in classroom	1.97	1.00	Disagree
Total	**3.78**	**0.69**	**Agree**

The results from Table B3 indicate the students' attitude towards the use of ECG. Two items indicate the agreement. The attitude concerned with the usefulness of ECG is highest (3.95, 0.87) follow by the self-confidence in using ECG (3.76, 0.84). Only one item is neutral that is the degree of difficulty in learning new ECG. Two items are in disagreement concerned with anxiety and dislike for the idea of using ECG. However, these two items are negative affirmations. Thus, it can be inferred that students do not feel anxiety and like the idea of using ECG. In summary, the total mean and standard deviation interpret the agreement at (3.78, 0.69).

Table B4: Others' Opinions of the Use of Educational Computer Games which Affect Students

Others' Opinions	Mean	SD.	Interpretation
1. I think I should use educational computer games if my teacher recommends them	3.86	0.85	Agree
2. I think I should use educational computer games if my friends studying in other faculties are using them	3.46	0.94	Neutral
3. My parents think using educational computer games is a good idea	3.51	1.01	Agree
4. My friends think I should use educational computer games in classroom	3.81	0.91	Agree
5. My supervisor think using educational computer games is a good idea	3.70	0.87	Agree
Total	**3.67**	**0.71**	**Agree**

Table B4 shows the results of students' social subjective. In other words, other people who are important to student think he/she should or should not accept the use of ECG. Overall, the students agree with others' opinion at (3.67, 0.71). Among those people, their teacher has the most affect on their opinion in using of ECG (3.86, 0.85). Follow by friends, supervisor and parent in descent order. Only item 2 is interpreted neutral. It is friends in other faculties (3.46, 0.94).

Table B5: Students' Perceived Enjoyment When Using Educational Computer Games

Enjoyment	Mean	SD.	Interpretation
1. Using educational computer games in classroom is/ will be fun and amusing	4.28	0.80	Agree
2. Using educational computer games in classroom is/ will be pleasant and gratifying	3.93	0.84	Agree
3. Using educational computer games in classroom is/ will be exciting and simulating	4.10	0.83	Agree
4. Using educational computer games in classroom is/ will be boring and tedious	2.14	1.11	Disagree
5. Using educational computer games in classroom is/ will be challenging and competitive	3.99	0.88	Agree
Total	**4.03**	**0.66**	**Agree**

Table B5 describes the students' perceived enjoyment of ECG. Most of the items indicate the agreement of enjoyment when using ECG. The total mean and standard deviation is (4.03, 0.66) which is interpreted as "Agree". The highest agree is item 1 (4.28, 0.80). It refers to fun and amusing. Subsequent agreement refer to exciting and simulating (4.10, 0.83); challenging and competitive (3.99, 0.88) and pleasant and gratifying (3.93, 0.84). The rest disagree with the use of ECG is boring and tedious (2.14, 1.11).

Table B6: Students' Intention to Use Educational Computer Games

Intention to Use	Mean	SD.	Interpretation
1. Whenever possible, I intend to use educational computer games in my future learning	3.97	0.84	Agree
2. I definitely do not think I will use educational computer games in classrooms	2.12	1.19	Disagree
Total	**3.92**	**0.86**	**Agree**

Table B6 shows the students' intent to use of ECG. There are two items. One is positive, another one is a negative affirmation. Students agree with a positive affirmation in item 1 (3.97, 0.84) and disagree with negative affirmations in item 2 (2.12, 1.19). Summing up, it can be implied that whenever possible, the students intent to use ECG in their future learning at (3.92, 0.86).

ECG Acceptance factors which affect the behaviour intent to use of lecturers

Table B7: Lecturers' Perceived Usefulness of Educational Computer Games

Usefulness	Mean	SD.	Interpretation
1. Using educational computer games as a tool for learning in classrooms increase/ will increase my teaching and academic performance	3.63	0.83	Agree
2. Using educational computer games enhances/ will enhance the effectiveness on my teaching	3.69	0.78	Agree
3. Educational computer games engage/ will engage my students during their learning	3.81	0.82	Agree
4. Educational computer games allow/ will allow my students to progress at their own pace	3.69	0.73	Agree
5. Educational computer games do not support my teaching	2.06	1.01	Disagree
Total	**3.75**	**0.71**	**Agree**

Table B7 shows the descriptive results of mean and standard deviation of items concerning the perceived usefulness of education computer games. Lecturers mostly agree with the items, except they disagree with item 5. The mean in those 4 items that agree are slight difference. The highest agreement is in perceived usefulness with engagement the students during their learning (3.81, 0.82). Followed by 2 items with equal means: enhance the effectiveness on lecturers' teaching (3.69, 0.78) and allow students to progress at their own pace (3.69, .073). Lecturers disagree with item 5 "ECG do not support my learning" (2.06, 1.01). In summary, lecturers agree with the usefulness of ECG for classroom use (3.75, 0.71).

Table B8: Lecturers' Perceived Easy to Use Educational Computer Games

Easy to Use	Mean	SD.	Interpretation
1. Learning to operate educational computer games in classrooms is/ will be easy for me	3.59	0.87	Agree
2. It is/ will be convenient to use educational computer games for learning classrooms	3.16	1.05	Neutral
3. Learning how to play educational computer games in classes is/ will be too complicated and difficult	2.81	0.93	Neutral
4. It is/ will be time consuming to familiarise myself with educational computer games	2.47	1.04	Disagree
5. Overall, I think educational computer games are/ will be easy for me	3.72	1.02	Agree
Total	**3.44**	**0.63**	**Agree**

Table B8 shows the degree of lecturers' agreement on perceived ease of use for ECG. In general, lecturers agree with the ease of use (3.34, 0.48). However, regarding each item, lecturers agree with item 1 and 5; are neutral for items 2 and 3; and disagree with item 4. On item 4, lecturers disagree with time consuming to familiarise with ECG (2.47, 1.04). This may imply that they do not spend much time to become acquainted with ECG use.

Table B9: Lecturers' Attitude toward the Use of Educational Computer Games

Attitude	Mean	SD.	Interpretation
1. I think I have/ may have self-confidence in using educational computer games in class	3.72	0.92	Agree
2. I think I feel/ may feel anxiety when using educational computer games in classroom	2.28	0.95	Disagree
3. I think it is hard to learn a new educational computer game	2.53	1.07	Neutral
4. I think the use of educational computer games in classroom is useful	3.94	1.01	Agree
5. I dislike the idea of using educational computer games in classroom	2.13	1.18	Disagree
Total	**3.74**	**0.73**	**Agree**

The results from Table B9 indicate the lectures' attitude toward the use of ECG. Two items indicate the agreement. The attitude concerned with the usefulness of ECG is highest (3.94, 1.01) followed by the self-confidence in using ECG (3.72, 0.92). Only one item is neutral which is hard to learn new ECG (2.53, 1.07). Two items are in disagreement concerned with anxiety and dislike to the idea of using ECG. However,

these two items are negative affirmations. Thus, it can be inferred that students do not feel anxiety and like the idea of using ECG. In summary, the total mean and standard deviation indicate agreement at (3.74, 0.73).

Table B10: Others' Opinions of the Use of Educational Computer Games which Affect Lecturers

Others' Opinions	Mean	SD.	Interpretation
1. I think I should use educational computer games if my colleagues in this faculty recommends it	3.34	1.00	Neutral
2. I think I should use educational computer games if my colleagues in other faculties are using them	3.23	0.99	Neutral
3. My colleagues think using educational computer games is a good idea	3.97	0.79	Agree
4. My friends think I should use educational computer games in classroom	3.77	0.95	Agree
5. My superiors at work think using educational computer games is a good idea	3.77	.088	Agree
Total	**3.60**	**0.77**	**Agree**

Table B10 shows social subjective concepts on the use of ECG of lecturers. In other words, other people who are important to a lecturer think he/she should or should not accept the use of ECG. Overall, the lecturers agree with others' opinion at (3.60, 0.77). Among those people, their colleagues have the most affect on their opinion in using of ECG (3.97, 0.79). They agree that friends and superiors at work affect the use ECG equally at (3.77, 0.95) and (3.77, 0.88) respectively. Colleagues in the faculty (3.34, 1.00) and other faculties (3.23, 0.99) affect lecturers' opinion at a neutral level.

Table B11: Lecturers' Perceived Enjoyment When Using Educational Computer Games

Enjoyment	Mean	SD.	Interpretation
1. Using educational computer games in classroom is/ will be fun and amusing	4.16	0.84	Agree
2. Using educational computer games in classroom is/ will be pleasant and gratifying	3.84	0.67	Agree
3. Using educational computer games in classroom is/ will be exciting and simulating	4.09	0.68	Agree
4. Using educational computer games in classroom is/ will be boring and tedious	2.28	1.05	Disagree
5. Using educational computer games in classroom is/ will be challenging and competitive	3.91	0.85	Agree
Total	**3.94**	**0.65**	**Agree**

Table B11 describes the lecturers' perceived enjoyment of ECG. Most of the items indicate the agreement of enjoyment when using ECG. The total mean and standard deviation is (3.94, 0.65) which is interpreted as "Agree". The highest agreement is item 1 (4.16, 0.84). It refers to fun and amusing. Subsequent agreement refer to exciting and simulating (4.09, 0.68); challenging and competitive (3.91, 0.85) and pleasant and gratifying (3.84, 0.67). The rest disagree with the use of ECG as it is boring and tedious (2.28, 1.05).

