

**HEA-OR-096**

**BENEFITS AND OBSTACLES IN USING COMPUTATIONAL AND INTERACTIVE TECHNOLOGIES IN EDUCATION.  
AN INSIGHT FROM TEACHER'S PERSPECTIVE  
(A STUDY ON BANGKOK METROPOLITAN ADMINISTRATION SCHOOLS)**

Lumpapun Punchoojit<sup>1</sup>, Pimonpan Isarabhakdi<sup>2</sup>

<sup>1</sup>*Department of Computer Science, Faculty of Science and Technology, Thammasat University, Pathum Thani, Thailand*

<sup>2</sup>*Institute of Population and Social Research, Mahidol University, Nakhon Pathom, Thailand*

Corresponding author's email: l.punchoojit@gmail.com

Child-Computer Interaction (CCI) is a growing sub-field of Human-Computer Interaction (HCI). It concerns phenomena surrounding the interaction between children and computational and communication technologies. Presently, there is a shortfall of empirical studies for establishing a solid design framework for children educational products. This study aims to be an initial step for future empirical research to establish a framework for the design of educational products for children. The study examined the use of computational and interactive technologies in primary and lower secondary levels in Thai schools. In-depth interview was carried out with six teachers from four schools. The results substantiated that the use of technologies had benefits on the students at all levels. Several computational and interactive technologies were found to be used in the education, and mobile devices were the primary source that the students used to access electronic information outside the classroom. Using interactive technologies helped promoting in-class motivation, and helps reducing barrier between teachers and students. Peer-assisting behavior was prevalent among the students. Several obstacles have been addressed by the informants. Some of them were caused by students' behaviors. Some were related to hardware, infrastructure, and classroom layout. Some of the problems were related to language incompetence.

**Keywords:** Child-Computer Interaction, Human-Computer Interaction, Children, Human Factors, Interview

## **1. INTRODUCTION**

Child-Computer Interaction (CCI) is an active research area in the recent years. This sub-field of HCI concerns phenomena surrounding the interaction between children and computational and communication technologies [1]. Similar to HCI, CCI is a multidisciplinary field which incorporates a wide range of research approaches, including psychology, developmental psychology, learning science, product and interaction design, computer science, media studies, and game design [1]. CCI has an extensive range of research themes, for instance, input methods, evaluation methods, product design [1,2]. The use of interactive technology as educational tool is also one of major research themes in CCI.

In Thailand, the immense growth in technology is changing education paradigm. Fundamental computer study has been in the basic education core curriculum since 1978 [3]. This is to equip students with computer literacy. Presently, computer is not the only digital instructional

media. Various interactive technologies have been used in education; for example, digital textbooks, CAI (Computer-Assisted Instruction) programs, and various educational software.

A number of studies confirm the benefits of using technologies in education. This includes motivating and keeping students engaged with the class [4]. The studies were mostly in educational area which focuses on learning outcome. In CCI, the major concern is to study the activities, behaviors, concerns, and abilities of children as they interact with computer technologies, and to design, evaluate, and implement interactive computing system for children [5].

It is important to allow children to perform computer activities that are at their level of development. Developmental Psychology indicates that children have certain capabilities and limitations that are different than adults; for instance, memory, attention, and motor abilities [6]. Thus, it is challenging to design products for children, as it must be consistent with children's ways of thinking and learning [7]. There are notable benefits of developmentally appropriate computer experience for children; for example, enabling them to acquire knowledge and skills faster through active participation [8]. If children perceive that the system is too difficult to use, their perception may influence their ability to absorb the materials [9].

In order to design usable products, a design framework is required. Presently, there is a shortfall of empirical studies for establishing a solid design framework for children educational products [1]. This study examined the use of computational and interactive technologies in students at primary and lower secondary levels in Thai schools, by gaining an insight from teacher's perspective. This study aims to be an initial step for future empirical research to establish a framework for the design of educational products for children. The results of this paper will help formulating hypotheses and direction to further empirical research in child-computer interaction.

