Rapeepisarn, K., Pongphankae, S., Wong, K.W. and Fung, C.C. (2008) *Educational use of handheld game consoles – PSP and NDS in Thai colleges.* In: Proceedings of the 7th International Conference on e-Business 2008 (INCEB 2008), 6-7 November 2008, Rangsit University, Bangkok, Thailand.

EDUCATIONAL USE OF HANDHELD GAME CONSOLES - PSP AND NDS IN THAI COLLEGES

Kowit Rapeepisarn[1]
Sumet Pongphankae[2]
Kok Wai Wong[3]
Chun Che Fung[4]

School of Information Technology
Murdoch University
Murdoch, WA 6150, Australia
Email[1, 3, 4]: {k.rapeepisarn| k.wong| l.fung}@murdoch.edu.au
Email[2]: sumet@ymail.com

ABSTRACT

Today's students are fascinated by computer and console video games. Computer game-based learning has gained increasing acceptance and has been applied as an option to classroom lecturing. Educational use of handheld game consoles such as Sony PlayStation Portable (PSP) and Nintendo Dual Screen (NDS) also gain much attention in many places. However, research on the use of these applications in Thai colleges is scarce. This paper aims to examine the features, characteristics, advantages and educational use of PSP and NDS consoles, and to examine the learning and teaching with technology in Thai colleges. This paper also proposes a conceptual model of the adopting of these two kinds of handheld game consoles in Thai college learning environment.

Index Terms -- Digital Game Platform, Educational Computer Game, Edutainment

1. INTRODUCTION

The number of handheld game consoles has increased significantly over the past years. Sony Play Station (PSP) and Nintendo Dual Screen (NDS) are popular for children and teenager. The educational use of handheld game such as PSP and NDS also gain much attention in many places [1],[2],[3],[4],[5]. Using PSP and NDS for education is an interesting concept and the systems are captivating. PSP and NDS can be used to aid college students in different academic subjects such as mathematics, logic and language training. The growing use of handheld game consoles has made them adopted rapidly being as an acceptable technology in the schools. However, PSP and NDS are unlikely to replace other educational technologies. They are suitable for addressing specific problems and requirements. PSP and NDS can be used as learning tools, and reference resources. Teachers are using PSP and NDS for record keeping, scheduling, and as well as teaching of software applications. Additional devices such as digital cameras, GPS devices, and other modules can expand the functionalities of the systems. The key features of the handheld game consoles are portability, mobility and expandability. For example, GPS (Global Positioning Satellite) devices can be used with a PSP. With the advantages of PSP and NDS, a lot of school in many places including UK and Japan [2],[4] uses of these handheld games for teaching and learning purposes. However, the use of educational game of PSP and NDS is still unpopular in Thai colleges due to the negative images associated with games and the communities are unaware of the potential of the game industry. It is therefore the purpose of this paper to examine the game industry in Thailand. The paper then examines the learning and teaching with technology in Thai colleges, and the educational use of PSP and NDS. To contribute the body of knowledge, this paper will propose a conceptual model for the adoption of these two kinds of handheld game systems in Thai college learning environment.

2. GAMES INDUSTRY IN THAILAND

Globally, the computer games industry has become bigger than other entertaining businesses such as movie and music. In 2006, the United State has 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) [6]. This is followed by the Japanese game market with a value of 187.8 billion Baht, and the Korean game market with the value of 102 billion Baht [6]. Even though the game market in Thailand is rather small in comparison with other markets, the Thai game industry has 5.7 billion Baht market value which is about 0.61% of the world

market [6]. The digital games industry in Thailand is now growing and progresses rapidly with the government's support under the national IT plan [7]. IT 2000 has provided the framework and guidelines for IT policies and initiatives for five years. After that, the National IT Committee (NITC) has conducted a research project and developed a ten year National IT Policy for the period 2001-2010 called IT2010. IT 2010 is identified five main goals that have to be developed. They are: e-Society, e-Education, e-Government, e-Commerce, and e-Industry.