Table B12: University Environment Support Factors

University Environment Support Factors	Mean	SD.	Interpretation
1. Resources (funding, equipment, etc.)	.400	1.26	Agree
2. Professional development opportunities on using educational computer games	3.90	0.90	Agree
3. Access to Internet	4.29	0.69	Agree
4. Quality of software	4.16	0.89	Agree
5. Physical classroom structures	3.94	1.06	Agree
6. Support from university administrators	4.06	1.15	Agree
7. Support from other teachers	3.77	0.95	Agree
8. Support from students' parents	3.57	1.16	Agree
9. Technical support (technician)	3.77	0.99	Agree
10. Time to plan for technology implementation	3.97	0.98	Agree
11. Time to let student use technology	4.00	0.73	Agree
12. Smaller class room	3.68	1.13	Agree
13. Mobile equipment (laptops, etc.)	3.58	1.02	Agree
14. Proper connections (computer to projector, etc.)	3.74	1.18	Agree
Total	**3.88**	**0.73**	**Agree**

Table B12 illustrates 14 factors supporting the university environment. Lecturers agree with every factor. The total mean and standard deviation are (3.88, 0.73). Among 14 factors, it can be classified from the highest to lowest agreement as follow:

1. Access to Internet (4.29, 0.63)
2. Quality of software (4.16, 0.89)
3. Support from university administrators (4.06, 1.15)
4. Time to let student use technology (4.00, 0.73); and
   Resources: (funding, equipment, etc.) (4.00, 1.26)
5. Time to plan for technology implementation (3.97, 0.98)
6. Physical classroom structures (3.94, 1.06)
7. Professional development opportunities on using educational computer games (3.90, 0.90)
8. Support from other teachers (3.77, 0.95); and
   Technical support (technician) (3.77, 0.99)
9. Proper connections (computer to projector, etc.) (3.74, 1.18)
10. Smaller class room (3.68, 1.13)
11. Mobile equipment (laptops, etc.) (3.58, 1.02)
12. Support from students' parents (3.57, 1.16)

Table B13: Lecturers' Intention to Use Educational Computer Games

Intention to Use	Mean	SD.	Interpretation
1. Whenever possible, I intend to use educational computer games in my future teaching	3.75	0.91	Agree
2. I definitely do not think I will use educational computer games in classrooms	2.00	1.11	Disagree
Total	**3.88**	**0.96**	**Agree**

Table B13 shows the lecturers' intent to use of ECG. Lecturers agree with item 1 (3.75, 0.91) and disagree with item 2 (2.00, 0.91). Item 2 is negative affirmations; it can imply that lecturers think they will use ECG in the classroom. To

sum up, it can also be implied that whenever possible, the students intent to use ECG in their future learning at (3.88, 0.96).

Table B14: The Association Between Perceptual Learning Styles and Preferred Learning Styles

Perceptive Learning Styles	Preferred Learning Styles								Total	
	Activist		Reflector		Theorist		Pragmatist			
	f	(%)	f	(%)	f	(%)	f	(%)	**f**	**(%)**
Visual	40	10.1	20	5.0	36	9.0	77	19.3	**173**	**43.5**
Aural	16	4.0	19	4.8	26	6.5	41	10.3	**102**	**25.6**
Read	8	2.0	12	3.0	16	4.0	36	9.0	**72**	**18.1**
Kinaesthetic	12	3.0	7	1.8	13	3.3	19	4.8	**51**	**12.8**
Total	**76**	**19.1**	**58**	**14.6**	**91**	**22.9**	**173**	**43.5**	**398**	**100.0**

Table B14 shows the association between perceptive learning styles and preferred learning styles. It reveals the figures in descendent order as follows. 1) 19.3 % is the students who are pragmatist associated with a visual style; 2) 10.3 % is the students with pragmatist and aural styles; 3) 10.1% is the students with activist and visual styles; and 4) 9.0 % are divided into two groups, first is the students with theorist and visual styles and second is the students with pragmatist and read styles. The rest are less than 9 %. The smallest group of students is the one who has reflector associated with kenaesthetic styles (7.0 %).

Table B15: Results from Independent t-test Compare mean of Lecturers in Experience on ECG

Equal Variances	Number of respondents	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Experience	9	-.354	30	.726	-.1353	.38243
Non experience	23	-.294	10.786	.774	-.1353	.46002

Table B15 shows the significance (2-tailed) test is 0.726. This means there was not a statistical significant effect for the lecturers in experience on ECG, t (30) = -.354, $p > .05$ with their Behavioural Intent to Use. It can be inferred from the result that there is no statistical significant difference at 0.05 between the lecturers who has experience and non experience on ECG toward behaviour intent to use ECG.

APPENDIX C: TRANSCRIPTION FROM THE INTERVIEW SURVEY

Question1: If it is the university's policy to use educational computer games in classrooms, what is your opinion on this?

Agreement: Among 18 interviewees, 16 out of 18 agreed with the policy. Their opinions are: *"It's interesting; It's is appropriate because learning is dynamic, new technology should be adopted; This policy is extremely possible; I agree to adopt games into the curriculum; I think most students can play games; It's a good idea; I agree to use it."*

Besides agreement, some interviewees added these comments:

Interviewee 9: *"Good. It might be worth a try. Maybe start with some small groups, such as mathematics group. Because children like to play games, it will be a good way to attract students to a lesson"*

Interviewee 10:*"It's a good idea, for example, constructivists applied Panya to physical education, and golf games to study wind direction*"

Interviewee 11: *"I'm strongly agreed with this. Games will make learning not so boring. They will help the understanding of hard topics. Games also help student remember topics longer. All children learn games very fast, and they are unanimously understood. Game user manuals might be complex, but learnable"*

Interviewee 13: *"I agree. Pictures, sounds, animations, and plotted-plays make children understand the lessons more"*

Interviewee 14: *"I agree, if it is an educational innovation. Students grow up with an IT society and live in a game-playing culture. Adopting games into lessons has to be planned to be used in phases. These are some considerations: 1) There will be some adaptations, 2) Tools and equipment have to be prepared, 3) Class size must be appropriate. Moreover it depends on subjects, says, theory-oriented subjects might be harder to use than empirical-oriented subjects*"

Interviewee 15: *"I agree. Universities usually support the uses of educational media. Thus, using games for education will work and universities also provide both students with something interesting and knowledge"*

Interviewee 16: "*Computer games are media which make learning more concrete. Computer assisted instruction which consists of text, sound, and animation, is not good as computer games which are virtually realistic. They can well link up with the learners' imaginations, because 1) they are well liked from prior experience, 2) games are simulation, 3) they can boost up thinking, analysing and synthesising. The advantages of computer games are they are harmless, low-risk, bringing happiness when learning, do not conflict with prior experience, challenging, exciting for what might come. They also improve a learners' concentration, because games usually are fast. The interactions in games help creativity. When combined these with a students' interests, they will make learning objectives become more absorbed without lots of filtering. Moreover, students are not let so down when losing games*"

Interviewee 18: *"It is possible to have this kind of media in the undergraduate classroom. However, it depends on what subject areas will you put them in? Is it suitable? In my opinion I think this is a form of CAI. One of the things is "Don't forget the ethic"*

Disagree: There were only two interviewees who disagreed with this question. The comments are:

Interviewee 1: "Most teachers in Thailand think this kind of media is unnecessary to support learning"

Interviewee 17: "I think this should not be used yet. I want to see more case studies or some examples"

However, there are some additional comments concerned with obstacles and difficulties if this kind of education tool has been adopted:

Interviewee 1: *"…teachers are the key-person to adopt this technique… and some subjects are not suitable to use games, people who will use this technique have to balance between learning contents and student enjoyment*"

Interviewee 2: *"…but the obstacle is that society will raise some questions, like "Are games really good?" or "What games are appropriate for teenagers?"…"*

Interviewee 3: *"…because there are many teachers who don't know and have a vague idea of "edutainment". The teachers should be informed that this kind of media exists. Moreover, the teaching model should be defined, whether formal or informal teaching"*

Interviewee 4: *"…However, there would be some difficulties, because the government and society still have negative attitudes toward game playing, especially the parents"*

Interviewee 7: *"…adapting the content of the course into games might be difficult, because it's entertainment-oriented. And, it's also hard to sell, if it's an educational game"*

Question 2: What types of computer games do you think are appropriate for the education environment?

There are a variety of comments from the interviewees, however some game genres they recommend for designing educational game are:

Adventure: *"adventure games are appropriate for learning history; adventure is good for adventurous, exciting, interesting, entertaining; Adventure, for example create the game like 'How to survive on a deserted island'..."* (Interviewee 4, 5, 9, 12 13, 14)

Puzzle: *"Puzzle games are suitable for subjects that are focusing on problem-solving, and can be used in many ways depends on levels of learners; Puzzle games might be considered first for education, because they are simple..."* (Interviewee4, 5, 12)

RPG: *"RPGs are suitable for interaction (engineering); News journal writing (subject unit in Journalism) might use RPG..."* (Interviewee 3, 14)

Simulation: *"...Simulations are suitable for planning; suitable for scientific experiments, laboratory experiments; Calculation-based subjects, engineering..."* (Interviewee 3, 5, 9, 10, 12, 13, 17)

Sport: *"...Sports games help understanding sports and safety in sports; Sports: sports teaching..."* (Interviewee 4, 9, 14)

As for the game genres they think are unsuitable for educational computer games: action, fighting, fighting, and racing. However, ten of them think there is no unsuitable kind of game, in other words any kind of game can be used for an educational computer games.