## **2. METHODOLOGY**

### **2.1. Data Collection Method**

This study applied qualitative approach in data collection. Qualitative approach is appropriate since there is a shortfall of knowledge on the phenomenon. In-Depth interview, based on a pre-defined set of questions, was employed to collect the data from the informants. Conversations between informants and researcher were recorded, under given consent from the informants.

### **2.2. Informants**

There were six informants in this study, all of which were teachers who engaged in computer/ICT teaching. They worked in four different Bangkok Metropolitan Administration (BMA) schools. Five of the informants taught primary level students, while one informant taught lower secondary level students. The detailed descriptions of each school and the informants can be found in section IIIA.

### **2.3. Data Analysis**

Content analysis was employed to analyze the collected data. This covered interpretation and analysis of raw data, categorization of data, and conceptualization of the findings.

### 3. RESULTS

#### 3.1. School Settings

BMA schools are public schools, administered by BMA. In every district of Bangkok, there must be located at least one BMA school. Most of them offer primary level education. The students are mostly from families with low socioeconomic status. The four schools in this study locate in different districts; consisted of two medium-sized schools, one small-sized school, and one large-sized school. School size is categorized by its total number of students. According to the BMA Department of City Planning [10], a small-sized school is characterized by having the total number of students for not more than 400. A medium-sized school is characterized by having the total number of students from 401 to 800. A large-sized is characterized having the total number of students for at least 801.

The small-sized school in the study had 201 students. This school offered two kindergarten levels and six primary levels. The first medium-sized school in the study had 443 students. This school offered two kindergarten levels, and six primary levels. The second medium-sized school in the study had 624 students. Similarly, this school offered two kindergarten levels and six primary levels. The large-sized school in the study had 1093 students. This school offered two kindergarten levels, six primary levels, and three lower secondary levels. This covers compulsory education in Thailand.

The total number of students in each school led to differences in number of classrooms per each level. The small-sized school had only one classroom for each grade. The first medium-sized school had two classrooms for each grade. The second medium-sized school had three classrooms for each grade, except for the third grade which had two classrooms. The large-sized school had three classrooms for each grade, except for the fourth and the sixth grades which had four classrooms. Although the number of classrooms in each level were not equal among the schools, the number of students in each class was basically equal. Approximately, there were thirty students in each class.

#### 3.2. Classes

The study found that Bangkok Metropolitan Administration schools offered computer classes to the students since the first grade. Computer class was categorized as a part of Occupation and Technology Learning Substance Group.

At lower primary level (Grade 1 – 3), there was only one period for the Occupation and Technology class each week. Half of each semester, the students would be studying the ‘Occupation’ part. This part of the course covered the topics on, for example, daily living, helping family, preserving the environment, producing simple handcrafts, and sufficient economy [11]. Another half of the course, the students would be studying the ‘Technology’ part. This part of the course aimed to equip the students with computer skills, which included communication, information search, data and information usage, as well as values and impact of technology [11].

At upper primary levels and lower secondary levels, Occupation and Technology class was increased to two periods per week. The students would be studying the ‘Occupation’ part for one period, while another period would be allocated to the ‘Technology’ part.

Class hour allocation for computer class was similar in all schools. In some schools, an additional computer class were offered. In this study, the second medium-sized school offered an additional computer class to the students, both at lower and upper primary levels; and the large-

sized school offered an additional computer class to the students at upper primary and lower secondary levels.

The schools normally allowed a one-hour after-school access to the computer rooms, because the students were sometimes not able to finish the assignment within the class period, and some students were interested in practicing computer skills.

Approximately, a computer teacher has 200 – 300 students which they were responsible for. This directly depends on the size of the school and the number of computer teachers in the school. The small-sized school in this study had only one computer teacher. The teacher was responsible for the Technology part in the Occupation and Technology class at all grades. The first medium-sized school had two computers teacher. The teacher who was the key informant for this study was responsible for the Technology part in the Occupation and Technology class at upper primary level. The second medium-sized school had only one computer teacher. The teacher was responsible for both parts of the Occupation and Technology class at all grades, as well as the additional computer class. The large-sized school had three computer teachers. The first teacher was responsible for both parts in the Occupation and Technology class at lower primary level. The second teacher was responsible for the Technology part in the Occupation and Technology class and the additional computer class at upper primary level. The third teacher was responsible for the Technology part in the Occupation and Technology class and the additional computer class at lower secondary level.