In the e-Education aspect, educators tend to concentrated 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 of use [8]. As illustrates in Table 1, Personal Computers and Internet have high flexibility and high interactivity

Table 1: ICT and their potential for education [8]

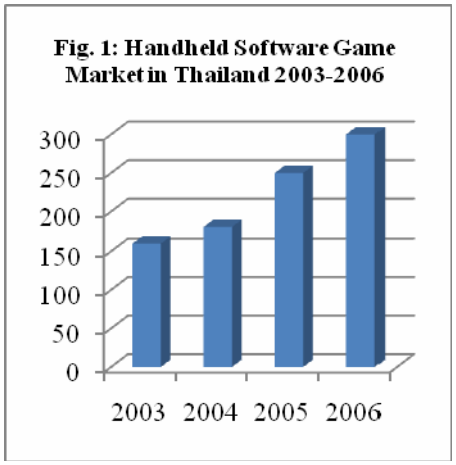
Technology	Outreach	Flexibility	Sensorial Stimulation	Interactivity
Audio	High	Limited	Audio only	Limited
Television	High	Limited	Audiovisual	Limited
Video	Low	High	Audiovisual	Limited
PC	Low	High	Audiovisual	High
Internet	Highest	High	Audiovisual	High

In term of the digital game development in Thailand, International Game Development Association (IGDA) [9] reported that there are roughly 43 Thai Game development companies. It can be observed that they are competing each other in producing and developing game applications using various tactics. Thai games industry can be divided into six sectors which are online games, 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 entered the market and the emergence of online games for the Thai communities [6]. The increasing growth of six game sectors is shown in Table 2.

Handheld game systems that are the most popular in Thailand are Nintendo DSLite (NDS) and PlayStation Portable (PSP). The market of handhelds game software in Thailand was quite stable during 2003-2004. The mid of 2005 was a turning point for the handheld game market due to the first appearance of handheld PSP and the Nintendo DS game consoles which helped boost the market to 40% that year [1]. The incline growth of handheld game from 2003-2006 in Thailand is illustrated in Figure 1.

Table2: Thai Game Market Value by Game Platform [6]

Game Platform	2003 mil. Baht	2004 mil. Baht	2005 mil. Baht	2006 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%)



According to the authors' research survey on the adoption of educational computer game in four universities in Thailand [10], it reveals the number of students and lecturers who regular play digital games on various platforms. As can be seen in Table 3, the percentages of students and lecturers play on PC platform are 92.2 % and 89.7% respectively. Apparently, the least popular platform is handheld which account the values of 40.7% and 31.0% from students and lecturers respectively.

The types of handheld games the respondents play are GameBoy, PSP, NDS. The proportions are illustrated in Figure 2

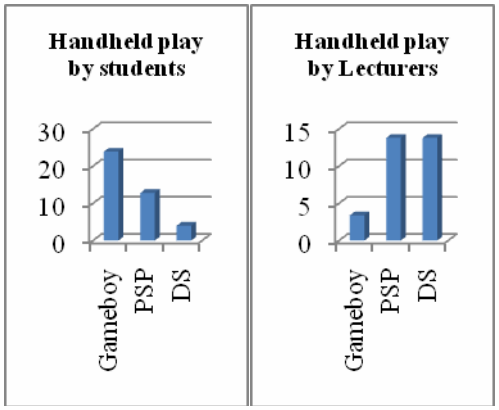
Table 3: Proportion of Thai students and Lecturers who play games on various digital game platforms

Computer Game Platform	Number of students who play games		Number of lecturers who play games	
	f	%	f	%
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

.

Fig 2: comparison of handheld game plays by students and lecturers (in percentage)



3. LEARNING AND TEACHING WITH TECHNOLOGY IN THAI COLLEGES

Thai colleges have use technology for educational purposes for decades. However, most Thai universities are mainly concentrated on the use of computer assisted instruction (CAI), World Wide Web and multimedia in undergraduate teaching [11]. According to the Reform Educational Act 1999, teaching and learning situation in higher education in Thailand faced new challenges [12]. This causes many paradigms shifts in educational context which include the provision of equal learning opportunity for all students, the learner-centred approached, and also the use of educational technology to enhance the effectiveness and efficiency of teaching and learning.

