JAMES COOK UNIVERSITY

DOCTORAL THESIS

Culture-Centred Integration of ICT in Southeast Asia Secondary Schools

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Declaration Of Authorship

I, V. Sithira Vadivel, declare that this thesis titled "Culture Centred integration of ICT in Southeast Asia Secondary Schools" and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly during candidature for a research degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. Except for such quotations, this thesis is entirely my work.
- I have acknowledged all primary sources of help.
- Where the thesis is based on work done by myself jointly with others, I have acknowledged all primary sources of help.
- Where the thesis is based on work done jointly with others, I have clarified exactly what others did and what I have contributed myself.

Signed: _____

Date: 5th September 2022 _____

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Abstract

All of us want a good education for ourselves and our loved ones. However, that is not the case for many people in different parts of the world. Education in Southeast Asia (SEA) Secondary schools have been lagging behind the Western regions as reported in the Global Education Monitoring Report 2020. According to the Global Education Monitoring Report, the majority of illiterates aged between 25 to 64 (269 million) are found in Central and Southern Asia (UNESCO, 2020). To improve teaching and learning, mobile education was introduced. Western countries have been successful in improving educational qualities using advanced online tools and mobile Information Communication Technology (ICT). The Global Census Education report in 2018, reported that the United States leads in smartphone use with 74% usage in classrooms compared to the **whiteboard use as a popular education tool in SEA classrooms** (UCLES, 2018). To catch up with the West, SEA countries have also been strongly supporting ICT uses in education. The ministries of education in the Philippines, Malaysia, Indonesia, and Brunei have also been supporting the adoption of technology-assisted learning in secondary schools to assist teachers and students to improve teaching and learning experiences. However, the report by UNESCO 2015 states that ICT tools are not engaging and are inappropriate for students' age or ability level (UNESCO, 2015).

In this thesis, I identify the ICT adoption challenges that hinder the effective use of ICT in SEA secondary schools. **The first challenge** is the slow adoption of ICT in education in SEA. Especially the countries surrounding Singapore show that there is an inefficient and ineffective use of ICT with poor learning outcomes and poor learning experiences. Despite government initiatives to promote ICT use in schools, the uptake of e-learning technology in Southeast Asia countries has been considerably low.

The second challenge is that the ICT design hinders teachers' effective use of ICT in Southeast Asia. Teachers and students have shown significant resistance to ICT use of culturally incompatible ICT solutions. As the early architects of computing technology designed and responded to western culture (Tedre et al., 2006), this factor disenchants Southeast Asian teachers and students toward effective use of ICT.

The third challenge is that there have been no studies on the cultural preferences of teachers and students in Southeast Asia. The culture-centred ICT design for Southeast Asia significantly affects the development of culturally compatible ICT solutions for education. This hinders a smooth transition for effective use of ICT and improves the adoption rate in Southeast Asia.

The fourth challenge is the lack of cultural and emotional metaphor studies in ICT design for Southeast Asia. Deep emotional cultural presence of cultural metaphor must be present to evoke cultural affection towards ICT use. Triggering and conjuring the same emotions during cultural festival activities calibrate cultural dynamics and exhibit the ability to view the learning content with ICT trough the cultural lenses.

The aims of this thesis are to (i) **investigate** the slow adoption of ICT solutions, (ii) **study** the cultural preferences, (iii) **design and evaluate** cultural themed ICT design and cultural activity ICT, and (iv) **develop** new ICT guidelines and practices for secondary schools that will **accelerate the adoption** of ICT solutions in Southeast Asia.

This thesis starts by **surveying** the approach, usage, perception, and challenges of adopting technology among teachers and students in secondary schools in the Philippines, Malaysia, Indonesia, and Brunei. The survey included 342 teachers and 978 students from four Southeast Asian countries. I then identified the following as critical barriers to adopting ICT in Southeast Asia: (i) cultural barriers and resistance among teachers in Southeast Asia; (ii) cultural emotions exist among teachers and students; (iii) students prefer teacher-centred learning over mobile-based learning; and (iv) current educational technology is not culturally compatible for Southeast Asian teachers. New culture-centred ICT design and activities are developed and evaluated in two Southeast Asian countries, Brunei and Indonesia. The surveys and evaluation results postulate four ICT guidelines: festive themes, auspicious cultural activity, non-auspicious activity, and emotional cultural metaphor. I call the guidelines Cultural Motivational Elements. Cultural Motivational Elements are used to formulate culturally aligned interactions for mobile online game-based learning platforms. Cultural Motivational Elements are evaluated in secondary schools in Indonesia and Brunei. The result shows improved learning outcomes and learning experiences in science education. Thus, removing cultural barriers and resistance among teachers and students in Southeast Asia. This will accelerate the adoption of ICT in Southeast Asia.

This thesis provides five significant contributions. Firstly, for the first time, I have conducted a comprehensive survey of ICT adoption in Southeast Asia since the 2012 UNESCO report. The result of the study shows low educational technology use in Southeast Asian secondary schools. From the data analysis, I identified **vital epistemological barriers** for both teachers and students in Southeast Asia, such as the cultural incompatibility of western ICT. This contribution is discussed in Chapter Four.

Secondly, **cultural themes metaphor (**playing activities with **a festive theme)** were developed and evaluated: A new cultural emotional metaphor. This contribution is discussed in Chapter Five.

Thirdly, **for the first-time culture-based ICT** was designed, developed, and evaluated in two countries in Southeast Asia that share similar cultural artefacts but speak other languages/dialects. The culture-based ICT is designed as playing a popular traditional game as **cultural activity metaphor,** an activity of creating a cultural object **(auspicious activity metaphor)** with a **cultural gift metaphor** as **an emotional cultural metaphor**. The evaluation result significantly improves learning outcomes, teaching, and learning experiences. This contribution is discussed in Chapter Six.

Fourthly, four **Cultural Motivational Elements ICT guidelines** that **significantly improve education** in Southeast Asia were formulated by incorporating interactive cultural activities metaphor (non-auspicious), auspicious activity metaphor, cultural theme metaphor, and gift metaphor as a cultural emotional metaphor. This contribution is discussed in Chapter Seven.

Fifthly, using the **Cultural Motivational Elements, I extended the current Human-Computer Interaction Model** with a new extension of cultural motivational elements with (i) cultural theme as an emotional cultural metaphor; (ii) cultural gifts as an emotional cultural metaphor; (iii) cultural activities (auspicious and non-auspicious) as a deep emotional metaphor. This was proposed upon successfully evaluating the culture-based ICT evaluation in Indonesia and Brunei secondary schools. This contribution is discussed in Chapter Seven.

Keywords: Culture-centred ICT, Culture-based education, interactive culture, motivational culture, auspicious culture, auspicious interaction, emotional metaphor, deep emotional metaphors, motivated cultural learning, cultural activity, cultural theme.

Table Of Contents

List of Figures

List of Tables

List of Abbreviations

ICT	Information Communication Technology
UAI	Uncertainty Avoidance Index
IDV	Individualism
MAS	Masculinity
PDI	Power Distance Index
UNESCO	United Nations Educational, Scientific, and Cultural Organization
SEA	Southeast Asia
CMEs	Cultural Motivational Elements
HCI	Human Computer Interactions
SEM	Structural Equation Model
CP	Cultural Pride
CM	Cultural Motivation
CFA	Confirmatory Factor Analysis
TUPS	Technology Uses and Perception Survey

Chapter 1 Outline

1. Introduction

1.1 Current State and Challenges of ICT

1.2 The Missing Culture in ICT for Southeast Asia

1.3 Motivating Challenges

1.4 Research Questions

1.5 Aims

1.6 Contributions

1.6.1 Practical Contributions

1.6.2 Theoretical Contributions

1.7 Overview of the Research Method

1.7.1 Initial Assumptions

1.7.2 What This Thesis is About

1.8 The Structure of this Thesis

1.9 Publications

1 Introduction

This thesis investigates the slow adoption of Information Communication Technology (ICT) and the factors hindering ICT use in Southeast Asia (SEA) secondary schools. To identify the factors, a comprehensive survey of ICT adoption has been carried out in four SEA countries: Brunei, Indonesia, Malaysia, and the Philippines secondary schools. Results from the surveyed data show new findings of low educational technology use in SEA secondary schools and cultural factors that hinder ICT adoption in Southeast Asia secondary schools.

For the first time in the world, this thesis proposes the Cultural Motivational Elements ICT (CME ICT) guidelines for SEA secondary schools. The guidelines have been developed based on the factors identified during the survey, and I proposed, designed and evaluated four new solutions, which are listed below:

i. Cultural themes (E.g., festive themes) as a new Cultural Theme Metaphor;
ii. Cultural gifts as Cultural Gift Metaphors;
iii. Non-auspicious activity as new Cultural Activity Metaphors;
iv. Auspicious activity as new Cultural Activity Metaphors.

These solutions were proposed as CME ICT guidelines and practices.

Before proceeding further, I will explain the significance of cultural themes and cultural activities in Southeast Asia. It describes how I derived the new cultural theme metaphor, cultural gift metaphors and cultural activity metaphors as the ICT solution to improve the slow adoption of ICT in SEA.

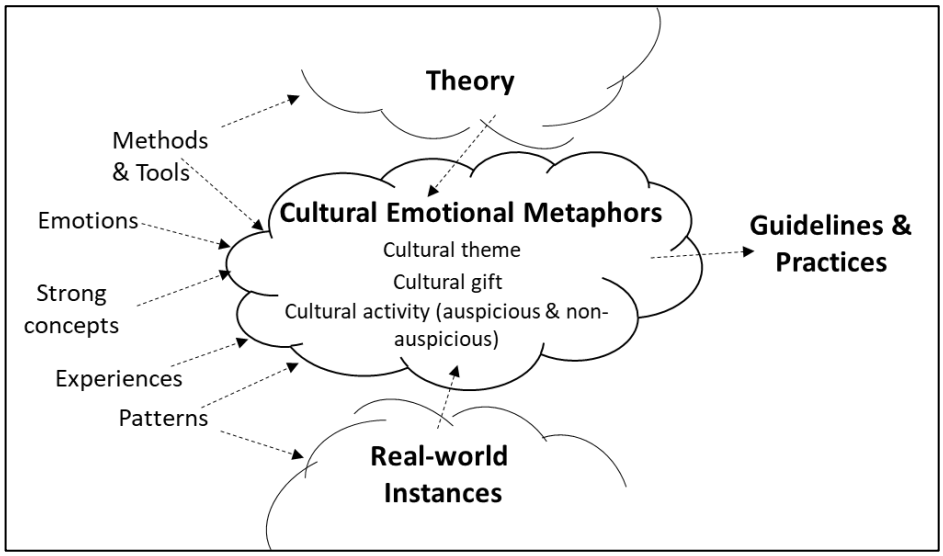

Figure 1-1: Concept of proposed solution.

I define Cultural Emotional Metaphors as a stimulant that evokes cultural experiences when most members of a given culture participate in a unique event or an activity that induces cultural emotional attachments. In this paper, I define Cultural themes as part of Cultural Emotional Metaphors. Cultural themes can be created based on cultural festivals, also called traditional events (E.g., traditional weddings), that are often celebrated in harmony in SEA. Cultural festivals can evoke users' cultural emotions (Berger, 2012). During festivals, there are festive spirits with a passionate atmosphere. Cultural emotional experience can be felt during local cultural festivals in SEA, E.g., Lunar New Year, Ramadhan festivals, Diwali and Christmas. The festive interaction of giving and sharing in SEA is more meaningful and connected with users because it evokes an emotional festive mood (Swearer, 2010). As examples of cultural themes created from cultural festivals, I observed that during Christmas, the festive spirit is stimulated by the presence of a decorated Christmas tree, exchanging gifts among family members, and mingling with Santa Claus. The festive mood during the celebration can be experienced during the occasion, thus triggering cultural emotions. The same cultural emotions can be felt during Lunar New Year when red packets and oranges are exchanged with joy and happiness during the festive occasion. Examples of cultural themes that evoke the same emotions, excitement and joy in the community can also be observed during Traditional weddings in Southeast Asia, such as traditional Muslim, Chinese, Hindu, and Christian weddings. These cultural themes, such as festive themes and traditional wedding themes, connect people with cultural emotions (mood) while in celebration. The uses of cultural icons or cultural symbols, such as pagoda, chopsticks that are used as cultural metaphors (Lukas, 2007; Saxe, 2012) and agricultural metaphors (Cole, 1991) instill familiarity when compared to festivity themes and traditional wedding themes that can spur emotional festive mood (Wolf, 2000). The positive emotion triggers cultural excitement and cultural joy of celebration. Cultural icons that symbolise cultural themes can be used as emotional metaphors that trigger cultural emotions.

As examples of cultural gifts as Emotional Metaphors, I observed the use of ketupat (rice dumplings) as gifts during the Ramadhan festivals (Vinning and Crippen, 1999), the gift of ang pow packets (red packet) during Lunar New Year (Ling, 2021), and the lighting of lamps during Diwali (Kumar, 2015) are perceived as a gift with good wishes, good fortune, and prosperity during festivals and during auspicious occasions. These gestures of gift offerings can go beyond a simple cultural metaphor. Cultural gift as emotional metaphors triggers cultural emotions among users as it signifies good luck and good fortune. Cultural icons symbolising propositions during cultural festivals and events have emotional attachments. Such cultural objects evoke excitement and joy among users. The use of cultural icons as emotional metaphors strengthens the cultural emotions and cultural pride among Southeast Asians.

As examples of non-auspicious activities, I observed the traditional cultural games and activities played by people in SEA. These activities are aligned with cultural values and are essential to SEA. Cultural games played during a non-auspicious period and as leisure activities, such as the gasing (top),

kite (wau) flying and printing batik designs (silk prints) activity in SEA (Jaelani et al., 2013), further amplify the effect of connecting the user to the profound cultural activity experiences of playing the cultural activities (Akhir et al., 2015) with emotions that evokes excitement, happiness, and joy of playing. The sorting or ordering games generally used in computer games merely instill user experience. However, the non-auspicious traditional cultural activity, such as the gasing (top) and printing batik (silk prints), evokes cultural experience while playing the activity and immersing in the culturally fascinating game. Thus, cultural activities can be classified as deep cultural and emotional activities. This cultural activity can go beyond festive cultural themes and apprenticeship metaphor, which focuses on the system (Rogoff, 2008) and culturally sustaining pedagogy practices (Ladson-Billings, 1995).