### **3.3. Computer and Other Interactive Technologies Used in Schools**

The availability of students' home computer were fairly low. However, the number of other mobile device, such as tablets and smartphones, owned by students' families were considerably higher. This can be elaborated by the following comment from one of the teachers.

*Not many of them own computers. BMA students are not from wealthy families. Only some of them may have one (computer). But, almost all of them have phones, smartphones, or tablets. But they aren't allowed to bring them (the devices) to the school, as the students may lost them (the devices).*

#### *Computer Teacher 6*

All teachers provided similar answers. Computers are generally more difficult to afford than mobile devices. Socioeconomic status of students' families was the reason why they may find it harder to own computers. Thus, mobile devices were the primary source for BMA students to access electronic information at home.

At school, variety of IT devices has been provided for BMA students. This included desktop computers, OTPC (One Tablet Per Child) tablets, BMA tablets, Microsoft MultiPoint application, educational media in DVD-ROM, CD-ROM, and external hard disk drive, digital cameras, and digital video recorders. Some schools may have a smart classroom.

A smart classroom was typically equipped with an interactive projector screen that allowed the teacher to interact with it directly; what was written or clicked by the teacher would be displayed instantly on the screen. The teachers could also create their own educational media and projected it on the screen. According to the informants, not all schools had smart classroom, because the cost for building this room was considerably high.

OTPC tablets was distributed to grade 1 students in the academic year 2012, according to the policy statement of Thai government at that time. The tablets ran on Android operating system. They were installed with interactive educational media that the contents were identical with those of student textbooks. The device also supported content updates from the Ministry of Education.

Besides OTPC tablets, BMA tablets were distributed to BMA students; exclusively to grade 1 and grade 7 students. However, by the time the interview was conducted, the BMA tablets were not yet delivered to the schools.

Microsoft Multipoint was an application that allowed the students to perform activities, such as spelling bee, interactively on a shared computer screen. The application allowed simultaneous multiple input from mice on the same computer. A cartoon icon was used to represent a mouse cursor of each student.

### **3.4. Commercial Programs Taught at Schools**

A variety of commercial computer programs were taught to the students, as specified by the core curriculum. Grade 1 students would be introduced with basic computer knowledge and interaction; for example, what were computer apparatus, how to switch on and shut-down the computers, how to click or drag-and-drop with a mouse. Grade 2 and 3 students were introduced to the Microsoft Paint (or MS Paint) program, which was a simple drawing program in Windows operating system. Grade 4 would be studying Microsoft Word (or MS Word), a word processing program. They would be also introduced to information search on the Internet. Grade 5 students would be studying Microsoft PowerPoint program. In addition to MS PowerPoint, Grade 6 and 7 students would be studying Microsoft Excel (or MS Excel) program. Grade 8 students would be studying Dreamweaver, a web development tool. Grade 9 students would be studying Adobe Authorware, which the students could create interactive educational media on their own.

The teachers commented that the core curriculum may not be sufficient to define the class content. The teachers also needed to apply their own ideas or adapt to student's interest; for example, having the students create greeting cards or promotional posters with the programs they taught in class. This were not specified in the core curriculum.

### **3.5. Performance Evaluation**

Performance and learning in the computer class were evaluated on three domains: cognitive domain, psychomotor domain, and affective domain. The students would be tested on their theoretical knowledge in quizzes and examinations. They were also tested on their operational skills through assignments. They were also evaluated on the affective domain, which included moral disciplines and computer ethics.

### **3.6. Motivation, Interaction, and Learning Achievement**

The teachers stated that class atmosphere was more enjoyable in computer class; both for the teachers and the students. The use of computers and interactive technologies had apparent benefits on the student's in-class motivation. It promotes students' engagement and reduced the barrier between teacher and students.