Question 3: What subject areas do you think educational computer games (ECG) can best support? Why?

Five interviewees think that almost every subject areas can use ECG to support learning. Three of them did not answer the question. Other comments from interviewees can be categorised into 3 aspects: memorised-based subject; experimental-based subject; and subject vs. game genre:

Memorised-based subject:

Interviewee 1: *"Memory-based subjects or subjects that students don't like to learn, such as history, might use RPG, so that students can learn through game characters"*

Interviewee 5: *"History and subject of memory-based can use strategy or war games. Engineering, electronics, and robotics use simulation games. Management, tourism, and medicine can also use games"*

Experimental-based subject:

Interviewee 1: *"Subjects with experiments, which are hard to do, such as chemistry, medicine, surgery, fire-fighting, are also suitable for educational games"*

Interviewee 2: *"Experiment-based subjects, mathematics, physics, memory-based subjects, sociology…"*

Interviewee 9: *"Experiment-based subjects, surgery, might use RPG as creating a game character travels into human body and learns about each organ. Learning vocabulary, and syntax, and other topics in humanities can use games"*

Interviewee 10: *"Experiment-oriented subjects, classroom design, and medicine"*

Subject vs. Game Genre

Adventure: Good for subject area like: Arts, civilisation, religion studies.

Puzzle: Accounting, mathematic, problem-solving based subject.

RPG: Medical Science (surgery) *"might use RPG as creating a game character travels into human body and learns about each organ…"*; (Interviewee 9); Law *(court room game, for example)*; Languages (Chinese, Japanese, French pronunciations); Geography (guide-tour game); and Medical anatomy (Interviewee 13).

Simulation: Physics, experiments, chemistry use simulation games; Engineering, electronics, and robotics use simulation games; medical science; surgery and body anatomy.

Strategy: *"Complicate science subjects, such as medicine. arts, such as history, can use strategy war games"* (Interviewee 11).

Other comment:

"…Theory-oriented subjects: not suitable, especially fundamental knowledge and memory-based topics, Practice-oriented subjects: More suitable, especially analysing, synthesising, and prediction" (Interviewee 16).

Question 4: Do you think you learn something new when you are playing computer games? If yes, what sorts of things do you learn?

The things interviewees learn when playing game can be classified as follow:

Fun and amusing: Almost everyone gained entertaining, relaxing, enjoyment.

Rules and regulation:

Interviewee 2: "I learned rules, logic and reasoning…"

Interviewee 18: "Yes, I have learned something from games. 1) game rules…"
Practiced: responsiveness, interfacing, planning skill, interaction, chat & interact with other players, team-working, determination, endeavor, analytical skill, winning tip (find every possible ways to win the game), problem-solving, observation.

Interviewee 3: *"I practiced responsiveness, quick interaction. Some games provide knowledge, and ideas, such as Sim City offer knowledge in strategic planning"*

Interviewee 4: "I've learned about usability, interfacing, and also learned reality in history, concepts, and planning from role playing games"

Interviewee 6: *"I learned team-working, determination, endeavor, and analytic skill (from board games)"*

Interviewee 7: *"In the virtual world, people can chat like in the real society, and can make friends"*

Interviewee 8: *"… To practice thinking skill, planning skill, and memorising skill"*

Interviewee 9: *"…exercising brain, and practicing thinking process…"*

Interviewee 10: *"…strategic practicing, winning tips, exercising thinking and planning processes…"*

Interviewee 11: *"…problem-solving skill, present games are more realistic, and involve human emotion…"*

Interviewee 18: *"Yes, I have learned something from games. 1) the game's rule, 2) discretion judgment in problem solving, find every possible way to win the games, 3) analysis, 4) observation, 5) memorise"*

Knowledge: learning vocabulary, use as example for creating graphic

Interviewee 9: *"...Relaxing, learning vocabulary, exercising brain, and practicing thinking process..."*

Interviewee 13: *"...I've learned vocabulary, and used games as examples for creating graphics..."*

Nothing special:

Interviewee 1: *"I might not learn anything special, but I learn involuntarily in an indirect way"*

There were 4 interviewees did not answer and 3 of them have never played games.

Question 5: What style of computer usage would educational computer games support? (For example: whole class in computer room, small group on one machine in classroom, individual use, pair, group etc.

Classroom style, classroom condition, necessary equipments etc. for educational computer games support learning in the classroom according to the point of view of interviewee:

Depend on context/ subject:

Interviewee 1: *"Classroom styles depend on the context and learning culture of each country. Self learning is suitable for western students. Thai students are taught to memorise, with teachers' supports"*

Interviewee 2: *"Classroom styles depend on content of the subjects and game-play in each game. Nowadays, people like to play online games in virtual society. Online game might be suitable, because they can be played anywhere"*

Interviewee 11: *"Classroom designs are based on teaching subjects"*

Depend on Game Genre:

Interviewee 3: *"They depend on game styles, for example, RPGs are multi-players. Playing style has to be considered whether exchanges are taken place or not such as solo-playing, or team-playing. Games are better than CD, because games have interactions"*

Depend on Game Platform:

Interviewee 11: *"...some subjects have to use PCs, some have to use game consoles. However, console games are not as various as PC games, because software*

developments have to be done on PC. Console games are convenient, as they can be plugged and played"

Interviewee 17*:* *"Console games are not marketed to use in education, most of education games are played on PC. When games are fully developed on PC, they will be ported to console"*

Interviewee 12: *"PC might be more fitted than console"*

Fully Equipment:

Interviewee 4: *"Classroom condition and fundamental equipments must be 1) flexible, 2) mouse, 3) keyboard, and 4) joystick. Moreover, it has to be considered that it is network playing or individual playing"*

Interviewee 6: *"Equipment has to be fully equipped"*

Interviewee 7: *"The classroom must be equipped with sufficient equipment"*

Interviewee 15: *"The classroom has to be fully equipped. Due to the noisy environment, headsets are needed. Using PC, console, or handheld devices are up to lesson designs"*

Individual/ Team Working

Interviewee 5: **"***Classroom conditions have to satisfy the group. Budgets, playing styles (individual or team) have to be considered"*

Interviewee 6: *"...If using a network system, students have to play only games in the lessons not using the Internet for other purposes. If using off-line, students have no access a to network, so that they will not be distracted from learning lessons. Teachers can connect to the Internet for teaching and providing reference to students in order to facilitate students' understanding"*

Classroom/ Computer laboratory Size

Interviewee 8: *"The classroom must be small, not more than 20 students*"

Other comment:

Interviewee 10: *"Beside classroom settings, the games must be made exciting, and make students feel they want to play and learn endlessly, and conform to the lessons' objectives"*

There are 3 interviewees do not answer this question.

Question 6: What would teachers need to know in order to use educational computer games effectively in the class?

In order to prepare themselves to use ECG effectively in the class, teachers need to know the following:

1) **Interviewee 3:** *"...have a good attitude toward game playing…"*

2) **Interviewee 4, 13:** *"…study and prepare course content for game developers; …classify and analyse content…"*

3) **Interviewee 4:** *"…plan the content to use in the game, plots, storytelling…"*

4) **Interviewee 4:** *"…select game style, genre…"*

5) **Interviewee 4:** *"…classify the level of learners…"*

6) **Interviewee 4:** *"…Teachers should or must be able to play games, teachers who cannot play games should start with some simple games such as board games, puzzle games, Brain Age, adventure games, and casual games"*

Interviewee 13: *"Teachers should prepare themselves by study each kind of game, game devices, basics of playing games…"*

7) **Interviewee 14:** *"It's necessary to have training and seminar programmes to build up the readiness, to gain information about using and playing games, to change behaviours, to provide good attitude toward games. Knowledge, beliefs, and feelings are also needed to be offered, because Thai society still feels about game playing negatively"*

8) **Interviewee 17:** *"Establish an organisation for gaming to prepare game content. Teachers should be able to play games. Pilot studies should be conducted"*

9) **Interviewee 18:** *In conclusion: "The preparation include: Content, Type of Game, Game selection, Game design. It is necessary that teacher should know how to play game"*

Other comment:

Interviewee 1: *"Teachers can be divided into 2 generations, old and new. Old-generation teachers are not familiar with this media, it is hard to use, must be learned. New-generation teachers might not have problems, because they are familiar with the media"*

There are six interviewees did not answers this question.

Question7: Please give any additional comments concerning the use of educational computer games in classrooms, if any.