The reform educators in Thailand adopted student-centred learning as the main focus of change in teaching and learning approach. Student-centred learning puts more responsibility on the learners for their own learning. It involves students in the decision-making processes, and they learn by doing, rather than just by listening and performing meaningless tasks which are often out of context [13]. This student-centred approach is simply moved away from the highly teaching-centred or didactic approach that has existed for a long time in Thailand [14]. This teaching approach causes a lack of creativity among most students since they are waiting for the teacher to tell them what to do in the class. Additionally, the learning tasks focus on academic-oriented rather than practice-oriented and students may not be able to relate to real life situations. In term of learning style in classroom, Thai students may not feel comfortable in asking questions or voicing their opinions. Thai teachers are highly respected and they are typically considered as being knowledgeable and authoritative. From primary and secondary education to college education, educators put emphasis on "knowledge-oriented" education. Thus, they do not teach students to question or to take charge of their own learning process by coming up with their own solutions [15].Nonetheless, recent literature in learning theories which support the constructivist-learning paradigm indicate that computer games support student-centred learning. Traditional lecture-based classroom activities do not support constructivist learning or the computer-based teaching including CAI and the use of web supplements only that typically accompany courses and texts (Black, 2001, cited in [16]). Computer games can be used as a learning tool. They can be used to motivate the students [17]. They can also teach people about complex systems to solve problems and make the players involve with the decision making process and how such decision may bring impact to this world [18]. Results from the survey on the adoption of educational computer games (ECG) of Thai students and lecturers conduced recently [5] show that all the ECG acceptance factors have positive influence on Behavioural intent to use ECG. In other words, both Thai lecturers and students readily accept the use of educational computer games for classroom leaning. However, there are many digital game platforms which have different features and unique advantages for educational use. Handheld games have now become more accepted in many countries. The use of handheld game for teaching and learning is discussed in the following sections

4. CHARACTERISTIC OF PSP & NDS

4.1 Product features & functions

Apart from personal computers, two types of personal handheld game systems - PSP and NDS are gaining success in the game market because of their small size, portability, and their variety of functions. The PlayStation Portable (PSP) is a handheld game console manufactured and marketed by Sony Computer Entertainment. PSP is the first handheld game console to use an optical disc format Universal Media Disc (UMD), as its primary storage media. The features are large screen, robust multi-media

capabilities, and connectivity with other PSP and internet [19]. On the other hand, the Nintendo DS (DS or NDS) is a dual-screen handheld game console developed and manufactured by Nintendo. It was released in 2004 in Canada, the United States, and Japan. The console features a clamshell design, with two LCD screens. DS stands for Dual Screen, and the second screen can be used as an input device with a stylus. The unit also features a microphone and voice recognition that are integrated in some games such as the popular Nintendog [20]. The comparison of PSP and NDS components is illustrated in Table 4.

Table 4: PSP and NDS components

Component	PSP-Slim	NDS-Lite
Dimensions(mm)	169.4×18.6×71.4	133×73×21.5
Weight	198 gram	218 gram
Screen Size	4.3 inches	3 inches
LCD Screens	1 Screen	2 Screens
Resolution	480×272 pixels	256×192 pixels
Controller	Button, Camera	Button, Stylus
Speaker	Stereo Speakers	Stereo Speakers
Media	UMD	Cartridge
Connectivity	WI-FI	WI-FI
USB Interface	Yes	No
Storage	Memory Stick	No
Microphone	No	Yes
Headset	Yes	Yes
Built-in Memory	64 MB	4 MB
Battery Life	5-8 hrs	5-8 hrs

4.2 Advantages of PSP and NDS

There are several advantages in using handheld game consoles to aid education in the university classes. The first advantage is their portability because of their small size and light weight. Students can put it to effective use. The second advantage is that it has a good resolution LCD screens for presentation content to learner. NDS has two-tiered top and bottom LCD screens and the size of each screen is three inches. A PSP has a horizontal LCD screen and the screen size is 4.3 inches. The key feature of NDS bottom screen is that it is a touch screen.