The students were found to be highly active and motivated in the computer class. They were eager to come to the class, to participate in class activities, and to answer questions from the teachers. The students who had good computer skills were often in haste to finish in-class assignments. They did not hesitate to assist their peers in the assignments. Some of them bragged about their skills, in order to get compliments and admiration from the teachers. One of the teachers provided revealing comments:

They participated more, and talked more in the (computer) class; especially, when they finish the assignments - like, "Done! Have you guys finished?" They wanted to show off their ability to their peers and the teacher. It was just like this in the computer class.

## 4th Asian Academic Society International Conference (AASIC) 2016

### *Globalizing Asia: Integrating Science, Technology and Humanities for Future Growth and Development*

#### Computer Teacher 5

Comparing with the class that use only textbooks, the students showed more interest and motivation in the class that use computers or other interactive devices; even the content on the books and on the computers or tablets were the same.

When I used only textbooks, they tended to be quiet. When I used the computers, they tended to compete each other to answer my questions. The learning environment was more enjoyable in the computer class.

#### Computer Teacher 2

They are more motivated in using computers (than textbooks); even I assigned them to read the same content.

#### Computer Teacher 3

In computer class, the students were more likely to have more peer interaction and discussion. When the teachers assigned some tasks, the students who were fast learners would voluntarily assist their peers who could not follow the tasks. This helped the teachers a lot; especially when there were several students that could not catch up. The informants stated that this made the students prided themselves, and helped boosting their study motivation and self-esteem. The teachers observed that the students understood explanations given by their peers more than those of the teachers. However, the teachers always needed to make sure that the students who could not catch up were able to complete the tasks by themselves.

Regarding interaction with the teachers, the students were not afraid of the teachers and they were enthusiastic to ask questions or to share originality in a computer class. The teachers stated that this was different from the other classes which the students tended to be passive and quiet. Some students also helped other teachers out with computer programs, or volunteered in school projects by helping with PowerPoint presentation or publicized posters.

The students were also keen in devoting their time to study on their own. Some students who had home computers may practice on the tasks that they learned from the class, or may even study in advance. Some students who did not own home computers typically access the computer room during the one-hour after-school session. Their motivation was essentially self-directed.

Average score of computer class was usually higher than those of other classes. Typically, students' average scores were around 60 – 70 percent; the average score of computer class was around 80 percent. This was similar in the classes that emphasized both theoretical knowledge and practical skills, such as physical education, art, and performance art.

There were apparent in-group differences among the students. Some of them were quick learners, while some other students were slower. The students who were faster in practical skills usually owned home computers, or may play a lot of computer games; thus, they could practice computer skills more than their classmates.

Gender difference was also pointed out. It was stated that male students were more enthusiastic in the class than female students; thus, male students were often quicker than female students in computer class.

### **3.7. Obstacles, Solutions, and Attitudes towards the Use of Computational and Interactive Technologies in Education**

#### **3.7.1. Obstacles and Solutions**

The interview revealed five categories of obstacles found in computer teaching and computer classes in BMA schools. The detailed descriptions of each obstacle, its effects, and solutions to such problem are described in the following sub-sections.

##### **3.7.1.1. Disinterested Behaviors**

Student's disinterested behaviors could be an obstacle to the study. Most of the time, disinterested students could not manage to follow their classmates. Computer lessons were usually in a step-by-step manner. When there were some students who could not follow, the rest of the class needed to wait. As a result of that, it slowed down the whole class. There were two apparent reasons for disinterested behaviors: getting distracted by games or the Internet, and talking in class.

When the students accessed the computers or IT devices, it was possible to reach other contents that were not related to the class; for example, games, social media sites, or other Internet contents. Thus, the students were distracted from the class. The solution to prevent this problem, given by the informants, was that they walked around the classroom, to ensure that the students were actually working on the class content. Changing classroom layout was also a strategy for teachers to be able to monitor student's behavior during the class.

Some students talked to their friends in the class. This could be disturbing and distracting for other students. The prevention to this disruptive behavior was to discourage it from occurring; for example, asking questions occasionally to keep the students focus on the class. In addition, teachers normally prefer to use peer-assisted strategy when there were many students who could not follow.