Interviewee 1: *"The programme has to be made in a way that teachers can change the content easily whenever they want to add or modify the content"*

Interviewee 2: *"Students have different experience in game playing. Some of them use to play games, and some of them are good at that. They use different skills in playing"*

Interviewee 3: *"Teachers have to have knowledge about games. CAI focuses on content, while game focuses on amusement"*

Interviewee 4: *"Most people still do not understand the differences between ordinary games and educational games. The addition of this kind of media makes change in teaching, so that supports from the government are needed"*

Interviewee 5: *"It is possible, difficulties are not much"*

Interviewee 6: *"Developers should create games in Thai, and develop games for teenagers in Thailand"*

Interviewee 8: *"I want this to be happened, but in the real market, they tend not to develop educational games"*

Interviewee 12: *"We should use game for assisting teaching. Use them as addition activities in class. Game helps improving skills, expanding content from classroom, boosting memory"*

Interviewee 16: *"...I would suggest establishing Framework: University Policy for Educational Digital Game in Thai context in the following aspects"*

1) *Religion, "moderate practice", not too much and not too little*
2) *Sufficient economics, in the aspects of teachers, learners, academic, producers, managements*
3) *The National Education Plan, The National Economic and Social Plan 10*
4) *Thai children personality*
5) *Thai children learning*
6) *The cycle of game utilisation is develop, use, improve.*

Interviewee 16: *"...Computer games are media which make learning more concrete. Computer assisted instruction which consists of text, sound, and animation, is not good as computer games which are virtually realistic. They can well link up with the learners' imaginations, because 1) they well liked with prior experience, 2) games are simulation, 3) they can boost up thinking, analysing and synthesising. The advantages of computer game are harmless, low-risk, happy when learning, not conflict with prior experience, challenging, exciting for what might come. They also improve learners'*

concentration, because games usually fast. The interactions in games help creativity. When combined these with students' interests, they will make learning objectives more absorbed without lots of filtering. Moreover, students are not felt so down when losing games.

Considerations for related organs:

1) *Learners: should have perceptual ability, and be interested in games for learning. Games are innovations that provide good learning experience. They make some aspects easier to understand and suitable to learn, such as planning, analysing, and synthesising. However, they might not appropriate for memorising or fundamental subjects, because it's not worth to invest. Children can learn from games both in classroom and laboratory. This kind of learning can be done anywhere.*
2) *Teachers: are not necessary to be expert in software and hardware, but they have to know courseware. Teachers provide some concepts for students to practice… the games have to be made with good objectives. Teachers have to provide instructions to use the games.*

   Only lecture = low learning, it is theoretical.

   Lecture + read = not enough, texts are still too abstract.

   Sound = increase learning.

   Pictures, animations, demonstrations, and simulations = increase potentially learning.

   The important things are that good contents and great designs will make good simulations in learning.
3) *Education personnel:*
   - *Facilitate software makings*
   - *Provide technical trainings*
   - *Construct learning contents by content experts*
   - *Three organs involve: computer scientists, art designers, and content experts. From studies, content experts come first, designers second, and computer scientists third.*
4) *Budgets: It has been found that Thai people can "adopt" but not "adapt". They are lacks of good policy on education innovations, are lacks of pilot projects, and lacks of making "active students" and "active teachers"*

Interviewee 18: "It is possible to have this kind of media in the undergraduate classroom. However, it depends on what subject areas will you put them in? Is it suitable? In my opinion I think this is a form of CAI. One of the thing is that "Don't forget the ethic"

Interviewee 17: "Life is like drama. Game is a simulation of life. Players control the outcome and plot of the game. The goal is to win the game. Game is just a motivation and incentive"

Question 8: Other comments which apart from the 7 questions above

People who involve in game development

Interviewee 16: "There are 3 groups of people who are involved in game development which we have to be concerned about when preparing the courseware; 1) content experts, 2) game designers, and 3) game developers. Content experts define content, objectives, and evaluations. Game designers design game pattern and game playing. Game developers are programmers, sound engineers, graphic designers, and sound designers"

Game Access in primary school, secondary school, and university

When asking the comparison of three education levels: primary school, secondary school and university whether which levels are easier for game access for classroom environment, most interviewees give their viewpoints that secondary school is the most suitable for game accessibility. Their opinions are illustrated in Table C1:

Table C1: Game Access in Primary School, Secondary School and University

	Primary School	Secondary School	University
Accessible/ Adoptability	easier	not easy	not easy
Complexity	lower	high	Higher
Content Design	easier	moderate	harder,
Education Game	more	moderate	less,
Frequency of Playing	high	highest	Moderate
Game Productivity	higher	moderate	Lower
Interest of User	higher	high	Lower
Subject Areas	all subjects	almost all	selective subject
The Usage	harder	moderate	Easier
Usefulness	high	higher	Highest

Game Access in Primary School:

Interviewee 1: *"In primary school, the access is easy, but the usage is harder…"*

Interviewee 2: *"In primary school, this level can build more educational games. Content designs are also easier…"*

Interviewee 3: *"In primary school, teaching skills in younger children is easier"*

Interviewee 4: *"In primary and secondary school, there are more game plays. In younger level, games can be done for all subjects"*

Interviewee 5: *"In primary level, frequency of playing is higher"*

Interviewee 6: "Game is more accessible and more suitable, in primary school"

Interviewee 7: *"In primary school, adoptability is easier, and complexity is lower"*

Interviewee 8: "Primary level, accessibility and game productivity in this level are higher"

Interviewee 9: *"Psychology of learning is the most suitable at the primary level. Learning skill is limited, so that stimulation by games will be useful. Content in this level is all new. In basic level, it's easy to do. The designs are not so complex"*

Interviewee 10: *"Building games for secondary level is the most suitable, because it's the key point to enter university level"*

Game Access in Secondary School:

Interviewee 1: *"In secondary school, the access is not easy, but not hard…"*

Interviewee 3: *"We must study 8 aspects of multiple intelligences. In secondary school, this level is the most game playing, but don't forget ethics and morality…"*

Interviewee 5: *"The secondary level is the most frequent playing. Game should be made in many subjects to lay the foundation for university level."*

Interviewee 6: *"In secondary school and university, complexity is higher."*

Interviewee 7: *"In secondary school, frequency of playing is the highest. In university, there is more game playing in first year students."*

Interviewee 8: *"In secondary level, frequency of playing is higher. Complexity is higher in university level."*

Interviewee 9: *"In secondary school, the playing skill is still developing; children have more language skill, and also have other experiences. Profession and career knowledge can be added in this level. Children in this level are very active, and can be interacted immediately."*

Interviewee 10: *"Building games for secondary level is the most suitable, because it's the key point to enter university level."*

Game Access in University

Interviewee 1: *"...In university, the presentation might be hard, the usage is easier, but the interest of the users might low"*

Interviewee 2: *"...In university, the usefulness might higher, but the content designs might be harder"*

Interviewee 4: *"...In university, number of game playing is lesser comparing to other levels, because there are other activities. "Content is more limited. Character designs and playing designs must be more complicate for older children."*

Interviewee 5: *"In university level, students still want to play, but they have more limited time. Game might be made for subjects that students are weak, such as physics or English with simpler game play. The technical difficulty depends on game-play, not students' ages or education levels. We can use sophisticate game-play in all levels, with modification of content."*

Interviewee 7: *"University students have more time, and parents also give more freedom to the students. However, time is limited in the fourth year."*

Interviewee 8: *"Complexity is higher at the university level."*

Interviewee 9: *"In university level, students study to be specialised in certain fields, so specialised games should be made. Games for fundamental courses can also be made. Developing games in this level, the break-even point is longer, but it's good for remote learning."*

Interviewee 11: *"In secondary and tertiary level the content will be more difficult*."

The use of game as a direct teaching tool (substitute teacher), indirect teaching tool (support teacher), and off the classroom

When asking what they think educational computer games should best be used as a direct-teaching-tool (substitute teacher), an indirect-teaching-tool (support teacher) or an off-classroom (use to support after class), most interviewees support the idea of indirect teaching tool. Their viewpoints are illustrated in Table C2:

Table C2: Use of Game as Direct-Teaching-Tool, Indirect-Teaching-Tool, and Off-Classroom.

Direct-teaching-tool	Indirect-Teaching-Tool	Off-Classroom
• Should not use as direct teaching tool • Should not use to replace teachers • Not suitable to substitute teacher	• Suitable for support learning • Support teachers is the most suitable method • Can be a complementary	• Alternative learning off the class • Unsuitable because lack of control • Fit for ones who can not catch up in the class • Product should be good enough for self learning

Direct-Teaching-Tool:

Interviewee 1: *"We should not use game as a direct teaching tool, because it lacks explanation. Explanation and detail of content still need lecturing from the teachers. Thai students still need monitoring…"*

Interviewee 2: *"Games should not be used to replace teachers, because it's hard to design complete course content."*

Interviewee 3: *"Using games instead of teachers is not suitable. In theory, there is no medium which can substitute as a teacher. Games cannot monitor or control students, cannot follow-up on results."*

Interviewee 4: *"I don't agree to use game as a substitute teacher. A game is a specialised learning experience, not everything can be gained from games. Game conclusions cannot tell anything, such as losing in a game does not mean the student lacks skill, or winning in game does not mean that the student is skillful."*

Interviewee 5: *"Using games instead of teachers is not good, because children will not have interaction with teachers."*

Indirect-Teaching-Tool:

Interviewee 1: *"…Thus, games are the most suitable for support learning in classroom. After teachers explain lesson objectives, games might be used as auxiliary activity or used to fill in gaps in the lessons."*

Interviewee 2: *"…Thus, games should be used to support teachers."*

Interviewee 3: *"…Using games to support teachers are the most appropriate...*"

Interviewee 4: *"Using game to support teacher is the most suitable, because it's stimulation. It can be used to learn before, between, and after teaching."*

Interviewee 5: *"Using game to support teacher is good and suitable, because teacher knows objectives and can make suggestions."*

Off-Classroom:

Interviewee 1: *"…Game can be use as an alternative learning off-the-classroom. The advantage is that game can be a complementary, while the drawback is that software piracy might be a problem…"*

Interviewee 2: *"…Using game outside classroom is also unsuitable, because of lack of control…"*

Interviewee 3: *"Using game outside classroom is fitted for students who cannot catch up with the class or who want to make themselves clear about the lessons."*

Interviewee 4: *"Using game after classroom is also another option, but the product should be good and children must have discipline."*

Interviewee 5: *"For after class, if the in-class product is good enough, it can be used after class."*

Trend of using computer game for education in university:

In conclusion, the summary from the interviewees can be summed up in that it is possible for the adoption of ECG for classroom learning; however there should be some pioneer studies such as comparison of experienced game players and first-time players. Some difficulties might be faced, such as the costs of hardware and software, lack of game personnel, and lack of interest from game companies. As for people involved for this adoption, games are not accepted by most teachers. The attitudes toward games by executives and parents are still negative. An attitude from most of people in government section toward games is still negative. Mass media also portrays game in negative ways.