As examples of auspicious cultural activities, I observed the traditional cultural activities during an auspicious period, such as presenting Ang Pow packets (red packets) by the elders to their children, the lion dance or dragon dance during Chinese festivals, the tea ceremony during traditional Chinese weddings, the lighting of lamps during celebrations for the Hindus (festival of lights) and Buddhist religions, eating turkey during thanksgiving (Christmas) and decorating Christmas trees for the Christian faith, are forms of auspicious activities that are perceived to bring happiness, success, good luck, and fortune. These activities promote cultural emotions among Southeast Asians (Choo, 2011). An example of an auspicious activity is constructing or building an auspicious object. Examples of such activities are designing an Ang Pow (red packet) packet, building or designing lanterns, designing an auspicious lamp, building or decorating Christmas trees, and building or designing auspicious dragons allows them to connect to the cultural experiences deeply. This experience goes beyond cultural metaphors, as proposed in Eglash's work on culturally situated design tools for the simulation of cultural arts (Eglash et al., 2006), where deep cultural emotions were not expressed during the simulation activity. Similarly, the scholars whose research was on cultural forms and cultural metaphors by Geoff Saxe, Michael Cole, and Barbara Rogoff (Saxe, 2015; Cole, 1971; Rogoff, 2003) were not necessarily related to the Southeast Asian context and cultural experiences. This postulates a critical limitation in the existing literature, which my research fills the gap.

Festive themes such as Ramadhan, Chinese Lunar New Year, and Christmas can be transformed into cultural themes used in educational technology designs and as emotional metaphors. Playing cultural activities (non-auspicious), constructing/designing an auspicious object as an auspicious activity with the use of cultural gifts as ideas hints in educational technology that conjures deep emotional experience while playing cultural activities among users that can go beyond cultural metaphors. The educational technology design can be fully transformed to evoke deep cultural emotions. These solutions can improve slow ICT adoption in SEA as users feel more emotionally connected to ICT activities. The current state of ICT involves the student in a move to acquire knowledge learned where cultural emotions are the missing driving force. The significance of cultural

themes, cultural activities (non-auspicious and auspicious activities), and emotional metaphors are clearly explained in this section; now, I move forward with the Background.

1.1 Current State and Challenges of ICT

Southeast Asian secondary schools and their ICT preparedness have faced several challenges. The teachers' and students' resistance to accommodating educational technology integration is at the forefront of the evolving academic challenges of technological advancement. The problems are more profound in some regions, with some schools being slow to adopt technology-assisted learning and showing resistance to change (Yap et al., 2008).

Based on 2012 statistics from the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the percentage of ICT-qualified teachers in Southeast Asian secondary schools is 50% in the Philippines and 11% in Malaysia, with no recorded statistics for Cambodia, Myanmar, and Indonesia (UNESCO, 2012). The UNESCO statistics on ICT infrastructure in secondary institutions with Internet-assisted instruction showed only Brunei and Singapore at 100%, Thailand at 97%, Malaysia at 96%, the Philippines at 28%, and no recorded statistics for Myanmar, Indonesia, and Cambodia. A fast-forward to 2020, according to the United Nations Educational, Scientific, and Cultural Organization, schools in Asia are still behind their Western counterparts in integrating educational technology (Global Education Monitoring Report, 2020). One of the main challenges in Southeast Asia, as stated in the Reports on the use of VLE-Frog (the e-learning platform used in Malaysian secondary schools), showed that most teachers were reluctant to use the platform as they did not enjoy using it and its implementation brought a certain amount of anxiety and threat; hence, it affected not only students' exposure to technology and e-learning but also their learning outcomes (Rashid 2014; Shazali and Hashim 2018).

The question that requires great attention at this juncture and the second challenge is, does ICT design hinders teachers' effective use in Southeast Asia? The design and architecture of computer systems are dominantly western, and the early architects of computing technology shaped and responded to the varying needs of Western society (Tedre et al., 2006). As such, the use of game-based learning in ICT has a western influence. Game-based techniques such as counting games, arranging games, and comparing games lack cultural learning dynamics. As such, the west's approach to ICT hinders the vast exploration of ICT in Southeast Asia.

At this point, I present the third challenge in ICT design to inspire SEA teachers and students and entice them to make a comfortable transition into using ICT for long-life learning (Lasagabaster, 2018). The fourth challenge is to get people to view learning content through the cultural lens (Johnson, 2000; Stambulova and Ryba, 2014) and accept the knowledge that aligns with their cultural values. Attractive cultural visuals can evoke positive emotions in learners and facilitate learning (Plass et al., 2014).

1.2 The Missing Culture in ICT for Southeast Asia

Researchers have long been working on integrating cultural artefacts as cultural metaphors. What we fail to understand is that cultural artefacts are not culture for the reason that cultural artefacts are not associated with deep cultural emotions. A deep emotional attachment must be present for the use of cultural metaphors. As such, it is crucial to use cultural metaphors to trigger cultural emotions and affection towards ICT with traditional festivals as cultural emotional metaphors. These replicate the same cultural emotions during celebrations which evoke festivity, joy, and happiness with the feeling of delight while working in a festive atmosphere, dynamics, and mood. To get people to view learning content through the cultural festivity lenses, festivities integrated ICT as a cultural emotional metaphor can be used.

Another viable technique is to treat ICT as an auspicious object for acquiring knowledge. Auspicious practices and beliefs are still given attention and utmost importance among Southeast Asians as they begin new events and activities. It is also believed that any events commenced on an inauspicious day will result in a disappointing yield (Farrelly et al., 2011). Chinese society has similar beliefs that auspicious beginnings can yield positive results. This can be observed among Chinese people in Singapore and around the world. Similarly, auspicious activities such as lighting lamps for auspicious occasions during Hindu and Buddhist festivals, and the use of 'Ang Pow' (red packet) during Chinese auspicious occasions, are considered significant and observed as auspicious that yield positive results among Southeast Asians. The auspicious activity of making and designing auspicious objects in ICT can go beyond emotional metaphors.

Traditional games in Southeast Asia have racial and cultural values. A study observing the impact of traditional games on students showed that the traditional games intervention program was highly effective and significantly improved children's fitness and motor skills (Gipit et al., 2017). Emotional intelligence can be observed through traditional games (Adiati, 2016). Traditional and cultural games can positively boost the morale of learners, as they have the potential to uplift learners' spirits while participating in the activity. Cultural activities are not forgotten, such as Congkak, a traditional board game with 16 holes played in villages in Southeast Asia with seeds or marbles. This game is played in the Philippines, as Sungka and Congkak in Indonesia, Malaysia, and Singapore (Kwok et al., 2018). Another traditional cultural game, Gasing or top in English, is frequently played in villages in Southeast Asia (Muzaini, 2017). The game of Gasing is spined with a rope and requires continuous spinning. This game is also played as part of the cultural competition in Indonesia and Malaysia to preserve national culture. Batik design (silk painting) is another traditional cultural activity in Southeast Asia that demonstrates the art and craft of traditional art design on fabrics and ornaments with vibrant designs and colours. Such traditional games are still shown in schools in Southeast Asia as part of cultural activities during racial harmony events and as tourist attractions. As part of preserving the culture of racial groups and maintaining racial harmony (Chua, 2005). Such activities and games

are close to the hearts of Southeast Asian learners as they grow and are exposed to those cultural dynamics. Such cultural activities are not neglected in Southeast Asia. Cultural activities and games are viable techniques to de-stress learners. Students can be diverted to a more relaxed and calm activity while concurrently gaining knowledge. This creates a learning comfort zone while simultaneously elevating cultural emotions with ICT. The involvement in playing cultural activity goes beyond cultural emotional metaphor.

Cultural emotional metaphors evoke emotional attachment toward festive activities. Cultural festivals have long been celebrated and rejoiced with a festivity mood. Our own specific culture mimics our identity, which warrants affirmation. Much of what is discussed in the primary metaphor is derived from human's five distinct senses: vision, taste, audition, smell, and touch. The sense of sight, touch, and audition alone would not postulate the significance of metaphors in the cultural domain. It must go beyond the sense of sight, touch, and audition, where it can trigger a sense of belonging that stirs cultural emotions. These modalities can arise in cultural emotional metaphors. Celebration of festivals naturally stirs cultural emotions. As such, it is fundamentally a bodily emotional experience that can go beyond primary metaphors. Thus, it is likely that western metaphors will not hold any emotional significance in this context. Western metaphors cannot be treated as universal and used in ICTs. Thus, cultural emotional metaphors can go beyond merely cultural artefacts, which are the missing elements in ICT design for Southeast Asia. The advancement of educational technology and the uptake of ICT tools will forever remain the same due to the cultural aspects of these countries. Thus, many new educational technologies and ICT are, to some extent, unexplored and untouched.

1.3 Motivating Challenges

The challenges identified here are as discussed in Section 1.1. It is impossible to solve all challenges identified in the education industry in SEA. However, the following challenges are significant and require attention to promote and improve ICT use in Southeast Asian schools,

1. **The main challenge** is the uptake of e-learning technology in Southeast Asian countries has been considerably slow, and most teachers are reluctant to use the platform as they do not enjoy using it.
2. **The second challenge is the ICT design** that hinders teachers' effective use in Southeast Asia. The design and architecture of computer systems are dominantly western.
3. **The third challenge** in ICT design is to inspire SEA teachers and students and entice them into making a comfortable transition into using ICT and maintain the ICT sustainability.
4. **The fourth challenge** is getting people to view the learning content through a cultural lens that simplifies acquiring knowledge.

1.4 Research Questions

The specific research questions are stated as follows:

RQ1: What barriers to slow ICT adoption in Southeast Asian schools?

This question addresses the **main challenge** and is required as a basis for the rest of the investigations. This research question will be further discussed in the relevant chapters to identify significant barriers to slow ICT adoption in Southeast Asia that impedes ICT uptake.

RQ2: Is the lack of cultural values the main factor for slow ICT adoption in Southeast Asia schools?

This question situates the study of cultural challenges in ICT design and addresses the **second challenge** of ICT design that affects teachers' effective use in SEA. Taken from the practice side, this research question tackles the practices of cultural values and the corresponding cultural design that affects ICT utilisation in SEA secondary schools.

RQ3: Are emotional cultural objects the preferred icons and metaphors in educational technology?

This question situates the study of emotional cultural objects in ICT for SEA and addresses the **third challenge** of ICT design. The study examines cultural preferences and how these inclinations are used as an emotional metaphor in ICT design. This research question is an extension of research question 2.

RQ4: Do cultural-related activities and design improve teaching/learning experience and learning outcome?

This question addresses the **fourth challenge** of ICT design to view learning content through a cultural lens. The question situates the study of cultural principles and beliefs. Specifically, the exploration of this question is provided by selecting cultural activities which have not been previously explored in culture-based ICT literature. This research question is an extension of research question 3.

1.5 Aims

Given the four challenges introduced in Section 1.2, I have formulated several research aims tied to the knowledge discovery process, leading to my study. Each of the aims focuses on addressing one of the four challenges. The aims are as follows:

Aim 1: Investigate the barriers to slow adoption of ICT solutions (Chapters Two and Four). This aim targets SEA schools as benefactors. This aim is to discover critical epistemological barriers affecting SEA secondary schools that affect the slow adoption of ICT.

Aim 2: Study the Southeast Asia-specific cultural preferences and cultural emotions (Chapters Four, Five, Six, and Seven). This aim targets teachers and students as benefactors. This aim is to discover cultural preferences and emotions among teachers and students. The cultural preferences and emotions are believed to hinder the effective use of ICT in SEA. This aim is the starting point of the cultural investigation for SEA.

Aim 3: Develop and Evaluate Southeast Asia-specific cultural ICT design (cultural theme) and Cultural activity (Chapters Five and Six). This aim targets teachers and students as benefactors. This aim investigates cultural preferences and acceptance among teachers and students in SEA by developing and evaluating SEA-specific culture-based ICT design.

Aim 4: Develop new ICT guidelines and frameworks for Secondary schools that will accelerate the adoption of ICT solutions in Southeast Asia (Chapter Seven). This aim targets ICT designers and schools as benefactors. This aim is to achieve culturally specific requirements for SEA by developing new culture-centred ICT guidelines and frameworks. These guidelines and frameworks will accelerate ICT adoption in SEA secondary schools, and the guidelines will serve as a model for future ICT design.

1.6 Contributions

This thesis provides five significant contributions. The contributions are presented in sections 1.6.1 Practical contributions (three significant contributions) and 1.6.2 Theoretical contributions (two significant contributions).

1.6.1 Practical Contributions

Firstly, a comprehensive survey of ICT adoption in SEA was conducted for the first time since 2012 (UNESCO, 2012) and reported new findings on low educational technology use in SEA secondary schools. From the data analysed, I identified **critical epistemological barriers** for teachers and students in SEA, such as the cultural incompatibility of western ICT solutions. This is presented in Chapter Four (Sithira et al., 2021).

Secondly, the **cultural theme of ICT was developed and evaluated as a festive theme:** A new cultural emotional metaphor. This is presented in Chapter Five (Sithira et al., 2020).

Thirdly, specific practices of the guidelines have been proposed, developed, and evaluated: **playing activities with cultural themes (festive themes), playing a popular traditional game as the cultural activity metaphor (non-auspicious activity), an activity of designing a cultural object (auspicious activity) and cultural gift emotional metaphor in activities**. This is presented in Chapter Six.

1.6.2 Theoretical Contributions

Fourthly, **four CMEs ICT guidelines** that **significantly improved education** in SEA were formulated by incorporating interactive cultural activities metaphor (non-auspicious), cultural activities metaphor (auspicious activities), cultural themes (cultural emotional) metaphors, cultural gift emotional metaphor. This is presented in Chapter Seven (Sithira et al., 2020).

Fifthly, using the CMEs, I extended the current HCI model. The **extension of the HCI model** with three cultural motivational elements: (i) Cultural Themes Metaphors; (ii) Cultural gift metaphor; (iii) Interactive Cultural Activities Metaphor (auspicious and non-auspicious activities) as deep emotional metaphor. This is presented in Chapter Seven.

1.7 Overview of the Research Method

This section briefly describes the overall approach of this study. I started by discussing an initial assumption about this study; then, I presented the actors and the settings involved in my research.