Because of the comparatively low price of both PSP and NDS, most families in Thailand may afford to have one. In addition, not only young people but more adults between18 and 34 years olds [21] own PSP than adults who own a laptop computer. PSP has many multimedia functions built in, including DVD quality video playback and audio. Even though both PSP and NDS are considered as low cost handheld game consoles, NDS is cheaper than PSP. In addition, the cost of NDS is about a fifth to a tenth of a desktop or laptop computer. With touch screen, one can type on a graphical keyboard, draw images, make highlights on objects, move objects around, and imitate a graffiti-like letter recognition system. The advantages of PSP and NDS are shown in Table 5.

Table 5: The Advantages of PSP and NDS

Advantage	PSP-Slim	NDS-Lite
Portable	Yes	Yes
Weight	Lightweight	Lightweight
Output Screens	Wide Screen	2 Screens
LCD Colour	Yes	Yes
Resolution	480×272 pixels	256×192 pixels
Touch Screen	No	Yes
Add-on Device	Yes	Yes
Speaker	Stereo	Stereo
WI-FI	IEEE802.11b	IEEE802.11b
USB Interface	USB 2.0	No
Extend Memory	Memory Stick	N/A
Microphone	N/A	Yes
Headset	Yes	Yes
Multiplayer	supported	supported
Output to TV	Yes	No

4.3 Comparison PSP & NDS in Education Use

PSP and NDS have been widely used as learning tools in many schools in UK and Japan. Over the last 12 months, PSP mobilisation programs in education have been steadily growing in use and as part of the accredited programs across the UK. Currently there are some 60 different programs running in Northern Ireland, Scotland, Cumbria, The North East, Birmingham, Leeds, Liverpool, East Anglia, London, the West Country and Kent [22]. One English teachers from Mapleseden Noakes Secondary School, Maidstone Kent said [22]:

> *"PSP made low achievers want more challenge in their task - and that they could choose to do that. PSP provided more time to reflect and improve the quality of input. It gives you time to stand back more. the quality of learning*

outcomes improves as well, as it is more individualised and so you can focus on specific learning tasks.'"

Connected Education is one firm officially with Sony to distribute PSP's with the appropriate software and tools for use in education. It is stated on their website [1]:

"Government and leading educationalists identified that internet enabled handheld devices such as PDA's and other 'Smart Phones' can improve the access to rich multimedia educational content in the classroom, across the campus and at home. Recent pilots at places have endorsed the use of these handheld devices with teachers and students alike."

Connected Education has spent the last 3 months working with teachers, students, and schools validating the use and pedagogy for PSP into education [1].

One secondary school in Birmingham (UK) named Holyhead Secondary School is running a trial using PSP as a device to support learning process in the school. At first, the trial will be based on French, History, and Geography lessons. If the trial is successful, the plan will be extended and it is possible that PSP will be used all over UK's schools [2]. French language teacher of that school who used to work for Sony said, "*The console is just like a mini-computer, but fast, and you can use it to tailor-make lessons for pupils who need support or stretching*". The students are not allowed to run any kind of games on the console. Shirali-Shaereza also confirms the use of PSP handheld game is popular in Iran. In his paper, he [3] mentions that PSP was proposed as a tool used to improve English classes of Iranian Schools.

In term of teaching support, instructors can prepare contents in audio or video and provide course guidelines and assignment or discussion points on text e-book. Parents can also support their children learning. For example, if a child has problem understanding some subject topics such as mathematics, biology or physic…etc. because of poor teaching strategy, the parents can help the child by going through some open education resources available on the internet today, download a well prepared learning materials on the subject topic. On April, 2008, a company called Plato announced that they will be bringing educational games to the PSP platform. The games are designed to help elementary and middle school students in different academic subjects such as mathematics and language [23].

The Nintendo DS has also proven itself as an incredibly popular game system. As more and more educational software have been developed for the Nintendo DS, it may begin to expand its inroad into the classroom as an exciting learning tool. One of the first educational software releases was Brain Age. This software encourages building players' 'brain power' during their spare time. Additionally, NDS can also use to support language teaching. Recently, a girl junior high school in Tokyo, Japan adopted the Nintendo DS as a means to assist the teaching of English Language to the students. Students use the plastic stylus to spell words correctly and are awarded once they completed five levels. There are many other educational software titles for the DS. SAT review program is now being made for the DS, and Electronic Arts has mental puzzles that have also been around for quite awhile [24].