Some major concerns from lecturers if ECG has been adopted into the curriculum as a teaching tool are:

Subject Areas, Learning Content and Learning Objective:

- "It depends on the subject areas and learning content."
- "It is hard to bring ECG use for some theoretical subjects."
- "I am not sure how can we design the learning content in game. Content of the subject has already complicated. How can we simplify and make the content easy to comprehend before put it into the game?"
- "It can use in the subject which have an experiment and risky task."
- "Must carefully select the lesson, not think about only for fun."
- "Gameplay should encourage the creativities including the clear learning process and clear learning objective."

Suitable Game Genre

- "It depends on the genre of game and how related to the subject areas."
- "It is very interesting but it also depends on the type of game whether it can get along well with the content of each subject. This include the time consuming to configure game must not take too long."
- "Think about the appropriate game genre for particular subjects."

Potential and Talent of Lecturers

- "It's good to have this kind of computer game in classroom, but this should be depends on the potential and talent of individual lecturer."
- "Lecturer should have a chance to modify the content of the lesson."

Suitable for Other Level of Study

- "ECG is very suitable for the young children especially for primary school kids."
- "It might be good to use for the secondary school students. It might be somehow uncontrollable to use for the undergraduate students. However, it must be more considered to select or create the appropriate game for them."

Use as Supportive Tool

- "Very good, but it should be used as learning support tool rather than use as the main learning device."
- "It should be only the supportive tool of learning not come to substitute the teacher."

The second questions: "What are other comments about the use of ECG in classroom you would like to add?" The respondents responded other comments as follow:

Additional Comments from Students

- "It should be a good benefit for the teaching and learning environment. Because learn from game is more interesting than from the lecture. Game is more fun, entertain, not boring."
- "Game producers should create and introduce more educational computer games so we can look at the sample of this kind of game."
- "If ECG was introduced to the classroom, it should focus more on content rather than on entertain."
- "Teacher should be in class for monitoring and guiding while teaching with this kind of game."
- "Those games should have been seriously selected and considered as suitable for the particular subjects."
- "I would like to learn from game only the subject which is very hard to understand."
- "It's hard for the ones who have never played."
- "Personally, I disagree. Students will concentrate on playing and ignore the lesson, even though the idea is learn and fun, but Thai students may choose only fun and overlook the knowledge gained from computer games. Like someone play RPG but did not read the story, when the game is over they still didn't know what the content is about."

Additional Comments from Lecturers

- "We should use this tool as carefully as possible. A computer game is a good interactive tool but the players do not necessarily take the responsibility for this interactivity. As this result, game may become useless and cannot use as effective device as it should be."
- "There are many methods to develop the understanding of students. Using computer games has to carefully considered. It might affect the personal heath, eye sight etc. "

- "There are other features to think about such as: the budgets, the resources, time and the teaching-learning management (the size of classroom, for instance)."
- "The computer laboratory and other peripherals should be sufficiently provided."
- "Should provide a variety of game types in one subject. Different students have different preference in playing games."

Open-ended Questions (from the self administer questionnaire)

1) What is your concern if educational computer games have to be adopted into the curriculum as a teaching tool in the classroom?

Some major concerns from lecturers if ECG has been adopted into the curriculum as a teaching tool are:

Subject Areas, Learning Content and Learning Objective:

- "It depends on the subject areas and learning content."
- "It is hard to bring ECG use for some theoretical subjects."
- "I am not sure how can we design the learning content in games. Content of a subject is already complicated. How can we simplify and make the content easy to comprehend before putting it into the game?"
- "It can use a subject which is experimented or a risky task."
- "Must carefully select the lesson, not think about only fun."
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- "Very good, but it should be used as learning support tool rather than use as the main learning device."
- "It should be only the supportive tool of learning not come to substitute the teacher."

The second questions: "What are other comments about the use of ECG in the classroom you would like to add?" The respondents supplied other comments as follow:

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- "It should be a good benefit for the teaching and learning environment. Because learning from games is more interesting than from the lecture. A game is more fun, entertaining, not boring."
- "Game producers should create and introduce more educational computer games so we can look at the sample of this kind of game."
- "If ECG was introduced to the classroom, it should focus more on content rather than on entertainment."
- "Teachers should be in class for monitoring and guiding while teaching with this kind of game."
- "Those games should have been seriously selected and considered as suitable for the particular subjects."
- "I would like to learn from games only for subjects which are very hard to understand."
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- "Personally, I disagree. Students will concentrate on playing and ignore the lesson, even though the idea is learning and fun, but Thai students may choose only fun and overlook the knowledge gained from computer games. Like someone playing RPG but did not read the story, when the game is over they still didn't know what the content about."

Additional Comments from Lecturers

- "We should use this tool as carefully as possible. Computer games are a good interactive tool but players do not necessarily take the responsibility for this interactive nature. As this result, the game may become useless and cannot used as an effective device as it should be."
- "There are many methods to develop the understanding of students. Using computer game is one to carefully consider. It might affect the personal health, eye sight etc. "
- "There are other features to think about such as: the budgets, the resources, time and the teaching-learning management (the size of the classroom, for instant)."
- "The computer laboratory and other peripheral should be sufficiently provided."
- "Should provide a variety of game types in one subject. Different student have different preference in playing game."

APPENDIX D: QUESTIONNAIRES

Student Questionnaire

Dear student:

This questionnaire is designed to investigate the feasibility to adopt educational computer games in the undergraduate course in Thailand. This questionnaire consists of four parts:

Part A: Demographic Information
Part B: Educational Computer Games Acceptance
Part C: Learning Style
Part D: Experience on Computer Games

To help you understand the terms are used in this questionnaire, please see the explanation below:

Term:	Explanation
Educational Computer Games	Games designed to teach students about a certain subject or help them to learn a skill as they play the game. To demonstrate the willingness of employing educational
Educational Computer Games Acceptance	Computer games for the tasks to support learning or teaching.
Learning Styles	Characteristic of processing information, feeling, and behaving in learning for individual.
Teaching styles	Methods or manners of teaching based on individual instructors' beliefs which includes good teaching, personal preferences, abilities, and the norms of a particular discipline.

Completion of the questionnaire is entirely voluntary and you can decide not to participate at any time simply by not completing and submitting the questionnaire. All information given during the survey is confidential, and no names or other information that might identify you will be obtained.

If you have any questions about this project please feel free to contact me (Kowit Rapeepisarn, k.rapeepisarn@murdoch.edu.au, Thai Mobile: + xxxxxxxxxxx, Australia Mobile: +614 06106654), or my supervisors (Associate Professor Kevin Wong, k.wong@murdoch.edu.au, +618 93606100). Or alternatively you can contact Murdoch University's Human Research Ethics Committee (ethics@murdoch.edu.au, +618 93606 677).

PART A. Demographic Information

This portion is aimed to gather demographic information from the survey. Unless specified in the question, please select and tick √ **only one appropriate** answer for each of the following questions.

A1. What year are you studying now?

☐ Year1 ☐ Year2 ☐ Year3 ☐ Year4 or above

A2. What is your gender?

☐ Male ☐ Female

A3. What types of educational technology have you ever used or applied in your learning? (**You may choose more than one answer**)

☐ E-learning ☐ Computer assisted instruction

☐ World Wide Web ☐ Others (Please indicate)

A4. Have you ever used computer game as a learning tool in the classroom?