1.7.1 Initial Assumptions

The research work described below relied on initial assumptions on the abstract knowledge of HCI design and how this knowledge can be operationalised in the design aspect.

The first assumption is that culture is a broad context requiring sub-division to explore the required intent of cultural values and beliefs, which significantly impact cultural emotion. This assumption is consistent with the approach (Norman et al., 2004) on the model of emotion, where they identified visceral, behavioural, and reflective, which has a different impact on product design and reception.

The second assumption is that people show respect and have great pride in their cultural values and beliefs. Cultural prides are deep-rooted, and people are more connected to this aspect of life. This assumption is aligned with McCarthy and Wright's (2004) framework of the user experience in terms of how it is 'felt' by the user.

The third assumption is that people have pleasurable experiences with cultural events. This assumption is aligned with Jordon's (2000) based on Tiger's (1992) framework of pleasure. There could be identifiable resources that researchers could create for designers' intention and that is presented in a way that designers can engage meaningfully.

Chapter eight provides a reflection on the research described in the intervening chapters and how these assumptions are supported by providing a different view on the relationship of HCI abstract knowledge and design with the discussion on limitations and future recommendations.

1.7.2 What This Thesis is About

To better understand the context of this thesis, I now identify three main actors and their practice who will benefit from this research:

- Designers for ICT design practice. For the sake of this thesis, this can be defined as the activity of designing and producing interactive activities, artefacts, and experiences in the technological context. Design practice is structured in several communities of course, and what individual

practitioners consider their design object, methodological orientation, and their job descriptions to be, for example, “user experience design”, “interactive design”, or the use of artefacts in the most straightforward direction;

- Educators for teaching practice with ICT. For the sake of this thesis, this can be defined by the activity of exploring educational tools to support their teaching practices with ease and convenience, reducing cultural barriers resulting in long-term and sustainable ICT use;
- Learners for ICT learning practice. For the sake of this thesis, this can be defined by the activity of exploring educational tools to support their learning practices with ease and convenience, reducing cultural barriers and to simplify learning.

These three practice situations are linked by “non-human” objects and forms knowledge which act as bridges. The HCI knowledge that includes cultural aspects and events is the main bridge between researchers and designers for the context of this thesis.

1.8 The Structure of This Thesis

I now describe the role of each chapter in this thesis.

In Chapter Two I present the literature review chapter, I discuss related work on ICT solutions in education and culture, first by reviewing ICT use in western and Southeast Asia countries. I review selected articles and journals based on relevancy and applicability to education, technology, and cultural perspective. The sections are divided into ICT in Education: Western Approach; Challenges in Asian schools: UNESCO data; Presence of Uncertainty Avoidance; Impact of Southeast Asian Culture; Cultural and Emotional aspects in Asia; Culture-centred ICT for Education; Role of Cultural Games among Southeast Asians; Gaps and Critical Review; Research Hypotheses.

In Chapter Three I introduce the research method, I describe the overall approach taken in this thesis. The summary of studies starts from a literature review, followed by the study on the comprehensive survey. Focus groups that led to study one. I outline the study one which is on the festive theme design and evaluation and finally study two, which is a case study where cultural activity experiments with the proposed culture-based ICT guidelines.

In Chapter Four I propose a comprehensive survey that spans across two approaches. I first discuss the survey base on country perspectives, data analysis from Malaysia and Indonesia secondary schools and followed by data analysis from the Philippines and Brunei secondary schools. Secondly, I discuss the survey base on teachers’ and students’ perspectives: analysis based on teachers’ data and perspectives across the four countries and followed by analysis based on students’ data and views across the four countries. The Data analysis section use Mann-Whitney U Test, descriptive statistics (mean and standard deviation), descriptive and use of inferential statistics to compute the mean, standard deviation, frequency, and Pearson’s correlation coefficient, one-way ANOVA, and PLS-SEM

Bootstrapping using SmartPLS. This study aims to **identify the barriers** to the slow adoption of ICT in Southeast Asia and to discover the presence of **cultural motivation** among teachers and students.

In Chapter Five (study one) I discuss the design of educational tools with cultural themes, using **festive themes metaphors as new cultural emotional metaphors** as the preferred mode of teaching and learning. By doing so, this chapter evaluates festive theme educational tools as cultural emotional metaphors. Data was analysed based on descriptive statistics (mean and standard deviation).

In Chapter Six (study two), I propose auspicious activity and cultural activity as new cultural activity metaphors to build/design auspicious objects and to play cultural activity (non-auspicious). I design and evaluate the prototype as **interactive cultural activity metaphor (non-auspicious and auspicious activity)** and **cultural gift metaphors** with culture-centred ICT guidelines. This chapter evaluates and validates the relevance of interactive cultural activities for non-auspicious and auspicious interactive activities as new classes of experience where such a learning model has not been used proposed so far. The data analysis for this section use basic statistical analysis, T-test, Structural Equation Model (SEM) and Confirmatory Factor Analysis (CFA).

In Chapter Seven, I propose the four **CMEs ICT guidelines**. Following the outcome of the literature review, comprehensive survey, study one and study two and their commonalities, chapter seven engage the results and findings. I propose an interpretive framework to discuss the experience of live cultural activity and design guidelines to support this domain. As a main contribution to this thesis, the detail illustration of CMEs ICT guidelines and practices is in Appendix B as a main contribution to this thesis. In this chapter, I also explain the **extension of the current HCI model** with my significant findings for future ICT design and implementation.

Finally, in the concluding Chapter Eight, I present and discuss a reflection on the whole thesis, the status of cultural motivational elements as theory and how they relate to the design activities.

Table 1-1 shows the list of publications for each chapter that are either published or accepted for publications. A journal version of Chapter six is currently under review by Transaction of Computer-Human Interaction.

1.9 Publications

Table 1-1: List of Publications.

Chapter	Title	Reference
2	Improving teaching and learning in Southeast Asian secondary schools with the use of culturally motivated web and mobile technology.	(Vadivel, 2017)
3	None	-
4	Cultural Emotion Games as Trajectory Learning in Southeast Asia. *(Another Section of this Chapter was sent to Journal of Technology, Knowledge and Learning - under review)*	(Vadivel, 2021)
5	Culturally Themed Educational Tools for Enhancing Learning in Southeast Asian Secondary Schools.	(Vadivel, 2020)
6	Cultural Activities as New Cultural Metaphor *(This Chapter was sent to Transaction of Computer-Human Interaction - TOCHI)*	(Vadivel, 2022. Cultural Activities as New Cultural Metaphor). [Unpublished manuscript].
7	CMEs ICT guidelines and practices and an extension to the HCI model (*This Chapter was sent to HCII Conference – Accepted)*	HCI International Conference 2022 (published by Springer under the LNCS series)
8	None	-

Chapter 2 Outline

2. Literature Review

2.1 Literature Survey

2.2 ICT in Education: Western Approach

2.3 Challenges in Asian Schools

2.3.1 UNESCO Data

2.3.2 Challenges in ICT Acceptance & Readiness

2.3.3 Western and Asian Learning Styles

2.4 Cultural Presence in Asia

2.4.1 Cultural and Emotional Aspects in Asia

2.4.2 Computer-related Anxiety

2.4.3 Culture-Centred ICT for Education - Asians' Cultural Pride and Motivation

2.5 Studies of Metaphors

2.5.1 Linking Cultural Activities as Cultural Metaphors - Auspicious and Non-Auspicious

2.5.2 Linking Cultural Offerings (Gifts) as Cultural Metaphors

2.6 Identified Gaps: Missing Cultural Metaphors for ICT in Southeast Asia

2.6.1 Research Hypotheses

2 Literature Review

In this chapter, I will explain the research method used. I review relevant application areas, approaches, problems, gaps, and evaluation methods of ICT in education to identify trends and opportunities to improve ICT adoption in SEA education. I will start with a general approach to ICT use (Western to Asian) and move towards a more specific method of cultural metaphors in ICT to highlight the significant gaps. More specifically, through this literature review, I identify the challenges of Southeast Asian users towards the western approach and cultural aspects.

These areas are divided into sub-topics as stated here: 2.1 is the Literature Survey where I present the techniques used for the selection of literature. The western process and challenges are discussed in 2.2 Western approach and 2.3 Challenges in Asian schools with the specific discussion from UNESCO data. The importance of cultural aspects in Southeast Asia is discussed in 2.4 as cultural presence in Asia; in 2.5, I discuss Ethnocomputing and Anthropological studies and the current studies on metaphors, and in 2.6, I identify and discuss the gaps: missing cultural metaphors for ICT in Southeast Asia, in 2.7 I propose the research hypotheses. Sections 2.2 and 2.3 are mainly introductory to the problem identification in my thesis, and Sections 2.4 to 2.6 primarily contribute to the gaps and solutions in my thesis. I will further expand some of these sections in the preceding chapters to highlight the significance and how it contributes to my final solution.

2.1 Literature Survey

To begin the research, the research method used literature and journals were reviewed to identify potential gaps and to understand the body of knowledge. The JCU E-library, Google Scholar, and Online Digital Library (Research Gate and SAGE) were used to identify journals, research papers, books, and theses. Since the research was based on technological integration in Southeast Asian secondary schools from a cultural perspective, the keywords used for searching the literature were ‘mobile education’, ‘education with social media’, ‘technology and education’, ‘cultural presence in Asia’, ‘technological and pedagogical’, ‘smart learning’, ‘ICT in Southeast Asian schools’, ‘culture and pedagogical approaches’, ‘cultural emotions’ and ‘Southeast Asian culture and game-based learning’.

About 120 pieces of literature were selected, with publication years ranging from 1983 to the present day. The earlier published journals and articles were selected to study pedagogy and andragogy approaches, cultural values, and educational models and frameworks. Publications from 1983 to 2000 were relevant to analyse the foundational studies on the proposed education and cultural perspectives model. The selected technical literature hailed from the twenty-first century, ranging from 2000 to the present. To narrow the scope, only literature that focused on educational methods in secondary and primary schools worldwide with an emphasis on classroom activities in Asian schools was included. The literature discussed Asian teaching and learning approaches and associated with the cultural values

in classroom learning. These provided a foundational perspective in identifying the differences in teaching and learning techniques applied by Western and Asian communities based on their cultural views. The technical literature and journals were selected based on the latest technology that identified how mobile technology, game-based learning, and social networking improved educational values.

2.2 ICT in Education: Western Approach

This section identifies the Western approach to embracing ICT in education. The Western regions showed a more positive acceptance of using tablets, laptops, or mobile devices. The study on mobile devices among secondary school students in Greece revealed that mobile phones are the primary device used by all students (Nikolopoulou, 2018). Teachers in Europe were also more confident in mobile-based learning. Wastiau et al.'s, 2013 showed that digitally skilled teachers in Europe were satisfied and optimistic about the impact of ICT on learning by organising more ICT-based activities for their students. Indeed, it also shows that more confident and supportive teachers use ICT infrastructure effectively and explore the potential of ICT. In addition, the study by Wastiau et al. (2013) found that tablet devices, laptops, and mobile phones can be used optimally in European education (Wastiau et al., 2013). Spires and other researchers (Spires et al., 2008) also found similar results among 4,000 middle school students in North Carolina. Students wanted more creative and ubiquitous technology usage in school, as they believed learning was more fun using technology (Spires et al., 2008). Westerners are more willing to explore ICT and forthcoming in embracing ICT. The same results were echoed in Clark's work (Clark et al., 2009), which explored students aged between 11 and 16 years from the cities of London, where the learners display more positive perceptions and experiences of technology-mediated activities in school (Clark et al., 2009). Western teachers and students are more open to technology-based learning.

Technology use improves interactivity and promotes high engagement with positive experiences among students. This outcome reverberated in the study to observe Australian students' active engagement and positive experiences when using an online program. The observation shows that students happily engaged with the online materials and enjoyed using the online program. Researchers have also demonstrated that using advanced technology was appealing to students in the western regions. Students were willing to explore the advanced technological tool features incorporated into their learning. Their willingness and exploratory attitude can also be observed in higher educational institutions. For example, the University of Kentucky College of Pharmacy observed many students eager to provide feedback using the Audience Response Systems (ARS), a tool designed to aid faculty members in engaging and interacting with students (Cain et al., 2009). European students were more willing to embrace e-learning platforms. Scholars on e-learning acceptance measures found that British students are more eager to embrace e-learning as part of their learning opportunities than Lebanese students (Tarhini et al., 2016). The technology transition and acceptance in the west have been

successful compared to the Asian region. This problem could be due to cultural factors affecting technology design, ultimately affecting the success rate of technology use (Al-Gahtani, 2004).

I could relate the level of technology acceptance by western students to the universal approach of ICT design which suits well the westerners. The reason to iterate this point at this juncture is to highlight the significant differences between Western culture from other cultures and how the current ICT design suits western users' preferences. For instance, specific hand gestures are interpreted differently in a different culture. In Western culture, the "thumbs-up" sign signifies approval, whereas, in Bangladesh, it means a confrontation with people. In western culture, avoiding eye contact is considered submissive; however, in Arabic culture, eye contact is often avoided because humility is an essential aspect of the Islamic religion (Ellsworth and Carlsmith, 1973; Okano, 1994; Rhema and Miliszewska, 2010). In a similar context, the design of software applications for the icons, symbols, and colours are inclined toward the western approach and compatibility rather than the universal approach. When ICT was concerned, much attention was paid to Western inspirations and practices.

The following section focuses on critical indicators of ICT utilisation and challenges faced in Asian schools. In 2.2.1, I discuss ICT use in Southeast Asia with relevance to UNESCO data; in 2.2.2, I discuss the challenges in ICT acceptance and readiness in Asia.