NDS is easy to use and it could be used in the classroom. This could reduce the pressure on the teachers who may be frightened or intimidated by modern technology. Kane [4] wrote in the article: Beyond Pokémon: Nintendo DS goes to school in Japan: "*The school found that nearly 80% of students who used the DS each day mastered junior-high-level competence in English vocabulary, compared with 18% before*."

Nintendo DS are also used for teaching problem-based learning from kindergarten through to twelfth grade students. In Lipinski's [5] research, he found that Problem-Based Learning (PBL) is a teaching approach that involves a student-centred methodology. With PBL, students can collaborate to solve problems and reflect on their experiences while working in small collaborative groups. He used three alternatives techniques to make PBL more accessible to the K-12 classroom. The results revealed that of all solutions that were investigated, Nintendo DS seems to be the most feasible in the case of teaching K-12. He also found that NDS provides a cheap, economical, and user friendly interface for PBL for Kindergarten through Twelfth Grade (K-12).

5. DISCUSSION

The advancement of technology offers the teachers and students with opportunities in experiencing interactive and innovative classroom activities. To teach creatively, technology integration should be well planned by incorporating strategies to foster students' learning and thinking creatively. Recently, the use of computer game in educational purpose has gained more attention in many schools and colleges. Most of the games that were implemented in the classroom are PC based [25]. Recently, mobile platforms like handheld PDAs have become more fashionable. In some countries such as UK, Japan have some trial uses of PSP and NDS for classroom learning. The majority use of these handheld game platforms focuses on language teaching and mathematics. One research employed NDS for Problem-Solving Learning (PBL) for kindergarten to K-12. Most of the studies on educational use of PSP and NDS focus on target group in primary and secondary schools. Even though some research emphasized on wireless mobile device in tertiary educational courses [26], use of handheld game platform like PSP and NDS are in tertiary level is hardly found.

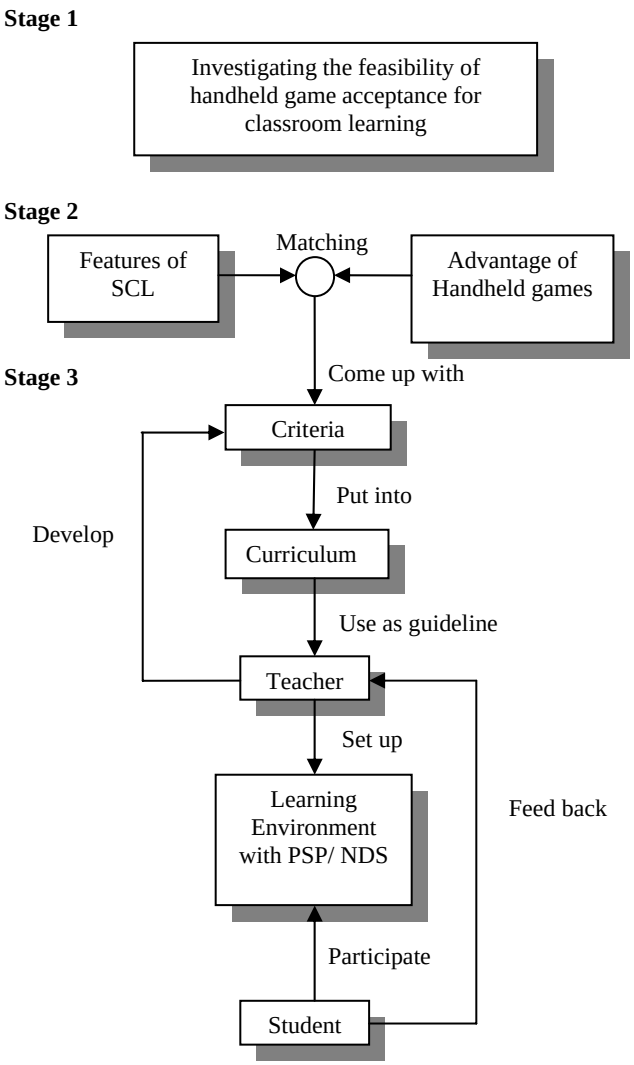
According to the Reform Education Act 1999 [27], Thai universities adopted student-centred learning as the main focus in teaching. It might be feasible that the educational use of PSP and NDS can support this learning environment. There are several reasons that these kinds of handheld game can be applied in tertiary curriculum courses: 1) handheld game machines especially PSP and NDS are still very popular for Thai young people. The market of handheld game software also registered a noticeable growth from the year 2003 to 2006 [6]; 2) practical features of the handheld platforms include portability; light weightless; low cost; easy to use etc., are all potential factors for accepting the devices for classroom use. 3) the educational use of handheld game can fulfil the features of student-centred learning (SCL). Those features of SCL are: focus on students' experience and interests; learning by doing; tasks 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. [13]. These features compete with potential uses of handheld game for learning. This assumption is supported by a study by Federation of American Scientists [28] who claimed that games could teach skills including: strategic thinking, interpret analysis, problem solving, forming and executing plans and adapting to rapid change.