☐ Yes ☐ No

PART B. Educational Computer Games Acceptance

B(a). This portion relates to how useful you think using educational computer games in the classrooms will enhance your knowledge and learning performance. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Usefulness	1	2	3	4	5
B1.	Using educational computer games as a tool for learning in classrooms increases / will increase my learning and academic performance	☐	☐	☐	☐	☐
B2.	Using educational computer games enhances / will enhance the effectiveness on my learning	☐	☐	☐	☐	☐
B3.	Educational computer games engage / will engage me during my learning	☐	☐	☐	☐	☐
B4.	Educational computer games allow / will allow me to progress at my own pace. (I can use as much time as needed to practice and master the skills required)	☐	☐	☐	☐	☐
B5.	Educational computer games do not support my learning	☐	☐	☐	☐	☐

B(b). This portion relates to whether you think using educational computer game is free from effort. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Easy to use	1	2	3	4	5
B6.	Learning to operate educational computer games in classrooms is / will be easy for me	☐	☐	☐	☐	☐
B7.	It is / will be cumbersome to use educational computer games for learning in classrooms	☐	☐	☐	☐	☐
B8.	Learning how to play educational computer games in classes is / will be too complicated and difficult for me	☐	☐	☐	☐	☐

B9.	It is / will be time consuming to familiarise myself with educational computer games	☐	☐	☐	☐	☐
B10.	Overall, I think educational computer games are / will be easy to use	☐	☐	☐	☐	☐

B(c). This portion relates to your positive or negative feelings toward the use of educational computer games. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Attitude	1	2	3	4	5
B11.	I think I have / may have self-confidence in using educational computer games in class	☐	☐	☐	☐	☐
B12.	I think I feel / may feel anxiety when using educational computer games in classrooms	☐	☐	☐	☐	☐
B13.	I think it is hard to learn a new educational computer game	☐	☐	☐	☐	☐
B14.	I think the use of educational computer games in classrooms is useful	☐	☐	☐	☐	☐
B15.	I dislike the idea of using educational computer games in classroom	☐	☐	☐	☐	☐

B(d). This portion relates to others' opinions of the use of educational computer games. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Others' opinions which affect you	1	2	3	4	5
B16.	I think I should use educational computer games if my teacher recommends them	☐	☐	☐	☐	☐
B17.	I think I should use educational computer games if my friends studying in other faculties are using them	☐	☐	☐	☐	☐
B18.	My parents think using educational computer games is a good idea	☐	☐	☐	☐	☐
B19.	My friends think I should use educational computer games in classroom	☐	☐	☐	☐	☐

B20.	My supervisor think using educational computer games is a good idea	☐	☐	☐	☐	☐

B(e). This portion relates to how much you think you will be using educational computer games in classrooms. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Enjoyment	1	2	3	4	5
B21.	Using educational computer games in classrooms is /will be fun and amusing	☐	☐	☐	☐	☐
B22.	Using educational computer games in classrooms is /will be pleasant and gratifying	☐	☐	☐	☐	☐
B23.	Using educational computer games in classrooms is /will be exciting and stimulating	☐	☐	☐	☐	☐
B24.	Using educational computer games in classrooms is /will be boring and tedious	☐	☐	☐	☐	☐
B25.	Using educational computer games in classroom is /will be challenging and competitive	☐	☐	☐	☐	☐

B(f). This portion relates to how willing you are to try and plan to use of educational computer games. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Intention to use	1	2	3	4	5
B26.	Whenever possible, I intend to use educational computer games in my future learning	☐	☐	☐	☐	☐
B27.	I definitely do not think I will use educational computer games in classrooms	☐	☐	☐	☐	☐

PART C. Learning style

C(a). This portion relates to your perceptual style of learning. Choose the answer which best explains your preference and circle the letter(s) A, B, C, or D. **Please circle more than one** if a single answer does not match your perception. Leave blank to any question that does not apply to you.

C1. You are helping someone who wants to go to your airport, town centre or railway station. You would:
- A. go with her.
- B. tell her the directions
- C. write down the direction (without a map).
- D. draw, or give her a map.

C2. You are not sure whether a word should spell 'dependent' or 'dependant'. You would:
- A. see the words in your mind and choose by the way they look.
- B. think about how each words sounds and choose one.
- C. find it in a dictionary.
- D. write both words on paper and choose one.

C3. You are planning a holiday for a group. You want some feedback from them about the plan. You would:
- A. describe some of the highlights.
- B. use a map or website to show them the places.
- C. give them a copy of the printed itinerary.
- D. phone, text or email them.

C4. You are going to cook something as a special treat for your family. You would:
- A. cook something you know without the need for instructions.
- B. ask friends for suggestions.
- C. look the pictures through the cookbook for ideas.
- D. use a cookbook where you know there is a good recipe.

C5. A group of tourists want to learn about the parks or wildlife reserves in your area. You would:
- A. talk about, or arrange a talk for them about parks or wildlife reserves.
- B. ask friends for suggestions.
- C. talk them to a park or wildlife reserve and walk with them.
- D. give them a book or pamphlets about the parks or wildlife reserves.

C6. You are about to purchase a digital camera or mobile phone. Other than price, what would most influence your decision?
- A. Trying or testing it.
- B. Reading the details about its features.
- C. It is a modern design and looks good.
- D. The salesperson telling me about its features.

C7. Remember a time when you learned how to do something new. Try to avoid choosing a physical skill, eg. riding a bike. You learned best by:
- A. watching a demonstration.

B. listening to somebody explaining it and asking questions.
C. diagrams and charts – visual clues.
D. written instructions – eg. a manual or textbook.

C8. You have a problem with your knee. You would prefer that the doctor:
A. give you a web address or something to read about it.
B. used a plastic model of a knee to show what was wrong.
C. described what was wrong.
D. showed you a diagram of what was wrong.

C9. You want to learn a new program, skill or game on a computer. You would:
A. read the written instructions that came with the program.
B. talk with people who know about the program.
C. use the control or keyboard.
D. follow the diagrams in the book that came with it.

C10. I like websites that have:
A. things I can click on, shift or try.
B. interesting design and visual features.
C. interesting written descriptions, lists, and explanations.
D. audio channels where I can hear music, radio programmes or interviews.

C11. Other than price, what would most influence your decision to buy a new non-fiction book?
A. The way it looks is appealing.
B. Quickly reading parts of it.
C. A friend talks about it and recommends it.
D. It has real-life stories, experiences and examples.

C12. You are using a book, CD or website to learn how to take photos with your new digital camera. You would like to have:
A. a chance to ask questions and talk about the camera and its features.
B. clear written instructions with lists and bullet points about what to do.
C. diagrams showing the camera and what each part does.
D. many examples of good and poor photos and how to improve them.

C13. Do you prefer a teacher or a presenter who uses:
A. demonstrations, models or practical sessions.
B. question and answer, talk, group discussion, or guest speakers.
C. handouts, books, or readings.
D. diagrams, charts or graphs.

C14. You have finished a competition or test and would like some feedback. You would like to have feedback:
A. using examples from what you have done.
B. using a written description of your results.
C. from somebody who talks it through with you.
D. using graphs showing what you had achieved.

C15. You are going to choose food at a restaurant or café. You would:
A. choose something that you have had there before.
B. listen to the waiter or ask friends to recommend choices.

C. choose from the descriptions in the menu.
D. look at what others are eating or look at pictures of each dish.

C16. You have to make an important speech at a conference or special occasion. You would:
A. make diagrams or get graphs to help explain things.
B. write a few key words and practice saying your speech over and over.
C. write out your speech and learn from reading it over several times.
D. gather many examples and stories to make the talk real and practical.

C(b). This portion relates what type of learner you are. Below is a list of 24 questions. If your answer to the question is YES, tick √ in the check box YES. If your answer is DEFINITELY YES (because that question describes one of your main characteristics), tick √ in the check box DEFINITELY (instead of YES). If your answer is NO or if you are not sure, tick √ in the check box NO.

C17.	Do you find it easy to meet new people and make new friends?	☐ NO	☐ YES	☐ DEFINITELY
C18.	Are you cautious and thoughtful?	☐ NO	☐ YES	☐ DEFINITELY
C19.	Do you get bored easily?	☐ NO	☐ YES	☐ DEFINITELY
C20.	Are you a practical, “hands on” kind of person?	☐ NO	☐ YES	☐ DEFINITELY
C21.	Do you like to try things out for yourself?	☐ NO	☐ YES	☐ DEFINITELY
C22.	Do friends consider you to be a good listener?	☐ NO	☐ YES	☐ DEFINITELY
C23.	Do you have clear ideas about the best way to do things?	☐ NO	☐ YES	☐ DEFINITELY
C24.	Do you enjoy being the centre of attention?	☐ NO	☐ YES	☐ DEFINITELY
C25.	Are you a bit of a daydreamer?	☐ NO	☐ YES	☐ DEFINITELY
C26.	Do you keep a list of things to do?	☐ NO	☐ YES	☐ DEFINITELY
C27.	Do you like to experiment to find the best way to do things?	☐ NO	☐ YES	☐ DEFINITELY
C28.	Do you prefer to think things out logically?	☐ NO	☐ YES	☐ DEFINITELY
C29.	Do you like to concentrate on one thing at a time?	☐ NO	☐ YES	☐ DEFINITELY
C30.	Do people sometimes think of you as shy and quiet?	☐ NO	☐ YES	☐ DEFINITELY

C31.	Are you a bit of a perfectionist?	☐ NO	☐ YES	☐ DEFINITELY
C32.	Are you enthusiastic about life?	☐ NO	☐ YES	☐ DEFINITELY
C33.	Would you rather "get on with the job" than keep talking about it?	☐ NO	☐ YES	☐ DEFINITELY
C34.	Do you often notice things that other people miss?	☐ NO	☐ YES	☐ DEFINITELY
C35.	Do you act first then think about the consequences later?	☐ NO	☐ YES	☐ DEFINITELY
C36.	Do you like to have everything in its "proper place"?	☐ NO	☐ YES	☐ DEFINITELY
C37.	Do you ask lots of questions?	☐ NO	☐ YES	☐ DEFINITELY
C38.	Do you like to think things through before getting involved?	☐ NO	☐ YES	☐ DEFINITELY
C39.	Do you enjoy trying out new things?	☐ NO	☐ YES	☐ DEFINITELY
C40.	Do you like the challenge of having a problem to solve?	☐ NO	☐ YES	☐ DEFINITELY

PART D. Experience on Computer Games

This portion relates to your experience and behaviour in playing computer games. Please tick √ **only one answer** (unless specify) for each of the following questions and fill in the blank provided.