2.3 Challenges in Asian Schools

2.3.1 UNESCO Data

Low ICT-qualified teachers in Southeast Asia reflect on the slow ICT adoption in Southeast Asia. Based on 2012 statistics from UNESCO, the percentage of ICT-qualified teachers in Southeast Asian secondary schools is 50% in the Philippines, 11% in Malaysia, and 90% in Thailand, with no recorded statistics for Cambodia, Myanmar and Indonesia (Information and Communication Technology in Education in Asia, 2012). Even adults in Asia have low basic ICT skills compared to adults in Western regions. UNESCO's 2020 Global Education Monitoring Report data showed that the percentage of adults possessing eight basic ICT skills (using the basic arithmetic formulas in a spreadsheet and creating an electronic presentation with presentation software) in Cambodia, Indonesia, and Malaysia is in the lower range (below 30%), while the percentage of adults possessing eight basic ICT skills in Denmark, Iceland, and Luxembourg is in the higher range (above 50%). Furthermore, the rate of adults with fifteen or more ICT skills in Denmark, France, Finland, and Germany is above 40%, while the percentage of adults with fifteen or more ICT skills in Southeast Asian countries is much lower. In Cambodia, for instance, only 9% of adults possess these skills, and in Indonesia, only 8% have these skills. No data was available for Thailand, Vietnam, the Philippines, and Myanmar. The data on the percentage of schools with ICT for pedagogical purposes show that only 32% of Southern Asian schools have the internet, while 100% of European schools have the Internet (Global Education Monitoring Report, 2020). Even with government initiatives, the statistics on ICT for Southeast Asia are still

considered low. This low basic ICT skills among Asians could result from UNESCO's approach and framework, which are inclined toward western policies and European schools. Based on a 2019 UNESCO report, European student mobility increased with the level of study; hence, mobility programmes for East and Southeast Asian students are to be built based on the European experience (Global Education Monitoring Report, 2019). This approach failed to promote the localised cultural stance, which could place substantial importance on Asian students who have strong emotional attachments to their cultural values (Kim et al., 2001).

2.3.2 Challenges in ICT Acceptance & Readiness in Asia

To state the cultural importance of ICT design and readiness, I could relate it to the acceptance of E-learning platforms in Southeast Asia. The Frog Virtual Learning Environment (VLE) has been used to enhance teaching and learning in Malaysia's public schools since 2012. However, a study on teachers' readiness to utilise Frog VLE in a Malaysian secondary school classified as a 'champion school' showed that teachers from the monitored school were still lacking in readiness and possessed inadequate skills in accessing Frog VLE (Kaur and Hussein, 2014). Another study on teachers' perceptions of e-learning in Malaysian secondary schools demonstrated that, besides limited ICT skills, low English proficiency is also a barrier to understanding the language used by Frog VLE. This, in turn, has caused confusion among teachers and students (Mei et al., 2017). A similar problem was observed in the acceptance and readiness for e-learning in North-eastern Thailand, which showed that the participants liked how online learning could be used anytime and anywhere. However, despite the positive perceptions, teachers had no experience with online teaching; hence, they were unprepared to use an online learning system (Anchalee and Jonathan, 2016). A similar situation appeared in Indonesia when an e-learning program adopted in 2016 demonstrated that attitudes toward e-learning are closely tied to perceptions about the ease of use and utility of e-learning programs; however, they could not understand the program's benefit (Haryanto et al., 2016).

College students in the Philippines did not appreciate the learning management system (LMS) because they felt that some features, such as sharing files and socialising with their peers, were like those of Social Networking Sites (SNS). When a system is easy to use, it is also perceived as applicable (Garcia, 2017). The study on ICT integration and challenges faced by teachers in Filipino schools showed that teachers were not interested in being trained in ICT utilisation in classrooms because they found that some ICT skills did not apply to their lessons. Moreover, some older teachers were no longer interested in learning ICT because they had difficulty adapting to it (Daling, 2018). Westernised education solutions and design hinder Southeast Asian teachers' and students' abilities to explore ICT easily. Southeast Asian students and teachers struggle to comprehend incompatible education tools in

classrooms that lack Southeast Asian values and practices. This point positioned Southeast Asian technology users as uncomfortable using westernised ICT.

2.3.3 Western and Asian Learning Styles with ICT

Asian students are more submissive and reluctant in nature when compared to their Western counterparts. This could be due to the language barrier. The results from Liu and Littlewood (1997) showed that 43% of students felt uncomfortable speaking in the Department of English at Hong Kong Polytechnic University. Furthermore, the study explored Asian students' participation in classroom learning, including their learning experience, attitudes, and proficiency. The students' discomfort in speaking English appeared simply because they did not have much practice with it (Liu and Littlewood, 1997). The researchers speculated that the negative attitude to participation among East Asian students might have been related to the local and academic cultures in which the students operated (Liu and Littlewood, 1997). Wong (2004) observed the learning styles of Asian international undergraduate students at South Australian University and found that learning styles in Asian countries are more teacher-centred, where teachers give students most or all the information. The different learning styles between Western and Asian students were highlighted by Tweed and Lehman (2002), who studied culture-influenced aspects in academic learning. Their work showed that Western-influenced students learn more by questioning ideas than Chinese-influenced students. The findings suggested that European-Canadian and Chinese Canadian students have a more Socratic approach to learning than Asian-born Chinese Canadian students (Tweed and Lehman, 2002).

The technology design does affect the learning styles of students. The study of technology design was highlighted by Zhang (2007), a researcher who reviewed ICT in Eastern schools by focusing on the pedagogical culture of technology design and use. This result corroborates the work by Chen et al. (1999), who studied web-based reflective inquiries in the student-centred learning system in Singapore. Chen identifies culturally mediated social interactions toward a shared vision are essential for an effective learning environment (Chen et al., 1999). Hallinger (1998) also pointed out that a traditional and centrally mandated educational reform can be outdated. Southeast Asia schools must develop the capacity for continuous innovation through locally adapted cultures for policies and practices. The incompatibility of current educational technology can result from the absence of an Asian learning context and cultural presence in the ICT solutions. Scholars have long been researching the cultural aspects and their integration into educational technology. However, the cultural reality and how well culture can facilitate ICT design is still not fully addressed for ICT acceleration in Southeast Asia.

The studies discussed in this Section highlight significant ICT challenges faced in Southeast Asia. In the following sections, I focus on the cultural aspects as the missing factor in ICT design and ICT acceleration in Southeast Asia. In Section 2.3, I explore the significance of cultural presence,

cultural practices, and their importance in Asia. I will discuss the general aspects of culture moving towards the specific area of culture-centred ICT for Southeast Asia.

2.4 Cultural Presence in Asia

In this section, I will first discuss the cultural work of Hofstede, which is the foundation for my proposal of cultural assimilation for ICT. Hofstede's cultural indexes were used in study two, discussed in chapter six.

Hofstede (1983) conducted a comprehensive study of how values at the workplace are influenced by culture. Hofstede analysed an extensive database of employees covering 70 countries. Notably, he discussed four cultural dimensions. Hofstede classified most Asian countries in a single grouping with high Power Distance Index (PDI), low Individualism index (IDV), high Masculinity index (MAS), and low UAI, with minimal variation between countries (Hofstede, 1983). A general analysis by Hofstede on UAI in organisations for Asian countries showed that Singapore, Malaysia, Indonesia, and Vietnam were low compared to other countries, such as Algeria, Angola, Azerbaijan, and Brazil. When UAI is used in technology among teachers and students in Southeast Asia, it shows a higher level of avoidance, leading to higher anxiety due to uncertainty. This point was supported in a study focusing on technology use among Cambodian students. Researchers identified that students with limited exposure to technology were more likely to have increased anxiety when using such technologies (Richardson et al., 2014). However, this anxiety can be reduced if the contents are presented in a way that stimulates learning (DeVaney, 2010).

In the next Section, 2.3.1, I discuss the impact of cultural emotions among Asians generally and Southeast Asians specifically.

2.4.1 Cultural and Emotional Aspects in Asia

In this section, I will discuss how emotional expression varies between Asians and Westerners. This section will discuss the importance of cultural and emotional presence in ICT. This argument will lead to the missing factor in ICT design for Southeast Asia that will be identified as a gap in section 2.5.

Researchers have observed that emotions are expressed differently in East Asian cultures than in Western ones (Parker et al., 2001). For example, embracing the good and bad in all things is regarded as the norm in East Asian culture. East Asians do not strive for an overly optimistic self-view (Heine and Lehman, 1997). East Asians positively engaged with their emotions, whereas Americans are more disengaged (Kitayama et al., 2006). In Southeast Asia, new venues for entertainment developed between the 1920s and 1950s, where people would socialise and relax. Colonial Malayan and Chinese transnational capital created amusement centres for entertainment, from Teochew operas to Wayang Kulit (puppet shows), which were made available to everyone (Barendregt, 2014). At one point,

Southeast Asia was crucial in the anthropological study of culture and emotion. This observation is also present in media, such as informal conversations, formal interviews, television shows, and newspaper articles (Boellstorff and Lindquist, 2004). Southeast Asians are taught to exercise restraint when experiencing strong emotions, which can signal strength. In a similar context, another study showed that individuals from a collectivist culture (e.g., Asians) suppress their emotions more than individuals from an individualist culture (e.g., Americans) (Matsumoto et al., 2008). Maximising positive emotions may be the cultural goal in Western contexts, whereas balancing positive and negative emotions is the cultural goal in Asian contexts (Leu et al., 2011; Miyamoto et al., 2010). Asians tend not to show their emotions openly, and children are taught to suppress their negative emotions to maintain family harmony (Uba, 1994; Yunus, 2005). Corroborating this finding, wisdom across cultures showed that Asian Americans find it easier to control their emotions after anger than their Anglo-American counterparts (Grossmann and Kung, 2020). Asians' cultural identity and cohesiveness, however, affect their emotional levels. The cultural emotions among Asians strongly affect their feelings of self-belonging and cultural identity. Such a cultural identity is seen in South Asians' homes in the United Kingdom, where traditional Asian landscapes, decorations, and narratives show a connective cultural significance and are emotionally valued by the family (Tolia-Kelly, 2004). Cultural identity and togetherness are also observed during festivals such as Lunar New Year, Eid Mubarak, Diwali, and Christmas. A study involving Southeast Asians settled in Oslo suggests that Asians heavily rely on dishes from their original food culture, and they continue with religious celebrations of their culture (Garnweidner et al., 2012). Culture can shape how people express their emotions in specific contexts, and emotions can be influenced by cultural factors (Matsumoto and Ekman, 1989; Turner and Stets, 2005).

Generally, Asians' culture and emotional presence can be classified as the opposite of Western culture and emotions. This was suggested in the study by Ku, McKenna, and Fox (2007) on the cultural dimension of well-being among Chinese adults and identified positive psychological themes, including happiness, relaxation, calmness, peacefulness, satisfaction, and self-contentment, determining that these themes affected mental sub-dimensions. Researchers have also observed that Asian cultures value relaxed and calm emotional states rather than energetic ones (Hansen, 1988). Diener and Biswas (2011) and Lim (2016) suggest that calmness, contentment, and subdued happiness were present in Asian contexts, whereas excitable and positive emotions were favoured in North American contexts (Diener and Biswas-Diener, 2011; Lim, 2016). At this juncture, I will iterate the term 'Culture shock', which is the consequence of strain, anxiety, and confusion in a new environment, as well as a feeling of the loss of a familiar cultural environment defined by Oberg (1960) and Rhinesmith (1985). Emotions that support cultural activities can ultimately reflect social activities (Kaptelinin and Nardi, 2012; Ratner, 2000). The cultural and emotional perspective plays a vital role in all Southeast Asian contexts, stimulating positive well-being. Participating in cultural activities and traditional games can substantially elevate cultural emotions among Southeast Asians.

Stimulating Southeast Asians with cultural emotions could be critical when designing technology-assisted learning. The cultural, emotional element could be used to achieve great results when it is well positioned in the design aspects. Many authors have argued that Asia's modernisation and economic development should not be solely from Westernization but should be shaped by their historical and traditional values that encompass strong emotional attachments among their people (Yang, 2014). The sense of belonging is one of the needs that facilitates intrinsic motivation for personal development. People feel more self-determined when they can relate to their community (Deci and Ryan, 2008). Even when identifying domestic care workers for the elderly, many countries have turned to international immigrant women for care labour. Filipino and Indonesian women are considered mainly for the emotional work of immigrant care workers (Tsujimoto, 2003; Yoshimizu, 2014). There is literature that sees social relations in Asia as more rooted in emotions than in the west. This literature emphasises culture, feelings, and ethical bonds among Asians, which are much stronger than in the west (Allison, 1994; Christopher, 1999; Clarke and Clarke, 1997).

So as the cultural activities that stay close to Southeast Asian tradition. Moser, Clinton, and Wallach (2017) argued that traditional and cultural activities remained central to Southeast Asian leisure. Cultural values are preserved and motivated to encourage tourism in Southeast Asian countries. Art activities helped showcase ethnic diversity (Piccard and Wood, 1997). Governmental support exists for certain leisure activities, such as the Balinese Legong dance, puppet theatre traditions, and wau (kite) flying (Davies, 2006; Foley, 2001). To test the effectiveness of happiness-increasing activities, an experiment was conducted on two groups: Anglo-Americans and Asian-Americans. Asian-Americans benefited more from the investigation because the actions were aligned with Asian-rooted values and priorities (Boehm et al., 2011). Parallel to this context, the study on emotions between an individualist society (e.g., Western society) and a collectivist society (e.g., Asian society) suggested that to achieve harmony, emotional expression may not be necessary for the collectivist society; instead, what seemed to matter was helping people to be sensitive to each other’s feelings.

The Southeast Asian conception of the hierarchical structuring of consciousness is somewhat alien to emotion researchers in North America. South Asians have been influenced by local symbolic elaboration, which translated into mental experiences that they regard as essential in their culturally constituted world. For Americans, embarrassment or shame could result in avoidance, silence, or withdrawal in the context of South Asian norms (Shweder et al., 1993). Cultural differences exist for some aspects of emotions, and one such aspect is emotional arousal levels. In western or individualistic cultures, high arousal (Eg. angry, afraid, annoyed) emotions are promoted, whereas, in Eastern or collectivist cultures, low arousal (Eg. calm, contented, relaxed) feelings are valued (Lim, 2016; Russell, 1989; and Scollon et al., 2011). Eastern and Asian people prefer a more subtle and soft demeanour.