##### **3.7.1.2. Hardware Malfunction and Unstable Network**

Hardware malfunction and unstable network connection were also obstacles in computer teaching. Hardware malfunction was commonly found in the computer classes. This was disruptive for the study, as the students needed to switch their workstations to the vacant ones.

Unstable network connection was a crucial problem in computer classes. This prevented the students from completing class assignments that required Internet search. Consequently, it slowed down the progress of the class. Some schools that had low network bandwidth could not have the students access the Internet all at once. The teachers needed to allow only half of the class to access the Internet first. Once the first half finished searching, the other half could access the Internet.

##### **3.7.1.3. Inconvenient Classroom Layout**

The space to build a computer room could be limited in some schools. Once the computer workstations were fully installed in the room, it became too tight to walk around. This blocked the teachers from reaching the students who sat at the back of the room.

The peer-assisted learning strategy was applied to alleviate the problem. The strategy was to partner a fast learner with a slower one; thus, the faster one could assist their peer instantly, without having the teachers reached the slower one.

### **3.7.1.4. Language Incompetence**

Language incompetence was a great barrier to any areas of study, including computer study which used many English terms. This definitely hindered the understanding of the class.

For students whose native language is Thai, English language incompetence was apparent when the students took written examinations, even the students might be able to perform well on practical session. On written examination, the questions which contained any English words were usually skipped; even though they were basic technical words or program names. According to one of the teachers, she observed that, in practical session, the students tended to memorize program functions as images and their locations, not by their names.

The strategy to tackle the problem was to have the students write the words and the pronunciations down in a notebook. It would help the students to memorize the words.

The problem of having limited vocabularies and language incompetence was more common among lower primary level students. With limited English vocabulary, many students at this level were relatively slow in studying computer.

The teachers stated that they may need to slow down the lecture or may need to go over the content again and again, to ensure that all students could follow the contents. Peer-assisting strategy were sometimes applied to deal with the situation.

### **3.7.1.5. Failed to Recheck the Works**

The students were often in haste to finish the tasks assigned by the teachers; however, they often failed to recheck their works. This was common with the assignments that involve copying and pasting information from the Internet. Some students did not even read the contents of the information they copied.

The teachers coped with this problem by warning the students that they would be asked about the contents they copied.

### **3.7.2. Attitudes**

The teachers agreed that using computers and interactive technologies in study were beneficial for the students. The interactive nature of such devices could easily draw student's attention to the class. At the lower primary level, the devices helped the students to learn how to read faster than the textbooks because the devices looked more interesting; so, the students paid more attention to the class. Furthermore, students at all levels were enthusiastic in participating in the class. Those who were good at computer skills were willing to teach and share their knowledge with their peers. This was actually an ideal environment for a classroom. Computer technology also helped the students in finding information that they may need.

However, the teachers perceived that technology can bring negative incidents in many ways. First, computers and IT devices can distracting be for some students. Thus, the teachers always needed to ensure that the students were focusing on the class content. Second, the students could not develop their fine motor skills if they used too much technology. For example, the tablets may require only one finger to operate the system. Thus, the teachers needed to have them frequently engaged in the activities that would develop their fine motor skills, such as writing. Lastly, technology allows the access to inappropriate content for children, for example, pornography, and illegal activities. They may also be targeted by online sexual predators. Presently, the schools already provided the lectures on computer ethics, and prevented the students from accessing such



content. However, the students needed to be information literate when there was neither school nor parental supervision.

### 4. CONCLUSIONS

#### 4.1. Conclusions

This study examined the use of computational and interactive technologies in students at primary and lower secondary levels in Thai schools, by gaining an insight from teacher's perspective. In-Depth interview was employed to collect data from the six informants, all of which were computer teachers in BMA schools.

The study found that various interactive educational technologies were used in BMA schools. The technologies included desktop computers, tablets, Microsoft Multipoint, smart classroom, CAI media, and other educational software. The use of technologies was found to have benefits on the students. The teachers stated that class atmosphere was more enjoyable in computer class; both for the teachers and the students. It helped promoting in-class interest, motivation, and engagement. Peer-assisting behavior in computer class was found to be more prevalent than other classes. Those who are fast learners were voluntarily willing to teach their peers. The students also had more peer discussion and interaction. It also helped reducing barrier between teacher and students. The teachers stated that this was different from the other classes which the students tended to be passive and quiet. The students were also willing to devote their time studying outside the class. Average score of computer class was apparently higher than the score of other classes.