Thus, in order to make use of handheld game for learning environment in Thai college, the authors would recommend a three stages study. Firstly, a survey should be conducted to examine the acceptance of these handheld games by the stakeholders. This includes students, lecturers, college administrators and students' parents. Secondly, set up the criteria of the potential benefit use of handheld games by matching the features of student-centred learning and the advantages of handheld games. Thirdly, incorporate the criteria into curriculum. Teacher uses criteria in curriculum as a guideline to set up the student-centred learning environment with handheld games. When students participate in this learning situation, they have to give feed back after each session of learning to the teacher for assessment. The teacher will evaluate, amend, and updates the curriculum. Figure 3 illustrates all stages of this conceptual model.

6. Conclusion

The body of theoretical and applied research concerning the use of computer games in teaching and learning in education is growing [25]. Much of these researches have been driven by two principles: 1) the desire to harness the motivational power of games in order to 'make learner fun', and 2) a belief that digital games offer a powerful learning tool [25]. Digital games played on many platforms involve: television-based systems, personal computer either online to a network or offline, handheld units such as Personal digital assistants (PDA), portable computer or mobile phone, and specific handheld consoles such as Sony PSP and Nintendo DS. Most games are PC-based, but recently digital handheld games such as PSP and NDS became gain more attention in classroom learning.

Fig. 3: Three Stages of adopting handheld games for learning in classroom



In higher education, the diffusion of computer technology increases inexplicably. All the Thai universities are networked and have broadband internet access. Thai universities are open to variety kinds of ICT use in classroom in one way or another. However, the idea of using educational digital games in classroom is remain uncertainty. At present, the acceptance of handheld game technology such as PSP and NDS in curriculum course is rather scared. This paper investigates the features, the advantages of these two kinds of handheld games in

educational use; the learning and teaching with technology in Thailand; and the teaching paradigm with student-centred learning. Subsequently, the authors propose the conceptual model "*Three stages of adopting handheld games for learning in classroom*". The stages include: 1) study the feasibility of handheld game adoption; 2) set up criteria of educational use of handheld games and 3) place into curriculum to support student-centred learning environment. It is hopeful that the contribution and proposal in this study will benefit Thai educators, students as well as Thai game software developers.

7. REFERENCES

[1] A. Field, "PSP in Education," [Online]. Available: http://www.effectiveict.co.uk/forum/index.php?showtopic=1487education, (2007, Jan.).

[2] "Sony PSP as an educational tool? " [Online]. Available: http://lusianadarmawan.wordpress.com/2007/04/04/sony-psp-as-an-education-tool, (2007, Apr.)

[3] M. Shirali-Shahreza, "Improving English Lab Classes Using Sony PSP (PlayStation Portable)," in *8th IEEE International Conference on Advanced Learning Technologies*, 2008, pp. 489-490.

[4] Y. I. Kane, "Beyond Pokémon: Nintendo DS goes to school in Japan," *The Wall Street Journal* p. A1, (2007, Jul.).

[5] M. Lipinski, "Feasibility of the Nintendo DS for Teaching Problem-Based Learning in Kindergarten through Twelfth Grade Students." vol. A thesis Master of Science: University of Missouri-Columbia, 2008.

[6] SIPA, *Animation and Games 2007*. Bangkok: SIPA, 2007.