2.4.2 Computer-related Anxiety

In this section, I will discuss computer anxiety affecting slow ICT adoption in Southeast Asia. I will also highlight the essential factors that can be used in ICT design to reduce anxiety. Anxiety is an emotional expression whose negative traits are tension, nervousness, doubt, and temperamentality (Yik and Bond, 1993). Many researchers who have studied the role of computer-related anxiety in e-learning acceptance or use have concluded that computer anxiety is associated with avoidance or decreased use of e-learning systems and technologies (Calisir et al., 2014; Igbaria and Parasuraman, 1989; Park et al., 2012; Purnomo and Lee, 2013; Venkatesh et al., 2003). Computer anxiety plays a vital role in adopting e-learning technologies in higher education institutions (Alenezi and Karim, 2010). It was found that individuals who are anxious about using computers are likely to be reluctant to adopt e-learning systems (Al-alak and Alnawas, 2011; Fazil and Ward, 2016).

A study in 2017 on foreign language enjoyment and anxiety observed that teacher and learner behaviour showed that foreign language classroom anxiety is less related to teaching practices than foreign language enjoyment. It also demonstrated that unusual classroom activities such as debates and group presentations could boost students' happiness; expectedly, when students' happiness increased, their anxiety levels decreased (Christensen, 2002; Dewaele et al., 2018). Using discriminant analysis, Michalos (1980) identified that satisfaction with family life was a powerful and predominant discriminator among three groups, which he identified as frustrated (dissatisfied and unhappy), resigned (satisfied and sad), and achievers (satisfied and happy). When a class is perceived as satisfactory, students may be more likely to persist in struggling and taking educational risks to improve their learning. Students also feel more satisfied when they can accurately recreate an activity they have previously experienced. The same point was identified in e-learning, where researchers found that students' satisfaction with e-learning systems affected the systems' perceived use (Heo and Han, 2003). Design-specific research methods are required to understand individuals' happiness and translate such understanding into the design (Brey et al., 2014; Hennessy, 2000; Kiener et al., 2013).

Scholars suggest that exciting and competitive games enable students to be more confident, and relaxation is vital to mastering the game's challenges and reaching the desired outcome (Vorderer et al., 2003). The potential of stress-relieving relaxation results from increased contentedness and calmness generated during the activities (Wood, 1993). The blurring use of ICT in Southeast Asian schools raised the issue of whether ICT in education policies is needed to engage students in learning and leisure activities (Yuen and Hew, 2018). Culture impacted the way people teach and learn (Choudhury, 2014). There is a lack of studies on ICT cultural integration. The cultural studies by Hofstede (1983) and Watkins (2000) were not done in the specific context of a technology-assisted teaching and learning environment. There were gaps in Hofstede's framework in the IT research application, and only a few instances have the framework been applied to software development research (Gaspay et al., 2009). Watkins's (2000) and Hofstede's (1983) studies were used to gauge the

presence of Southeast Asian culture in the education industry. The studies were used to identify the gaps in the analysis of cultural usage in technology-assisted teaching and learning in Southeast Asia. The absence of emotional aspects in educational technology tools in Southeast Asia must be addressed in the early stages of the design and development of educational technology tools. Well-poised technology-assisted teaching and learning can be achieved if the educational technology-designed framework is framed toward cultural and emotional aspects in Southeast Asia. Why are cultural emotions a significant factor in ICT design for Southeast Asia? I will discuss this aspect in Section 2.3.3.

2.4.3 Culture-Centred ICT for Education - Asians' Cultural Pride and Motivation

In this section, I will discuss the significance of cultural motivation and cultural pride in ICT design for Southeast Asia. The culture was conceptualised in its broadest sense as a way of life, beliefs, knowledge system, values, and behaviour passed down by parents (Harkness and Super, 1996). The cultural values passed down to become a source of cultural pride positively affect people's emotions. Cultural pride still exists amongst Southeast Asian people born in Western countries. Western influence, including Western music and media, has a minimal impact on Southeast Asian immigrants. However, Southeast Asian immigrants and American-born, young Southeast Asians demonstrated great respect for and interest in their roots and origin. Southeast Asian immigrants have their traditions and cultures instilled in them by their elders. This common practice can be observed in a study on the cultural orientation of 188 Southeast Asian-American-born and early arriving (age of five) young adults. The result showed that the participants had great ethnic pride and a solid Southeast Asian orientation toward ethnic activities, ethnic satisfaction, and ethnic affiliation (Ying and Han, 2008).

The preferences of Asian American adolescents towards their culture on cultural pride, language use, food, and recreational activity were echoed in several studies (Phinney, 2003) and (Tsai et al., 2002). Parental expectations of economic needs and ethnic and cultural practices play an essential role in influencing children's attitudes and behaviours (Trieu, 2016). Despite being born in a foreign land with heavy foreign influence, Southeast Asian ethnic pride still lingers with them and can be observed in many instances. Culture-specific education and programs are critical to their transition to adulthood, giving the children a positive sense of well-being. Hence, a strong connection amongst the children to their roots and tradition is evident in many situations.

Asians can regulate their motivation by using emotional suppression to seek balance in their emotional experience. This value is reversed among European Americans. In contrast, European Americans associate suppression of emotion with experiential avoidance (Troy et al., 2017; Su et al., 2014). These values were also observed in another study where Asian Americans dealt with their problems by themselves, bringing them to the family to solve or seeking advice from their elders (Inman

and Yeh, 2006). Seeking psychological help is often considered shameful and is avoided as it may bring disgrace to Asian American families (Sue, 1994; Root, 1985; Zane and Yeh, 2002). Due to influenced cultural practices, Asian American students withhold their strong emotions to avoid embarrassment and shame in public, preserve social harmony, and accept and endure their problems (Morris and Keltner, 2000). Asians perceive seeking professional help as a sign of weakness (Narikiyo and Kameoka, 1992).

Seeking balance in their emotional experience is a common attribute among Southeast Asians, even if western activities using western compatible educational tools do not seem to entice them. Southeast Asians use a "go with the flow" concept to force a liking towards what is instilled in them. Such is the case with educational activities in classrooms. Southeast Asians silently absorb their emotions during classroom activities while using incompatible western education tools, where the expected learning outcomes might be affected. Kinesthetic learning preference was identified in Wayyudin and Rido for Indonesian undergraduate students studying at Malaysian universities (Wahyudin and Rido, 2020) and in two studies by Park on Asian American students in secondary schools (Park, 1997). The kinesthetic learning style emerged among Southeast Asian students; it is understood that Southeast Asians are more inclined to enjoy "learning by doing" through participatory and hands-on activities.

In Section 2.4, I discuss the studies of metaphor, Ethnocomputing and Anthropological study this far with association with general metaphor and the missing elements of Southeast Asian cultural metaphor in Section 2.4.1 and Section 2.4.2.

2.5 Studies of Metaphors

In this section, I explore the associated research and theory issues with Ethnocomputing and Anthropological studies this far and their association with the missing element of Southeast Asia Ethnocomputing studies. Gloria Ladson-Billings argued the importance of "remixing" culturally relevant pedagogy pushing forward her original goals in the cultural landscape of the classroom. Ladson argued that many practitioners who seem to incorporate their research into practice are stuck with limited or superficial concepts of culture (Ladson-Billings, 2014). The use of metaphors in cultural contexts was well applied in Ron Eglash's work on the studies of linking mathematical ideas in cultural contexts, proving that there is more to explore in Ethnocomputing. Eglash's studies on Culturally Situated Design Tools (CST) show a great inclination toward native American beadwork, African Americans' cornrow hairstyles and urban graffiti as the underlying mathematical principles as he expresses it as moving from Ethnomathematics to Ethnocomputing. This proved a new opportunity and explored the relationship between culture and youth identity (Eglash et al., 2006). In a similar context, Gannon quoted examples of Japanese gardens, Chinese Family altars, and American Football as the National cultural metaphors in his seminal work (Gannon, 2002). Using metaphors as an illuminative principle, Guldenmund (2018) explained using cultural metaphors as a safety culture.

In a different perspective on the study of metaphors, Kövecses (1995) showed that conceptual metaphors and metonymies play an essential role in the conceptualisation of 'Anger' in English. He pointed out that the 'Heat' metaphors, and the 'Hot fluid in container' metaphor, are central to the metaphorical system of anger in English (Kövecses, 1995). Viewing travel metaphors from a different perspective was discussed by Wolff (1993), and landscape metaphors in cultural geography by Daniels and Cosgrove (Daniels and Cosgrove, 1993). The critical limitation of the existing literature on Ethnocomputing and the study of metaphors is that none of the studies was in the context of Southeast Asia. Southeast Asians' emotions towards their cultural activities significantly influence them and warrant a positive outcome. Transforming Southeast Asia cultural festivals and activities can considerably contribute to cultural and emotional metaphors for ICT design. With its rich ethnicity, Asia has more to contribute to Southeast Asia's Ethocomputing.

In the next section, I explore the cultural activity presence in Asia and Southeast Asia to understand the impact of auspicious and non-auspicious activities that can be presented as deep cultural and emotional metaphors.

2.5.1 Linking Cultural Activities as Cultural Metaphors - Auspicious and Non-Auspicious

In this section, I will describe the cultural activities in Southeast Asia that can be linked as cultural metaphors for Southeast Asia ICT design.

The beliefs and practices in countries in Southeast Asia have similarities. There are auspicious days in a particular month to start new crops, and some days are seen as bad because spirits are active at that time. People in Thailand are infused with knowledge of auspicious and inauspicious conjunctures, including lucky and unlucky days. It is believed that any events commenced on an inauspicious day will result in a disappointing yield (Farrelly et al., 2011). Chinese society has similar beliefs about how auspicious beginnings can yield positive results. This can be observed among Chinese people in Singapore and around the world. There is an expected rise of newborn babies (baby boom) during significant lunar zodiac years, such as the auspicious year of the Dragon, as that year is considered lucky; one sees the opposite result during the inauspicious year of the Tiger. These patterns are unique to Chinese cultural groups (Goodkind, 1996). Chinese culture and Feng-Shui are still practised in many parts of the world. In Southeast Asia, ethnic identity has become the pre-eminent determinant in the marketing of cultural products. Feng-Shui, which means "wind and water", aims to ensure that people live in harmony with their surroundings (Madeddu, 2021).

Gold ornaments are used to express elite identities, and the status and power connected to such identities are standard in local communities in Southeast Asia (DeMaNDt, 2015). Gold ornaments can be described as a prestige good and used as an auspicious figurine or "Feng-Shui". It is widely and popularly worn by brides during Malay, Chinese and Hindu weddings and is treated as an auspicious

symbol of prosperity and luck. Even till this era, these practices and beliefs are still given attention and utmost importance among Southeast Asians as they begin new events and activities. Leisure activities in Southeast Asia often have close ties with religious and spiritual beliefs, shaped by local beliefs and practices. Festivals and important dates on the religious calendar are how leisure and religion come together to form games and performances in Southeast Asia. Traditional Asian games such as speak takraw are popular among Southeast Asians. Many pre-colonial pastimes in Southeast Asia used craft skills such as kite flying and top spinning. Southeast Asia adopted late colonial qualities in their activities, which are still evidenced today in music, games, festivals, and competitions. During leisure time, women engaged in pragmatic activities in the domestic sphere, including embroidery, batik, and other handicrafts. Women throughout the region practised arts and crafts. State schools encourage these local activities because these are where students learn how to make kites, textiles, puppets, and local crafts and engage in performances, including music and dance (Moser et al., 2017).

Traditional games have racial and cultural values. A study that observed the impact of traditional games on students in the age range of 12-13 showed that the traditional games intervention program was highly effective and significantly improved children's fitness and motor skills (Gipit et al., 2017). In a similar context, Congkak, a traditional Southeast Asian game, was successfully digitalised with character design and visual icons. Participants who played this game enjoyed the freedom to explore Congkak's style and graphic icons (Mohamad et al., 2016).

Traditional and cultural games can positively boost the morale of learners, as they have the potential to uplift learners' spirits. Such activities and games were close to the hearts of Southeast Asian learners as they grew and were exposed to those cultural dynamics. Cultural activities and games are viable techniques to de-stress learners. Students can be diverted to a more relaxed and calm likely activity while concurrently gaining knowledge and creating a comfortable learning zone. Integrating cultural activity as part of learning activity elevates cultural emotions with technology. Savouring cultural games and activities enforced the strategy of blended cultural games and activities for Southeast Asians' ICT learning, which can result in positive learning experiences. In the following section, I will discuss cultural offerings and their relationship to cultural gifts as cultural metaphors.

2.5.2 Linking Cultural Offerings (Gifts) as Cultural Metaphors

In this section, I will explain what cultural offerings in Southeast Asia are and how they can be used as gift metaphors in Southeast Asia's ICT design. This discussion is crucial for my proposed prototype design in chapter six.

Asians perceived gifts offered during festivals and special occasions as a form of good luck, abundance, and happiness. This cultural gesture of gift offering is considered auspicious and significant in Asia and a mode of respect during festivals. The New Year among the Chinese is welcomed with an auspicious act such as offering joss sticks to hold the god of wealth, family members are expected to

return to their family home for a reunion dinner, and children pay respect to their parents by giving oranges. In return, Ang Pow (red packets) are offered by parents to their children (Choo, 2011) as a gift of blessings. Religious rituals performed during the opening and closing communication reciprocated with gift offerings (Feuchtwang, 2007).

In the Hindu religion, lamps are lighted and offered to mark the start of an auspicious occasion as a mandatory gesture. Prasada (food) offerings are considered a 'gracious gift' in contemporary South Asian religious practice (Pinkney, 2013). Ketupat (rice cake packed inside a diamond-shaped pouch made of woven palm leaf), which is offered during Muslim festivals, symbolised togetherness, and the act of providing this rice cake to your loved ones meant asking for forgiveness as well as an invitation to live together in harmony (Rianti et al., 2018). According to Heim, in Southeast Asia, the gift-giving process is a crucial element that cultivates 'ethics of esteem' (Heim, 2004). The ideas of gift-giving are well received by Southeast Asians and clearly articulate the real meaning used during festivals and auspicious occasions. Users perceived cultural offerings (gifts) as a metaphor, a form of an idea, and a gesture of good luck. The previous Sections extrapolate the factors for ICT acceleration in Southeast Asia. In Section 2.5, I present the literature review summary and the missing gaps in the ICT design for Southeast Asia.