D1. Do you play computer games?

☐ Yes
(Please answer the questions in left column below)

☐ No, never tried it
(Please answer the questions in right column below)

☐ Used to play, but don't play anymore
(Please answer the questions in left column below)

☐ Only tried it, but did not continue
(Please answer the questions in right column below)

If your answer is "yes" or "used to play, but don't play anymore"	If your answer is "no, never tried it" or "only tried it, but did not continue"
Which statement best describes your level of experience in playing computer game? ☐ Beginner ☐ Intermediate ☐ Advanced Please name three games you play the most. _____ _____ _____ (Continue to question D2)	Have you ever heard of the title of any computer games? ☐ Yes (list three games you have heard) _____ _____ _____ ☐ No (Go to question D7)

D2. What computer game platforms do you like to play? **(You may choose more than one answer)**

☐ Personal Computer (PC)	What type of PC? ☐ Microsoft ☐ Apple McIntosh (MAC)
	What physical media do you used? ☐ CD/ DVD ☐ Internet download ☐ Online delivery Services ☐ Others (please specify) _____

☐ Console	☐ PlayStation ☐ Ninetendo Game ☐ Microsoft Xbox ☐ Others (please specify) _____
☐ Handheld	☐ Gameboy ☐ PSP ☐ Others (please specify) _____
☐ Mobile Phone	☐ Nokia ☐ Sony Ericsson ☐ Panasonic ☐ Seimens ☐ Sumsung ☐ Other (please specify)_____
☐ Other platforms (please indicate)	----------

D3. How often do you play computer games?

☐ every day ☐ 4-6 times a week ☐ 2-3 times a week
☐ once a week ☐ less than once a week

D4. How long do you play computer games each time?

☐ less than 30 minutes ☐ up to 30 minutes ☐ up to 1 hour
☐ up to 2 hours ☐ more than 2 hours

D5. Where do you often play computer games? ,

☐ at university ☐ at home ☐ at my friend's house
☐ at game arcade ☐ other places (please indicate) _____

D6. What are your preferences and expectations from the computer games? (Please choose 3 answers and rank them according to the degree of importance. Use 1 to indicate the most important and 3 being the least.

For example, if your consider graphics design is the most important, followed by mode of playing, and then educational value you will write [1] Graphics design [2] Mode of playing [3] Educational value)

☐ Storyline ☐ Character design

☐ Graphic design ☐ Enjoyment provided

☐ Sound effect ☐ Modes of playing

☐ Education value ☐ Ease of winning the game

☐ Other aspects (please indicate) _____

D7. If you would like to make any other comments about the use of ECG in classroom, please use the space below and continue overleaf if necessary.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

This survey consists of two parts which are this questionnaire and the follow up interview

Would you like to participate in the interviews? (The estimated time for the interview will be approximately 30 minutes. Questions of the interview will be supplied to you prior to the interview. Arrangement will be made to conduct the interview.)

☐ No

☐ Yes (Please contact me on the given contact information shown in the beginning of this questionnaire)

Thank you for your participation and your contribution to this survey is greatly appreciated.

Do you want to receive a summary of this report by email?

If Yes, please supply your email address: _____

Alternatively, you may contact me at the given email address below.

k.rapeepisarn@murdoch.edu.au

Lecturer Questionnaire

Dear Lecturer:

This questionnaire is designed to investigate the feasibility to adopt educational computer games in the undergraduate course in Thailand. This questionnaire consists of four parts:

Part A: Demographic Information
Part B: Educational Computer Game Acceptance
Part C: Teaching Style
Part D: Computer Game

To help you understand the terms are used in this questionnaire, please see the explanation below:

Term:	Explanation
Educational computer games	Games designed to teach students about a certain subject or help them learn a skill as they play.
Educational Computer Games Acceptance	To demonstrate the willingness of employing educational computer games for the tasks to support learning or teaching.
Learning Styles	Characteristic of processing information, feeling, and behaving in learning for individual.
Teaching styles	Methods or manners of teaching based on individual instructors' beliefs which includes good teaching, personal preferences, abilities, and the norms of a particular discipline.

Completion of the questionnaire is entirely voluntary and you can decide not to participate at any time simply by not completing and submitting the questionnaire. All information given during the survey is confidential, and no names or other information that might identify you will be obtained.

If you have any questions about this project please feel free to contact me (Kowit Rapeepisarn, k.rapeepisarn@murdoch.edu.au, Thai Mobile: + xxxxxxxxxxx, Australia Mobile: +614 06106654), or my supervisors (Associate Professor Kevin Wong, k.wong@murdoch.edu.au, +618 93606100). Or alternatively you can contact Murdoch University's Human Research Ethics Committee (ethics@murdoch.edu.au, +618 93606 677).

PART A. Demographic Information

This portion is aimed to gather demographic information for the survey. Unless specified in the question, please select and tick √ **only one appropriate answer** for each of the following questions.

A1. How many years have you been teaching in the university?

☐ 1-5 ☐ 6-10 ☐ 10 +

A2. What is your gender?

☐ Male ☐ Female

A3. What types of educational technology have you ever used or applied in your teaching? **(You may choose more than one answers)**

☐ E-learning ☐ Computer assisted instruction

☐ World Wide Web ☐ Others (Please indicate) _____

A4. Have you ever used computer game as a teaching tool in the classroom?

☐ Yes ☐ No

PART B. Educational Computer Game Acceptance

B(a). This portion relates to how useful you think using educational computer games in the classrooms will enhance your knowledge and learning performance. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Usefulness	1	2	3	4	5
B1.	Using educational computer games as a tool for teaching in classroom increases /will increase my teaching and academic performance	☐	☐	☐	☐	☐
B2.	Using educational computer game enhances /will enhance the effectiveness on my teaching	☐	☐	☐	☐	☐
B3.	Educational computer games engage/ will engage my students during their learning	☐	☐	☐	☐	☐
B4.	Educational computer games allow/ will allow my students to progress at their own pace. (My students can use as much time as needed to practice and master skills required)	☐	☐	☐	☐	☐
B5.	Educational computer games do not support my teaching	☐	☐	☐	☐	☐

B(b). This portion relates to whether you think using educational computer game is free from effort. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Easy to use	1	2	3	4	5
B6.	Learning to operate educational computer games in classrooms is /will be easy for me	☐	☐	☐	☐	☐
B7.	It is /will be cumbersome to use educational computer game for learning in classrooms	☐	☐	☐	☐	☐
B8.	Learning how to play educational computer games in classes is /will be too complicated and difficult	☐	☐	☐	☐	☐
B9.	It is /will be time consuming to familiarise myself with educational computer games	☐	☐	☐	☐	☐
B10.	Overall, I think educational computer games are/ will be easy to use	☐	☐	☐	☐	☐

B(c). This portion relates to your positive or negative feelings toward the use of educational computer games. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree

Item	Attitude	1	2	3	4	5
B11.	I think I have /may have self-confidence in using educational computer games for teaching	☐	☐	☐	☐	☐
B12.	I think I feel/may feel anxiety when using educational computer games in classrooms	☐	☐	☐	☐	☐
B13.	I think it is hard to learn a new educational computer game	☐	☐	☐	☐	☐
B14.	I think the use of educational computer games in classrooms is useful	☐	☐	☐	☐	☐
B15.	I dislike the idea of using educational computer game in classroom	☐	☐	☐	☐	☐

B(d). This portion relates to others' opinions of your use of educational computer games. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Others' opinions which affect you	1	2	3	4	5
B16.	I think I should use educational computer games if my colleagues in this faculty recommend it	☐	☐	☐	☐	☐
B17.	I think I should use educational computer games if my colleagues in other's faculties are using them	☐	☐	☐	☐	☐
B18.	My colleagues think using educational computer games is a good idea	☐	☐	☐	☐	☐
B19.	My friends think I should use educational computer games in the classroom	☐	☐	☐	☐	☐
B20.	My superiors at work think using educational computer games is a good idea	☐	☐	☐	☐	☐

B(e). This portion relates to how much you think you will be using educational computer games in classrooms. Please select then and √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Enjoyment	1	2	3	4	5
B21.	Using educational computer games in classrooms is /will be fun and amusing	☐	☐	☐	☐	☐
B22.	Using educational computer games in classrooms is /will be pleasant and gratifying	☐	☐	☐	☐	☐
B23.	Using educational computer games in classrooms is /will be excited and stimulating	☐	☐	☐	☐	☐
B24.	Using educational computer games in classrooms is /will be boring and tedious	☐	☐	☐	☐	☐
B25.	Using educational computer games in classrooms is /will be challenging and competitive	☐	☐	☐	☐	☐

B(f). This portion relates to university environmental support factors which you believe will enable you to effectively use educational computer games in classrooms. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	University support factors	1	2	3	4	5
B26.	Resources (funding, equipment, etc.)	☐	☐	☐	☐	☐
B27.	Professional development opportunities on using educational computer games	☐	☐	☐	☐	☐
B28.	Access to Internet	☐	☐	☐	☐	☐
B29.	Quality of software	☐	☐	☐	☐	☐
B30.	Physical classroom structures (electrical outlets, movable tables, circuit breakers, space, etc.)	☐	☐	☐	☐	☐
B31.	Support from university administrators	☐	☐	☐	☐	☐
B32.	Support from other teachers	☐	☐	☐	☐	☐
B33.	Support from student's parents	☐	☐	☐	☐	☐

B34.	Technical support (technician)	☐	☐	☐	☐	☐
B35.	Time to plan for technology implementation	☐	☐	☐	☐	☐
B36.	Time to let students use technology	☐	☐	☐	☐	☐
B37.	Smaller class size	☐	☐	☐	☐	☐
B38.	Mobile equipment (laptops, etc.)	☐	☐	☐	☐	☐
B39.	Proper connections (computer to projector, etc.)	☐	☐	☐	☐	☐

B(g). This portion relates to how willing you are to try and plan to use of educational computer games. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree.