Several obstacles have been addressed. Some of them were caused by students' disinterested behaviors. Some were related to hardware and infrastructure. Some of the problems were related to language incompetence.

The informants agreed that using computers and technologies benefited students, as they could keep students engaged and enjoy the class. However, the students also needed to be equipped with information literacy, in order to prevent themselves from negative incidents.

#### 4.2. Future Works

This work gives an insight on the use of computers and other interactive technologies in education from teacher's perspective. In order to get the whole picture, the future work could be done by conducting a further investigation with the students. This would provide an extensive understanding from their perspective.

Based upon information provided by the informants, further research could be made. One could be made on child-appropriate language level used in educational software for children of different ages; especially when the original language of the software and student's native language were different. In addition, a further investigation can be made on search strategy employed by children, as one teacher pointed out that students rather looked at the program icons than read icon labels whenever they wanted to access a program.

### REFERENCES

1. J. C. Read and P. Markopoulos, "Child-Computer Interaction," *Int. J. Child-Computer Interaction*, vol. 1, pp.2-6, 2013.
2. CCI Workshop (2011) Theme issue on Child Computer Interaction [Online] Available: [http://www.springer.com/cda/content/document/cda\\_downloadaddocument/Theme+issue+on+Child+Computer+Interaction.pdf?SGWID=0-0-45-1057537-p1118980](http://www.springer.com/cda/content/document/cda_downloadaddocument/Theme+issue+on+Child+Computer+Interaction.pdf?SGWID=0-0-45-1057537-p1118980)

## 4th Asian Academic Society International Conference (AASIC) 2016

### *Globalizing Asia: Integrating Science, Technology and Humanities for Future Growth and Development*

3. Thamwipat K. and Rodloy P. (n.d.) A Study of Problems on Computer Teaching of Teachers in Primary School: a Case Study of North Thonburi Group, Bangkok [Online] Available: <http://digital.lib.kmutt.ac.th/magazine/issue8/articles/article3.html>
4. Noor-UI-Amin (2014) An Effective Use of ICT for Education and Learning by Drawing on Worldwide Knowledge, Research, and Experience [Online] Available: <http://www.nyu.edu/classes/keefer/waoe/amins.pdf>
5. J. C. Read and M. M. Bekker, "The Nature of Child-Computer Interaction," in Proc. 25th BCS Conference on Human-Computer Interaction, 2011, pp.163-170.
6. I. Radu and B. MacIntyre, "Using Child Developmental Psychology to Guide Augmented-Reality Design and Usability," in IEEE Int. Symp. Mixed and Augmented Reality, Atlanta, GA, 2012, pp. 227-236.
7. H. Gelderblom and P. Kotze, "Ten Design Lessons from the Literature on Child Development and Children's Use of Technology," in Proc. IDC 2009, Como, Italy, 2009, pp. 52-60.
8. S. W. Haugland and J. Wright, *Young Children and Technology: A World of Discovery*. New York, 1997.
9. S. MacFarlane, G. Sim and M. Horton, "Assessing Usability and Fun in Educational Software," in Proc. IDC 2005, Boulder, CO, 2005, pp. 103-109.
10. Department of City Planning, Bangkok Metropolitan Administration (2011) [Online] Available: [http://cpd.bangkok.go.th:90/web2/strategy/DATA54/ED\\_BKK54.pdf](http://cpd.bangkok.go.th:90/web2/strategy/DATA54/ED_BKK54.pdf)
11. Office of the Basic Education Commission, Ministry of Education (2008) *Indicators and Core Curriculum: Occupation and Technology Learning Substance Group* [Online] Available: [http://www.thaischool.in.th/\\_files/thaischool/09.pdf](http://www.thaischool.in.th/_files/thaischool/09.pdf)