2.6 Identified Gaps: Missing Cultural Metaphors for ICT in Southeast Asia

Students' active engagement during lessons stimulated their thinking capacity and allowed them to work beyond their fundamental abilities. Technology-based learning provides real active learning in the classroom. However, the extreme cultural barriers in Southeast Asia hinder teachers' and students' ability to explore ICT congruently. The cultural challenges faced by Southeast Asians in using current educational technology restricted their exposure to and experimental interest in ICT. Southeast Asians are more reserved, pessimistic, and interdependent in their approach, whereas their Western counterparts are more bold, optimistic, and independent (Uchida et al., 2008). Hence, the willingness to explore and experiment with ICT is more dominant among Westerners than Southeast Asians. There are retrospective accounts that current software and technology design are universal. Most ICT design researchers focus on improving ICT features, technical features, and user experience.

However, there is a lack of cultural integration in ICT design, with Western proliferation, software and technology severely affecting regions with minimal Western exposure. It would be an injustice if we failed to mention the emotional suppression among Southeast Asians in using Western-designed technology and tools at this juncture (Matsumoto et al., 2008; Uba, 1994; Yunus, 2005). Truly, incompatibilities existed with current educational technology tools, resulting in 'uncertainty avoidance' among Southeast Asians. Southeast Asians' treasure of cultural and traditional values instills certain levels of emotional pride within them. Southeast Asians pride themselves in traditional and cultural activities, rites, and auspicious events. The beauty lies in the consistent religious beliefs of the countries

and respect for the traditional values and cultural norms that constitute peace and harmony. The primary religion in Southeast Asia has similar beliefs and practices, and auspicious events and activities are observed as festivals and cultural events. Southeast Asian countries' cultural events and activities are carried out with respect, dignity, and pride among their people.

Hofstede's UAI has a solid connection to my study. Societies avoid uncertainties as part of their cultural and religious beliefs. As such, there is an avoidance of technology exploration among the Southeast Asian community due to their cultural and religious beliefs. Anxiety and uncertainty may be good predictors of technology avoidance. Technology developers and designers fail to acknowledge the emotional aspects of culturally affected users toward technology acceptance. The presence of Southeast Asian cultural emotions is missing in Western technology and digital tools, making the technology tools incompatible for Southeast Asians. There is a need to undertake explicit cultural integration in the design of educational technology in HCI. Educational tool design that integrates Southeast Asian cultural emotions and pride is the central focus of this research. Importantly, I must acknowledge that rural regions face more challenges in technology acceptance, leading to slow technology adoption. Notably, software design lacked consideration of cultural and emotional factors (Wallace and Sheetz, 2014).

Southeast Asian cultural and emotional factors can be observed in the daily tasks, activities, games, festivals, and traditional events to which Southeast Asians are accustomed. The cultural activities comprised batik activities (silk painting), wau bulan designing and flying (moon kite), and cultural games such as Gasing (top), Congkak, marbles, and five stones, which are still culturally adored. The activities are passed down from generation to generation. These activities create cohesiveness among the community, as there are group interactions, discussions, laughter, and joy in a laid-back environment. Thus, people are less anxious but culturally motivated. They are much happier, calmer, and more relaxed during these activities. Their beliefs and traditions strengthen their feelings, which can positively manifest in their daily activities (Murata et al., 2013). This prompts technology designers to consider traditional cultural activities as part of technology activities for more active learning for the Southeast Asian community. Rather than treating educational technology as a universal platform, we advocate approaching educational technology design as a rich, culturally embodied platform for diversified users' comfort and compatibility levels. The goal is to render visible and dominant cultural features to trigger cultural emotions for Southeast Asians in educational technology tools. Educational technology developers must explicitly embrace the possibilities of integrating Southeast Asian cultural elements into their design. Traditional games and cultural activities can be tapped as motivational activities that aid teaching subjects with technology-based learning (Tupas et al., 2018).

The literature review findings are summarised in Figure 2-1, the Literature Review Result Summary. There are four categories in the diagram identifying the four main factors: students, teachers, schools, and government. The outer layer specifies the deficiencies in each section, and the second outer

layer defines the efficiency of using technology in the classroom. The cluttered area of efficiency in students' domain indicates promising features that could benefit students in classroom learning. However, the cluttered areas in the teacher and school sections identify deficiencies as a lack of technology use in the teaching domain and practices and policies in the schools that failed to facilitate the positive integration of technology in the teaching and learning domain.

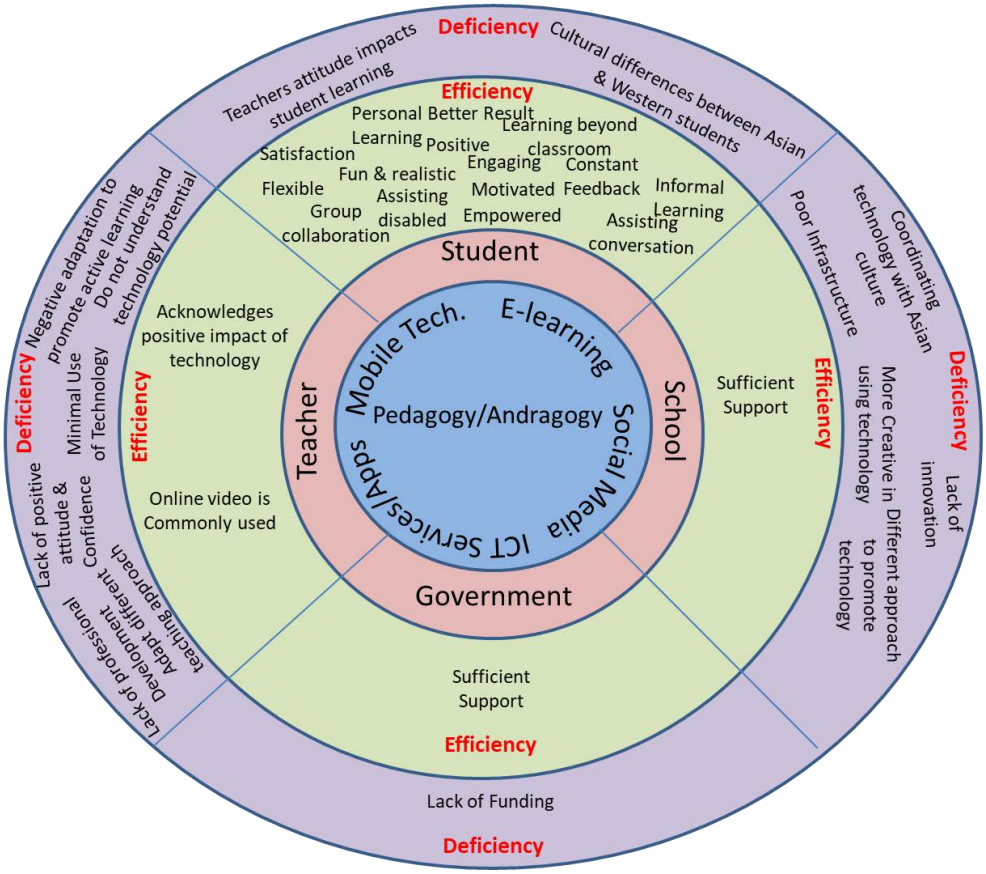

Figure 2-1: Literature Review Result Summary.

2.6.1 Research Hypotheses

From the literature reviewed for each topic and sections, I have formulated the following research questions, research aims, and research hypotheses, as shown in Table 2-1. The three primary deficiencies/gaps are: 'G1 - Lack of cultural values led to slow ICT adoption', 'G2 - Absence of Southeast Asian cultural preferences, and 'G3 - Absence of Asian cultural themes and activities.' They were identified as the basis to develop the new model. Table 2-1 below lists the gap, research questions, aims, hypotheses and approaches for this thesis.

Table 2-1: Gap to Approach Matrix.

Gap	RQs	Aim	Hypotheses	Approaches

G1 – Lack of cultural values led to slow ICT adoption.	**RQ1** – What are the barriers to slow ICT adoption in Southeast Asia schools? **RQ2** – Is the lack of cultural values the main factor for slow ICT adoption in Southeast Asia Schools?	**A1** - Investigate the barriers to the slow adoption of ICT solutions **A2** – Study the Southeast Asia specific cultural preferences and cultural emotions	**H1:** Cultural barriers hinder the widespread use of educational technology.	**i)Comprehensive Survey;** **ii)Focus Group - Design Cultural study;** **iii)CFA**
G2 - Absence of Southeast Asian cultural preferences	**RQ3** – Are emotional cultural objects the preferred icons and metaphors in educational technology? **RQ4** – Do cultural-related activities and design improve teaching/learning experience and learning outcome?	**A2** – Study the Southeast Asia specific cultural preferences and cultural emotions **A3** – Design, develop and evaluate Southeast Asia-specific cultural ICT (Cultural theme and Cultural activities)	**H2:** Southeast Asia cultural values and interaction are the preferred design for ICT **H3**: Southeast Asian Cultural values and activity can improve the teaching and learning experience	**i)Comprehensive Survey;** **ii)Focus Group - Cultural study;** **iii)Study One;** **iv)Study Two.**
G3 - Absence of Asian cultural themes and activities	**RQ4** – Do cultural-related activities and design improve teaching/learning experience and learning outcome?	**A4** – Develop new ICT practices, guidelines and frameworks for Secondary schools that will accelerate the adoption of ICT solutions in Southeast Asia	**H3**: Southeast Asian Cultural values and activities can improve the teaching and learning experience	**i)Comprehensive Survey;** **ii)Study One;** **iii)Study Two;** **iv)CFA;** **v) Focus Group - Cultural Study.**

These aims and hypotheses are the influencing factors for an effective teaching and learning outcome for the Southeast Asian region. It is prudent to reflect upon these factors in my future research. Institutions and teachers play a dynamic role in the manifestation of these factors. More studies and analyses are required to provide a complete foundation for the best interests of all party when moving to the technological era for secondary education in Southeast Asia. Advanced technology sustainability is critical to improving the teaching and learning experience. I conclude on a positive note by arguing that, the incorporation of Southeast Asian cultural elements is paramount to improve technology education experiences in Southeast Asia secondary schools.

Note to readers*: these aims are further refined into testable research hypotheses in each study after relevant literature on each topic has been reviewed and the research gaps identified.*

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Chapter 3 Outline

3. Identifying Cultural Factors and Improving Adoption of ICT for Education in SEA

3.1 Research Design

3.2 Research Method

3.2.1 Comprehensive Survey

3.2.2 Study One: Study on Impact of Cultural Themes (Using Festive Themed Educational Tools)

3.2.3 Study Two: Study on Impact of Cultural and Auspicious Activities

3.2.4 Proposal of CMEs ICT Guidelines and Practices for Southeast Asia

3 Identifying Cultural Factors and Improving Adoption of ICT for Education in SEA

3.1 Research Design

To solve the deficiencies identified in the literature review in chapter two, I will first define specific research questions, aims, objectives, and hypotheses. Firstly, a literature survey is done to identify the trends, gaps, and opportunities, which are covered in chapter two. Secondly, a comprehensive survey was carried out to determine the slow ICT adoption in Southeast Asia schools which is covered in chapter four. Thirdly, a study on design requirements and to evaluate the impact of a cultural theme-designed ICT solution was covered in chapter five. Fourthly, a study to evaluate auspicious activity and cultural activity as new cultural metaphors was covered in chapter six. Lastly, the proposal of final CMEs ICT Design guidelines with cultural activity and auspicious activities and the extended HCI model was proposed in chapter seven.

The literature was evaluated, and I identified several disparities which led to the identified gaps, formulation of Research Questions and Hypotheses:

Gaps identified:

G1 – Lack of cultural values led to slow ICT adoption;
G2 - Absence of Southeast Asian cultural preferences;
G3 - Absence of Asian cultural themes and activities.

The corresponding Research Questions (RQ):

RQ1 – What are the barriers to slow ICT adoption in Southeast Asia schools?
RQ2 – Is the lack of cultural values the main factor for slow ICT adoption in Southeast Asia Schools?
RQ3 – Are emotional cultural objects the preferred icons and metaphors in educational technology?
RQ4 – Does cultural-related activities and design improve teaching/learning experience and learning outcome?

The corresponding Hypotheses:

H1: Cultural barriers hinder the overall use of educational technology;
H2: Southeast Asia cultural values and interaction are the preferred design for ICT;
H3: Southeast Asian Cultural values and activities can improve the teaching and learning experience.

The next following sections explained the approach to solve the gaps, research questions and hypotheses identified above.

3.2 Research Method

The proposed research method is now described, as the strategy to implement the research design.

3.2.1 Comprehensive Survey

This section introduces the comprehensive survey techniques used to investigate the slow adoption of ICT solutions and the presence of cultural emotions in Southeast Asia. A comprehensive survey was carried out with questionnaires and interviews using random sampling from four countries in Southeast Asia. Five secondary schools were randomly selected from the capital city of each country. Thus, the included cities were Kuala Lumpur (Malaysia), Jakarta (Indonesia), Manila (the Philippines), and Bandar Seri Begawan (Brunei). The capital cities were chosen for the research for the reason that they are the prime economic locations for the governmental and administrative offices. Hence, the value of the education in the respective schools in that region would meet the expectations set by the countries' Ministry of Education. This, in turn, ensures the reliability of the random sampling size, as it meets the requirements identified in the research. The findings presented in this chapter are based on the probability set at $\leq .05$. Firstly, I report the ANOVA test results to compare the mean values between countries' dependent and independent variables by comparing teachers' and students' data. Descriptive and inferential statistics were applied to compute the mean, standard deviation, frequency, Pearson's correlation coefficient, one-way ANOVA, and PLS-SEM Bootstrapping using SmartPLS.

The hypotheses for this comprehensive survey were formulated based on the literature survey results. Literature findings from the Teachers' domain identified insufficient technical training for teachers. Therefore, hypothesis 1 was identified as:

S1_H1: *ICT usage in SEA is less than ICT usage in the west.*

Literature findings from the school domain identified that schools must demonstrate creativity in using technology and innovation in training teachers in coordinating technology with the Asian learning culture. Therefore, hypothesis 2 was identified as:

S1_H2: *Mobile technologies improve learning outcomes and students' learning experiences.*

Literature findings from the student domain identified that teachers' attitudes impact students' learning. Cultural learning differences exist among Asian and Western students and with Hofstede's cultural dimensions. Therefore, hypothesis 3 was identified as:

S1_H3: *Culturally motivated technology is required to stimulate teaching and learning*.

The summary of comprehensive survey study is shown in Table 3-1.