Item	Intention to use	1	2	3	4	5
B40.	Whenever possible, I intend to use educational computer games in my future teaching	☐	☐	☐	☐	☐
B41.	I definitely do not think I will use educational computer games in classrooms	☐	☐	☐	☐	☐

PART C. Teaching styles

This portion relates your preferred teaching styles. Please select and tick √ **only one answer** for each of the following questions.

Note: 1= Strongly Disagreement, 2=Disagreement, 3= Neutral, 4=Agree, 5=Strongly Disagreement.

Item	Teaching style	1	2	3	4	5
C1.	Facts, concepts, and principles are the most important things that students should acquire.	☐	☐	☐	☐	☐
C2.	I set high standards for students in the class.	☐	☐	☐	☐	☐
C3.	What I say and do models appropriate ways for students to think about issues in the content.	☐	☐	☐	☐	☐
C4.	My teaching goals and methods address a variety of student learning styles.	☐	☐	☐	☐	☐
C5.	Students typically work on course projects alone with little supervision from me.	☐	☐	☐	☐	☐
C6.	Sharing my knowledge and expertise with students is very important to me.	☐	☐	☐	☐	☐
C7.	I give student negative feedback when their performance is unsatisfactory.	☐	☐	☐	☐	☐
C8.	Students are encouraged to emulate the example I provide.	☐	☐	☐	☐	☐
C9.	I spend time consulting with students on how to improve their work on individual and/ or group projects.	☐	☐	☐	☐	☐
C10.	Activities in this class encourage students to develop their own ideas about content issues.	☐	☐	☐	☐	☐
C11.	What I have to say about a topic is important for students to acquire a broader perspective on the issues in that area.	☐	☐	☐	☐	☐
C12.	Students would describe my standards and expectations as somewhat strict and rigid.	☐	☐	☐	☐	☐
C13.	I typically show students how and what to do in order to master course content.	☐	☐	☐	☐	☐
C14.	Small group discussions are employed to help students develop their ability to think critically.	☐	☐	☐	☐	☐

C15.	Students design one or more self-directed learning experiences.	☐	☐	☐	☐	☐
C16.	I want students to leave this course well prepared for further work in this area.	☐	☐	☐	☐	☐
C17.	It is my responsibility to define what students must learn and how they should learn it.	☐	☐	☐	☐	☐
C18.	Examples from my personal experiences often are used to illustrate points about the material.	☐	☐	☐	☐	☐
C19.	I guide students' work on course projects by asking questions, exploring options, and suggesting alternative ways to do things.	☐	☐	☐	☐	☐
C20.	Developing the ability of students to think and work independently is an important goal.	☐	☐	☐	☐	☐
C21.	Lecturing is a significant part of how I teach each of the class sessions.	☐	☐	☐	☐	☐
C22.	I provide very clear guidelines for how I want tasks completed in this course.	☐	☐	☐	☐	☐
C23.	I often show students how they can use various principles and concepts.	☐	☐	☐	☐	☐
C24.	Course activities encourage students to take initiative and responsibility for their learning.	☐	☐	☐	☐	☐
C25.	Students take responsibility for teaching part of the class sessions.	☐	☐	☐	☐	☐
C26.	My expertise is typically used to resolve disagreements about content issues.	☐	☐	☐	☐	☐
C27.	This course has very specific goals and objectives that I want to accomplish.	☐	☐	☐	☐	☐
C28.	Students receive frequent verbal and/ or written comments on their performance.	☐	☐	☐	☐	☐
C29.	I solicit student advice about how and what to teach in this course.	☐	☐	☐	☐	☐
C30.	Students set their own pace for completing independent and/ or group projects.	☐	☐	☐	☐	☐

C31.	Students might describe me as a "storehouse of knowledge" who dispenses the fact, principles, and concepts they need.	☐	☐	☐	☐	☐
C32.	My expectations for what I want students to do in this class are clearly defined in the syllabus.	☐	☐	☐	☐	☐
C33.	Eventually, many students begin to think like me about course content.	☐	☐	☐	☐	☐
C34.	Students can make choices among activities in order to complete course requirements.	☐	☐	☐	☐	☐
C35.	My approach to teaching is similar to a manager of a work group who delegates tasks and responsibilities to subordinates.	☐	☐	☐	☐	☐
C36.	There is more material in this course than I have time available to cover it.	☐	☐	☐	☐	☐
C37.	My standards and expectations help students develop the discipline the need to learn.	☐	☐	☐	☐	☐
C38.	Students might describe me as a "coach" who works closely with someone to correct problems in how they think and behave.	☐	☐	☐	☐	☐
C39.	I give students a lot of personal support and encouragement to do well in this course.	☐	☐	☐	☐	☐
C40.	I assume the role of a resource person who is available to students whenever they need help.	☐	☐	☐	☐	☐

PART D. Experience on Computer Games

This portion relates to your experience and behaviour in playing computer games. Please tick √ **only one answer** (unless specify) for each of the following questions and fill in the blank provided.

D1. Do you play computer games?

☐ Yes
(Please answer the questions in left column below)

☐ No, never tried it
(Please answer the questions in right column below)

☐ Used to play, but do not play anymore
(Please answer the questions in left column below)

☐ Only tried it, but did not continue
(Please answer the questions in right column below)

If your answer is "yes" or "used to play, but do not play anymore"	If your answer is "no, never tried it" or "only tried it, but did not continue"
Which statement best describes your level of experience in playing computer game? ☐ Beginner ☐ Intermediate ☐ Advanced Please name three games you play the most. _____ _____ _____ (Continue to question D2)	Have you ever heard of the title of any computer games? ☐ Yes (list three games you have heard) _____ _____ _____ ☐ No (Go to question D7, D8)

D2. What computer game platforms do you like to play? **(You may choose more than one answer)**

☐ Personal Computer (PC)	What type of PC? ☐ Microsoft ☐ Apple McIntosh (MAC)
	What physical media do you used? ☐ CD/ DVD ☐ Internet download ☐ Online delivery Services ☐ Others (please specify) _____

☐ Console	☐ PlayStation ☐ Ninetendo Game ☐ Microsoft Xbox ☐ Others (please specify) _____
☐ Handheld	☐ Gameboy ☐ PSP ☐ Others (please specify) _____
☐ Mobile Phone	☐ Nokia ☐ Sony Ericsson ☐ Panasonic ☐ Seimens ☐ Sumsung ☐ Other (please specify)_____
☐ Other platforms (please indicate)	----------

D3. How often do you play computer games?
☐ every day ☐ 4-6 times a week ☐ 2-3 times a week
☐ once a week ☐ less than once a week

D4. How long do you play computer games each time?
☐ less than 30 minutes ☐ up to 30 minutes ☐ up to 1 hour
☐ up to 2 hours ☐ more than 2 hours

D5. Where do you often play computer games? ,
☐ at university ☐ at home ☐ at my friend's house
☐ at game arcade ☐ other places (please indicate) _____

D6. What are your preferences and expectations from the computer games? (Please choose 3 answers and rank them according to the degree of importance. Use 1 to indicate the most important and 3 being the least.
For example, if your consider graphics design is the most important, followed by mode of playing, and then educational value you will write [1] Graphics design [2] Mode of playing [3] Educational value)

☐ Storyline ☐ Character design
☐ Graphic design ☐ Enjoyment provided
☐ Sound effect ☐ Modes of playing
☐ Education value ☐ Ease of winning the game
☐ Other aspects (please indicate) _____

D7. What is your concern if educational computer games have to be adopted into the curriculum as a teaching tool in the classroom?

_____
_____
_____
_____
_____
_____
_____
_____
_____

D8. If you would like to make any other comments about the use of educational computer games in classroom, please use the space below and continue overleaf if necessary.

_____
_____
_____
_____
_____
_____
_____
_____

This survey consists of two parts which are this questionnaire and the follow up interview

Would you like to participate in the interviews? (The estimated time for the interview will be approximately 30 minutes. Questions of the interview will be supplied prior to the interview. Arrangement will be made to conduct the interview.)

☐ No

☐ Yes (Please contact me on the given contact information shown in the beginning of this questionnaire)

Thank you for your participation and your contribution to this survey is greatly appreciated.

Do you want to receive a summary of this report by email?

If Yes, please supply your email address: _____

Alternatively, you may contact me at the given email address below.

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