[7] C. Thuvasethkul and T. Koanantakool, "National ICT Policy in Thailand," in *Africa-Asia Workshop: Promoting Co-operation in Information and Communication Technologies Development. 25-29 March 2002* Kaula Lumpur and Penang, 2002.

[8] W. Haddad and S. Jurich, "ICT for Education: Potential and Potency," in *Technologies of Education: Potential, Parameters and Prospects*, Haddad and A. Draxler, Eds.: UNESCO and Academy for Educational Development, 2002, pp. 28-40.

[9] IGDA, "Game Company Listing in Thailand." vol. 2007, 2006.

[10] K. Rapeepisarn, K. W. Wong, C. C. Fung, and M. S. Khine, "How Teaching and Learning Styles Affect the Adoption of Educational Game in Classroom?," in *The 6th Annual International Conference in Computer Game Design and Technology*, Liverpool, UK: John Moores University, 2008. (Submitted)

[11] J. Miller, "Technology and Education Reform in Computer Science in Thailand," in *International Conference on Computers in Education/SchoolNet 2001, 12-15 November* Seoul, Korea: Incheon National University of Education, 2001.

[12] S. Sombunthame and A. Theeraroungchaisiri, *Thailand Cyber University: The Strategic Move to Higher Education Reform*. Bangkok: Commission on Higher Education, 2006.

[13] G. Rogers, "Student-Centred Learning - A Practical Guide for Teachers," British Council, Bangkok June 2002.

[14] H. Pillay, "Teacher Development for Quality Learning: The Thailand Education Reform Project " 2002.

[15] - W. Srisa-arn, "The Reform of Higher Education in Thailand: Successes and Failures," *Journal of Education, Chulalongkorn University*, vol. 28, pp. 33-48, 2000.

[16] R. D. Blunt, "A Causal-Comparative Exploration of the Relationship between Game-Based Learning and Academic Achievement: Teaching Management with Video Games," in *Applied Management and Decision Sciences*. vol. Ph.D. Dissertation: Waden University, 2006.

[17] J. P. Gee, *What Video Games Have to Teach Us about Learning and Literacy?* New York: Palgrave Macmillan, 2003.

[18] M. Prensky, "Computer Games and Learning: Digital Game-Based Learning," in *Handbook of Computer Game Studies*, J. Raessen and J. Goldstein, Eds. Cambridge, MA.: MIT, 2005.

[19] PSP_About, "Sony Computer Entertainment," [online]. Available: http://www.us.playstation.com/psp/about, (2008, Mar.).

[20] Educational Game Research, "Educational use for Nintendo," [Online]. Available: http://edugamesblog.wordpress.com/2007/07/11/educational-uses-for-the-nintendo-ds/, (2008, Aug.).

[21] Graham, "Sony PSP as Educational Handheld? ," [Online]. Available: http://www.handheldlearning.co.uk/component/option,com_smf/Itemid,58/topic,237.msg782#msg782, (2005, Sept.)

[22] Connected Education, "PSP case studies in education," [Online]. Available: http://www.connectededucation.co.uk/Homepage?Plugin=ConnectedED&TTU=0&thelayout=3&docname=SonyPSPPilot, (2008, Aug.)

[23] M. Athab, "Plato Bring Educational Game to PSP," [Online]. Available: http://www.pspfanboy.com/2008/03/03/plato-brings-educational-games-to-psp, (2008, Mar.)

[24] Kcroy, "Nintendo DS as a Learning Tools in Schools," [Online]. Available: http://wirededucator.wordpress.com/2008/06/30/nintendo-ds-as-a-learning-tool-in-schools, (2008, Jun.)

[25] ELSPA, *Unlimited Learning: Computer and Video Games in the Learning Landscape*. London:

Entertainment and Leisure Software Publishers Association, 2006.
[26] T. Cochrane, "Learning with Wireless Mobile Devices and Social Software," in *Proceedings of the 23rd Annual Ascilite Conference: Who's Learning? Whose Technology?*, 2006.
[27] Office of the National Education Commission, *National Educational Act B.E. 2542 (1999)*. Bangkok: Office of Prime Minister, 2002.
[28] Federation of American Scientists, *Summit on Educational Game 2006*. Washington DC.: FAS, 2006.