Table 3-1: Comprehensive Survey Aims to Achieve

Summary of what this study aims to achieve:

Research Question 1 – What barriers hinder ICT adoption in Southeast Asia schools?
Research Question 2 – Is the lack of cultural values the main factor for slow ICT adoption in Southeast Asia Schools?
Aim 1 - Investigate the barriers to slow adoption of ICT solutions
Aim 2 – Study Southeast Asia specific cultural preferences and cultural emotions
Hypothesis 1: Cultural barriers hinder the overall use of educational technology

3.2.2 Study One: Study on Impact of Cultural Themes (Using Festive Themed Educational Tools)

In this study, I researched the design requirements and cultural preferences of Southeast Asian students and teachers. The first part of the study aimed to identify design requirements to reduce cultural barriers. A total of 50 students aged between 17 and 21 from James Cook University who are of Southeast Asian origin participated in two, (i) focus group which is a brainstorm activity and; (ii) focus group which is a design preference survey. Ten teachers from Malaysia and Indonesia secondary schools were invited to participate in the design preference survey. Secondly, I evaluated the impact of cultural theme educational application by developing a prototype (interactive mobile game) with a festive cultural theme based on cultural preferences. Three experiments were set up (i) interactive mobile game-based learning with the festive cultural theme; (ii) a control theme; (iii) a traditional classroom-based learning. Eighty-four students aged 13-15 from three secondary schools in Jakarta, Indonesia, participated in this study. 34 students ($n = 34$) participated in the festive cultural theme activity, 26 students ($n = 26$) participated in the control theme activity, and 24 students ($n = 24$) participated in the classroom-based learning activity. All students were invited to complete a pre-test and a post-test survey comprising of seven questions on photosynthesis (a Science topic).

The hypotheses formulated for this study are stated below:
S2_H1: Teachers use technology and digital tools efficiently in the classroom;
S2_H2: Mobile technologies can improve learning outcomes and students' learning experiences;
S2_H3: Culturally motivated technology is required to stimulate teaching and learning.
The summary of study one is shown in Table 3-2.

Table 3-2: Study One Aims to Achieve.

Summary of what this study aims to achieve:
Research Question 3: Emotional cultural objects are preferred icons and metaphors in educational technology?

Aim 3 – Develop and evaluate Southeast Asia specific cultural ICT design Cultural theme and Cultural Activity

Hypothesis 2: Southeast Asia cultural values and interaction are the preferred design for ICT

3.2.3 Study Two: Study on Impact of Cultural and Auspicious Activities

In this study, I evaluated the impact of cultural activities on students' learning outcomes and learning experiences. The prototype evaluated was based on interactive cultural and auspicious activities designed with the proposed four guiding principles and framework for culture-based learning. The four guiding principles were developed based on the results of literature review and study 1.

In Setting 1: As part of evaluation between conditions, evaluation was set up based on two experiments traditional western approach experiment, n=100 and the cultural guidelines-integrated experiment, n=100. About 200 students between the age of 13 and 17 from Indonesia and Brunei participated in these experiments. Students were given instructions to complete a pre-test on photosynthesis (a Science topic), followed by playing the activity, and then completing a post-test question and a set of survey questions.

In Setting 2: as part of the evaluation within cultural conditions: an additional 59 students from Indonesia evaluated the cultural experiment on interactive cultural activity and auspicious activity. In addition, 15 teachers from Indonesia and Brunei secondary schools participated in evaluating cultural and auspicious activities and completed the survey.

Setting 1 (evaluation between traditional and cultural conditions)

Experiment 1: Traditional game features with ICT's general characteristics.

Experiment 2: Cultural and auspicious activity games incorporated the four ICT cultural guiding principles.

Setting 2 (evaluation within the cultural condition)

Experiment 1: Cultural activity game incorporated with the ICT cultural guiding principles.

Experiment 2: Auspicious activity game incorporated with the ICT cultural guiding principles.

The hypotheses formulated for this study are stated below:

S3_H1: Cultural ICT guidelines can improve teaching and learning experiences in SEA (Southeast Asia)

S3_H2: Culturally compatible ICT solutions can improve students' learning outcomes in SEA (Southeast Asia)

S3_H3: 'Cultural pride' triggers cultural emotions, thus minimising cultural barriers in SEA (Southeast Asia)

S3_H4: 'Cultural emotions' are critical to stimulating learning in SEA (Southeast Asia)

S3_H5: 'Cultural emotions' are vital to improving ICT utilisation in SEA (Southeast Asia)

The summary of study two is shown in Table 3-3.

Table 3-3: Study Two Aims to Achieve.

Summary of what this study aims to achieve:
Research Question 4 - Cultural related activities and design improve teaching/learning experience and learning outcome?
Aim 3 – Develop and evaluate Southeast Asia specific cultural ICT design (cultural theme) and Cultural Activity
Hypothesis 3: Southeast Asian Cultural values and activities can improve the teaching and learning experience.

3.2.4 Proposal of CMEs ICT Guidelines and Practices for Southeast Asia

In this Chapter, I summarised the findings from the literature review, comprehensive survey, study 1: Study on the Impact of cultural themes and study 2: Study on the impact of cultural activity, which was used as the base for the proposed culture-centred ICT guidelines and practices that mitigated the slow ICT adoption in SEA. I suggested four CMEs' ICT guidelines and practices.

The summary of this chapter is shown in Table 3-4.

Table 3-4: Chapter Aims to Achieve.

Summary of what this Chapter aims to achieve:
Research Question 4 - Cultural related activities and design improve teaching/learning experience and learning outcome?
Aims 4 – Develop new ICT guidelines and framework for Secondary schools that will accelerate the adoption of ICT solutions in Southeast Asia
Hypothesis 3: Southeast Asian Cultural values and activities can improve the teaching and learning experience.

Chapter 4 Outline

4. Comprehensive Survey of ICT Adoption in SEA and Cultural Factors of ICT Education

4.1 Introduction

4.2 Survey of ICT Adoption in Malaysia and Indonesia Secondary Schools

4.2.1 Background

4.2.2 Method

4.2.3 Data Collection and Analysis

4.2.4 Results - Survey

4.2.5 Results - Interview

4.2.6 Findings and Discussion

4.2.7 Conclusion – Malaysia and Indonesia Schools

4.3 Survey of ICT Adoption in Philippines and Brunei Secondary Schools

4.3.1 Background

4.3.2 Method

4.3.3 Data Analysis

4.3.4 Results - Survey

4.3.5 Results - Interviews

4.3.6 Findings and Discussion

4.3.7 Conclusion – Philippines and Brunei Schools

4.4 Analysis of Four Countries – Teachers' Perspective

4.4.1 Background - Cultural Differences and Emotions

4.4.2 Method

4.4.3 Data Analysis

4.4.4 Results

4.4.5 Analysis of the Model

4.4.6 Discussion

4.4.7 Conclusion

4.5 Analysis of Four Countries – Students' Perspective

4.5.1 Background - Emotions in Asia

4.5.2 Method

4.5.3 Data Analysis

4.5.4 Results

4 Comprehensive Survey of ICT Adoption in SEA and Cultural Factors of ICT Education

4.1 Introduction

In this Chapter, I present the results of a comprehensive survey for ICT adoption in SEA. This is the first time since the 2012 UNESCO report on ICT adoption, which shows the new findings on low educational technology use in SEA secondary schools. More specifically, I discovered the barriers to slow ICT adoption in SEA secondary schools. I empirically investigated the approach and usage of technology and perceptions among teachers and students in secondary schools in Malaysia, Indonesia, the Philippines, and Brunei. As hypothesised, I discovered emotional cultural presence in ICT use among teachers and students. The results also revealed a deficiency in the use of technology and digital tools in classroom activities by teachers, with the presence of cultural dimensions of collectivism, uncertainty avoidance, power distance, femininity and somewhat "cyberphobia" nature among teachers and students. The results suggest that secondary schools in SEA should use technology in the classroom with cultural attributes, which enhances the user experience to stimulate and motivate teachers' and students' participation during and after lessons. I suggest that a paradigm shifts in designing educational technology with the cultural attribute of Human-Computer Interaction is essential to facilitate effective teaching and to learn in Southeast Asia secondary schools.

The chapter is divided into four parts. Table 4-1 summarises what this study aims to achieve. It states the research questions, aims, and hypotheses, which this chapter is designed to address. Figure 4-1 illustrates the overall flow of this chapter. Firstly, I surveyed Malaysia and Indonesia schools, and data was analysed based on these two countries. Secondly, I surveyed Brunei and Philippines schools, and data was analysed based on these two countries. Thirdly, I examined the data from teachers' perspectives for all four countries. Fourthly, I explored the data from students' perspectives for all four countries. The findings from the first study show the presence of Southeast Asian learning culture, which affects the learning outcome. This led to an additional examination with two more countries in Southeast Asia, Brunei and the Philippines, to further validate the findings. The second study's findings show that diversified teaching and learning with technology integration is required to stimulate and motivate students with cultural norms in the teaching and learning domain. A further analysis was carried out concerning teachers' data to find overall teachers' challenges and barriers to technology use in Southeast Asia. From this study, I discovered that a new e-learning research model for Southeast Asia is required based on cultural emotions and suggested a paradigm shift in designing e-learning platforms for Southeast Asian secondary education. Finally, further examination was carried out concerning students' data to find the overall students' challenges and barriers in Southeast Asia. From the findings of this study, I discover and propose (i) future e-learning platforms to stimulate learning to

solve the problem of slow ICT adoption in Southeast Asia, (ii) To facilitate and improve positive emotions in activities and nullify negative emotions, thus influencing their learning outcome; (iii) Create a cultural, emotional attachment towards E-Learning platforms thus to break the barrier of uncertainty avoidance among Southeast Asian students using E-Learning platforms.

Table 4-1: Summary of what this study aims to achieve.

Summary of what this study aims to achieve:
Research Question 1 – What barriers hinder ICT adoption in Southeast Asia schools?
Research Question 2 – The main factor for slow ICT adoption in Southeast Asia Schools is the lack of cultural values?
Aim 1 - Investigate the barriers to slow adoption of ICT solutions
Aim 2 – Study the Southeast Asia specific cultural preferences and cultural emotions
Hypothesis 1: Cultural barriers hinder the overall use of educational technology

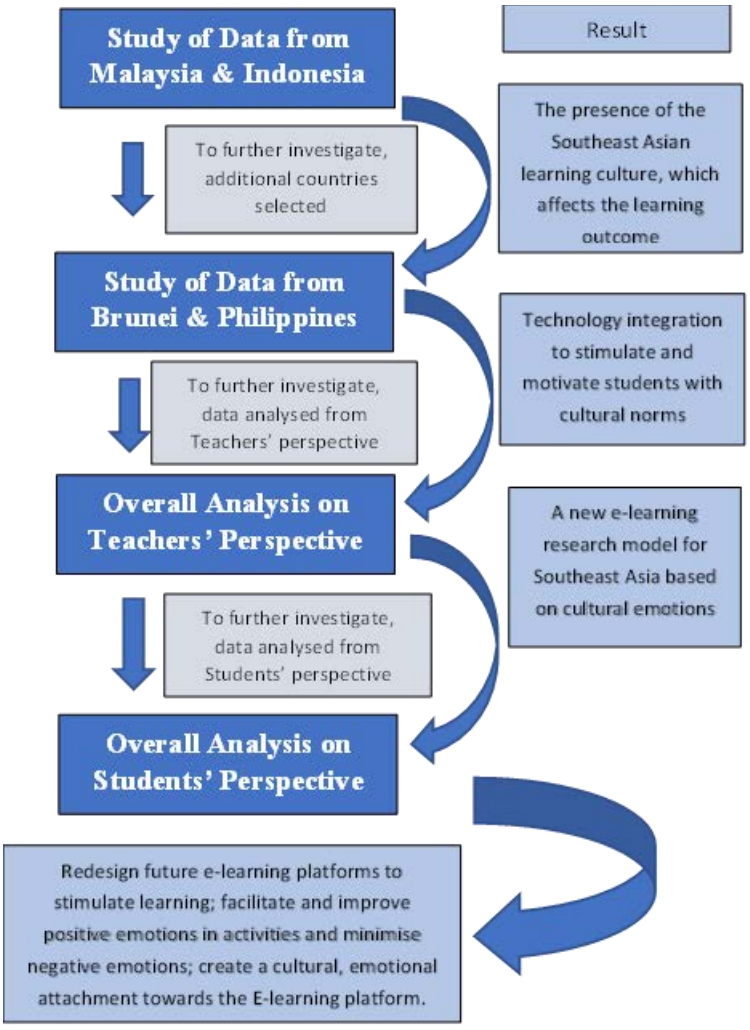

Figure 4-1: Overall Flow of Chapter four.

The remainder of this chapter is structured as follows: In Section 4.2, I present a study of Malaysia and Indonesia schools; Section 4.3 presents an analysis of Brunei and Philippines schools; Section 4.4 presents data from teachers' perspective; Section 4.5 presents data from the students' perspective.

4.2 Survey of ICT Adoption in Malaysia and Indonesia Secondary Schools

4.2.1 Background

I propose a culture-centred learning model that summarise the results from technology use and learning approaches from the literature review section. Insufficient technology support in the teachers and schools sphere confirms students' inability to use high standards of technological tools and services, affecting successful learning outcomes to achieve better results (Vadivel et al., 2017).

An analysis of the literature review section shows a common deficiency in the teaching and learning domain. These contributed to three hypotheses. In the teacher domain, the study revealed that teachers lack professional development and skills in adopting positive technology-assisted teaching in the classroom which leads to lack of exploration of educational technology leaving teachers with an incompetent level of technology use in the classroom. Therefore, Hypothesis 1 was formulated as:
S1.1_H1: Insufficient technical training and professional development for secondary school teachers have led to incompetent technology use.

In the school domain, the study revealed that schools must demonstrate creativity in using technology and innovation in training teachers in coordinating technology with the Asian learning culture. The study showed that mobile game-based e-learning is highly effective compared with regular project-based lessons (Huizenga et al., 2009) and that students who use mobile devices can engage and collaborate better with other students (Wankel, 2009). Hofstede's high collectivism index for Southeast Asian countries predicts that students with a high collectivism index seek group activities, enhance group affiliation, and participate in group decision-making. Therefore, Hypothesis 2 was formulated as:
S1.1_H2: Mobile technologies can improve learning outcomes and students' learning experiences.

The study revealed that teachers' attitudes impact students' learning in the student domain. Cultural differences exist among Asian and Western students and with Hofstede's cultural dimensions (high PDI, low UAI, feminine society, high collectivism index) among Southeast Asian teachers and students, thus affecting teaching ability and learning behaviour in a technology-assisted classroom. Therefore, Hypothesis 3 was formulated as:
S1.1_H3: Culturally motivated technology is required to stimulate teaching and learning

4.2.2 Method

I collected data from ten secondary schools in Kuala Lumpur, Malaysia, and Jakarta, Indonesia. The capital city was chosen for the research because it is the country's prime economic location and is where the governmental and administrative offices are. Hence, the education's value in the region's respective schools would meet the expectations that the nation's ministry of education has set forth. This would support the reliability of the random sampling size to meet the requirements identified in the research.
I selected Technology Uses and Perception Survey (TUPS) criteria for this research to identify the perceived usability of technology-assisted lessons among teachers and students and to ensure a user-centred design approach to improve the usability of technology-assisted teaching and learning. Data was collected from teachers and students on demographics, technology perceptions, and technology use, which include managing cultural layers that may lead to different learning outcomes. The demographic data collected from (i) teachers include gender, age, teaching experience, level, subject, type of students taught, and type of technology used in the classroom, and that collected from (ii) students include gender, level, and type of technology use in the classroom. The data for technology perceptions and technology use in the classroom include technology competency, opinions, attitudes toward technology use, and managing cultural issues with technology during lessons.

The data was analysed using the non-parametric and independent samples with the Mann-Whitney test to compare the mean rank between the two countries and descriptive statistics. The analysis includes: the frequency of technology use and the competency levels regarding the use of technology for activities such as research problem-solving, developing lessons, and assisting with teaching. Regarding opinions and attitudes on the use of technology, teachers and students were asked about their perceptions of technology use in terms of motivation, collaboration among team members, a deep understanding of specific technology topics, and quiet/passive students' active participation.

In the section on managing cultural issues, I evaluated Hofstede's cultural dimension index to construct the questions. Teachers were asked about the differences between male and female students' participation in technology use, students' practising mannerisms, students' dependency on teachers for the benefit of technology, students' becoming bored with using the same technology, constant motivation, student learning behaviour with technology, the ease of managing various types of students, and their perceptions of using different technologies for different topics. Students were also asked about working cultural issues with technology on constant motivation, understanding the subject taught, a preference for group activities, and becoming bored using the same technology (Hofstede, 1983).
The interview questions for teachers covered more details on teachers' perceptions of managing technology in the classroom, as well as the challenges and stimulating factors in technology-assisted learning.

4.2.3 Data Collection and Analysis

I used questionnaires and interviews to collect data from teachers and students. The following research questions were used as the rationale to develop the questions:

- Is there insufficient use of mobile and advanced technologies in Southeast Asia secondary schools?
- Is there a lack of competent ICT teachers in secondary schools?
- Does inefficient use of technology increase overall cost and deteriorates students' learning outcomes?
- What current e-education/mobile education technologies apply to Southeast Asia?

To understand and interpret the questions, I used an independent translator to translate the questions to Malay for Malaysian secondary schools and Bahasa Indonesia for Indonesian secondary schools and compared equivalency. On a five-point Likert scale (where 1=strongly disagree and 5=strongly agree OR 1=never used and 5=competent), respondents were asked to rate their overall satisfaction with using technology/digital tools in the classroom as their competency levels. The questionnaire was distributed to 100 randomly selected teachers and 260 selected secondary students from across five secondary schools in Kuala Lumpur and Jakarta. Overall, 301 questionnaires were completed in Malaysia's secondary schools, with 69 teachers *(n=69)* and 232 students *(n=232)* respondents from secondary two and three. From the Indonesian secondary schools, 358 questionnaires were completed, with 99 teachers *(n=99)* respondents and 259 students *(n=259)*. A total of 10 teachers from Malaysia and Indonesia participated in the interview. The data was analysed based on the following criteria:

i) Type of technology/digital tools used in classroom activities
ii) Impact of mobile-assisted learning on student behaviour
iii) Cultural presence in technology-assisted learning

This criterion is vital for identifying the Southeast Asian cultural teaching and learning behaviour among teachers and students using technological/digital tools. Data was analysed using the Mann-Whitney U Test for two countries and descriptive statistics (mean and standard deviation).

The mean and standard deviation were used to examine the main effect of each variable on the use of technology/digital tools in the classroom, as well as its impact on students' learning behaviour and culture. Then, a non-parametric test was employed (Mann-Whitney U Test) to compare the mean between the two countries and to determine the similarity of the test results between the two countries. The acceptance/rejection of the hypothesis identified on the perceptions of teachers and students' technological use in the classroom and students' learning behaviour was carried out. This analysis is significant in this study as it identifies areas that impact 'stimulation' and 'motivation' factors in a culturally oriented learning environment for using technological/digital tools among Southeast Asian students. The findings presented in this section are based on descriptive and inferential statistical

analyses with the probability set at $\leq .05$. My method and conclusions are limited to the self-reported nature of the survey questions and interviews and our assumptions.

4.2.4 Results - Survey

Before the results are presented, it should be noted that the Mann-Whitney U Test was used to analyse this study's results.

Result – Hypothesis 1: ICT usage in SEA is less than ICT usage in the west.

Here I clearly identify the independent variables as region and the dependent variable as ICT use. For this test, I first analysed the frequency of technology/digital tools teachers use in the classroom in SEA country for activities (mean and standard deviation). A low mean score of $M < 3.2$ for using technology/digital tools by teachers in Malaysia and Indonesia for their activities for all categories (refer to Table 4-2). Hence, I wanted to test if insufficient ICT use has led to the incompetent use of technology/digital tools in the classroom. I identified H_0: There is no significant differences of technology/digital use in classroom across the two countries. There are no differences in the utilisation of IT for education between Malaysia and Indonesia. Looking at the data in table 4-2 it seems the averages between the two countries are NOT significant. However, when compared to technology study in Quebec, Canada in Elementary schools with 799 teachers (Wozney et al., 2006). This study showed that 76% of teachers rated student access to computer resources as "acceptable," "good," "very good," or "excellent". While 56% of the respondents reported using computers for personal use between 1 to 5 hours a week.

Table 4-2: Use of Technology/Digital Use in Classroom by Country.

Country	***Technology/digital tool use in the classroom***	***N***	***Mean (M)***	***Standard Deviation (SD)***
Malaysia	Internet to solve problems	69	2.78	0.88
	Internet to develop lessons	69	2.32	0.92
	Mobile device	69	2.64	1.33
	Learning Management System	69	3.19	1.04
	Online Video	69	2.44	0.9
	Collaboration tools	69	2.5	1.03
	Email	69	2.69	1.11
	Social Media	69	2.44	1.36
Indonesia	Internet to solve problems	99	2.48	1.19
	Internet to develop lessons	99	2.69	1.06

	Mobile device	99	2.62	1.36
	Learning Management System	99	2.77	1.27
	Online Video	99	1.9	1.14
	Collaboration tools	99	1.81	1.29
	Email	99	2.03	1.15
	Social Media	99	2.35	1.42

Value 4=daily, 3=weekly, 2=monthly, 1=never, 0=NA

There are significant differences between the two countries and no corelation between the categorical variables "Professional development" and "Technology use" for teachers. The distribution of professional development for technology-assisted teaching across the country with $p \leq .05$. (Refer to Table 4-3). In comparison to Quebec, Canada Technology use in Elementary school, teachers who reported using computers "all the time" were more likely to place themselves in the "average," "advanced," or "expert" proficiency level $\chi 2(36, N = 764) = 330.39, p < .001$.

Table 4-3: Technology Professional Development for Teachers.

Professional Development	**Country**	**N**	**MEAN RANKS**
Sufficient Professional Development for Technology-Assisted Teaching	Malaysia	69	56.39
	Indonesia	96	101.46
Chi-Square = 36.3 ($p \leq .05$)			

I used an alternate hypothesis, H_1, to verify that incompetency in digital tools has led to the insufficient use of digital tools in the classroom. To test the alternative hypothesis, H_1, I observed the categorical variables for competency and using technology/digital tools in teaching.

The distribution is the same across countries ($p \geq .05$) for the following categories for Mann-Whitney U Test result. (Refer to Table 4-4):

- Internet research competency;
- Learning Management Systems (LMS)-assisted teaching competency;
- online-video assisted teaching competency;
- Social media-assisted teaching.

However, the rest of the categories show different results for both countries ($p \leq .05$).

Table 4-4: Teachers Technology Competency.

Competency	**Country**	**N**	**MEAN RANKS**
Internet Research	Malaysia	69	76.56
	Indonesia	96	87.63
Chi-Square = 4.26 (p ≥ .05)			
Internet use to develop Lessons	Malaysia	69	65.08
	Indonesia	94	94.42
Chi-Square = 15.75 (p ≤ .05)			
Mobile Device Assisted Teaching	Malaysia	69	72.49
	Indonesia	95	89.77
Chi-Square = 11.8 (p ≤ .05)			
LMS Assisted Teaching	Malaysia	69	82.8
	Indonesia	95	82.28
Chi-Square = 2.71 (p ≥ .05)			
Online Video Assisted Teaching	Malaysia	69	83.02
	Indonesia	94	81.25
Chi-Square = 11.74 (p ≥ .05)			
Collaboration Tool-Assisted Teaching	Malaysia	68	93.76
	Indonesia	94	72.63
Chi-Square = 2.36 (p ≥ .05)			
Email Assisted Teaching	Malaysia	69	89.23
	Indonesia	93	75.76
Chi-Square = 0.951 (p ≤ .05)			
Social Media Assisted Teaching	Malaysia	69	78.41
	Indonesia	92	82.95
Chi-Square = 11.84 (p ≥ .05)			

It is important to note that teachers' competency levels in using digital tools influence the ICT use in the classroom. The competency levels affect the extensive exploration of teachers' digital tools for classroom activities. Hence, I approve H_1—that teachers' incompetency with digital tools has led to the insufficient use of digital tools in the classroom. Teachers' incompetency in technology and digital tools will seriously affect students' learning ability. International studies also indicate that teaching strategies for 21st century competencies are not well implemented in educational practices due to insufficient preparation for teachers on innovative teaching and learning practices (Voogt et al., 2013). The same point was echoed by Lawless and Pellegrino, where they identified quality professional

development practices on essential technology used for instruction impacted teachers' behaviour resulted in low students' achievement (Lawless and Pellegrino, 2007).

Result – Hypothesis 2: Mobile Technologies Improve Students' Learning Experiences

Independent variable: use of mobile assisted learning
Dependent variable: learn experience
Students' data was used to assess mobile-assisted learning and the significant effect on learning behaviour. There was positive learning behaviour among students that can be observed during technology-assisted learning in the classroom, where the mean value is between 3 (neutral) and 5 (strongly agree) (refer to Table 4-5) mean scores for all categories with $M > 3$. Students are motivated when learning technology is used in classes in Malaysia (scores are significantly higher than the natural value 2.5). Students are motivated when learning technology is used in classes in Indonesia (score are significantly higher than the natural value 2.5). Hence, I approve H_1 – Mobile technologies can improve students' learning experiences.

Table 4-5: Mobile-Assisted Learning on Students' Behaviour (students' perception).

Country	***Learning* Behaviour *with Mobile Assisted Learning***	***N***	**Mean *(M)***	**Standard *Deviation (SD)***
Malaysia	Motivated when using Mobile Device	232	4.37	0.85
	Collaborate better with classmate	232	4.39	0.79
	Better Teamwork	232	4.27	0.86
	Better Understanding of the topic	232	4.15	0.85
	Constantly Motivated	232	4.23	0.76
	Prefer Group activity	232	4.16	0.96
	Bored using the same Technology/digital tools	232	3.08	1.14
Indonesia	Motivated when using Mobile Device	259	3.80	0.88
	Collaborate better with classmate	259	4.07	0.75
	Better Teamwork	259	3.88	0.85
	Better Understanding of the topic	259	3.71	0.79
	Constantly Motivated	259	3.85	0.84
	Prefer Group activity	259	3.89	0.90
	Bored using the same Technology/digital tools	259	3.22	0.91

Value 5 means strongly agree. 1 means strongly disagree

A Mann-Whitney analysis was conducted to test H_0—that the distribution of learning behaviour among students is the same across countries during technology-assisted learning. The mean rank distribution is not significantly different across all categories and countries ($p < 0.05$, so reject H_0) for all categories except for "Bored Using the Same Technology/Digital Tools," which is the same across the categories of countries ($p > 0.05$, so accept H_0) (refer to Table 4-6).

Table 4-6: Mann-Whitney Test on learning behaviour (students' data).

Learning Behaviour	**Country**	**N**	**MEAN RANKS**
Motivated when using a mobile device	Malaysia	232	287.28
	Indonesia	250	199.02
Chi-Square = 58.6 ($p \leq 0.05$)			
	Malaysia	232	273.01

Collaborate Better with Classmate	Indonesia	250	212.26
Chi-Square = 31.29 ($p \leq 0.05$)			
Better Teamwork	Malaysia	231	272.02
	Indonesia	247	209.08
Chi-Square = 24.09 ($p \leq 0.05$)			
Better Understanding of Topic	Malaysia	230	275.56
	Indonesia	248	206.06
Chi-Square = 35.86 ($p \leq 0.05$)			
Constantly Motivated	Malaysia	232	273.58
	Indonesia	250	211.73
Chi-Square = 15.03 ($p \leq 0.05$)			
Prefer Group Activity	Malaysia	232	264.14
	Indonesia	250	220.49
Chi-Square = 17.75 ($p \leq 0.05$)			
Bored Using Same Technology	Malaysia	229	234.13
	Indonesia	250	245.38
Chi-Square = 0.653 ($p \geq 0.05$)			

Hence, the data suggest that mobile-assisted learning improves student learning behaviour. However, the result showed a significant difference between Malaysia and Indonesia for all categories except for students being bored using the same technology/digital tools. Both countries had a similar outcome.

Teachers' data was used to assess mobile-assisted learning and its significant effect on students' learning behaviour. The mean score for all categories is $M > 3.4$ across both countries, where the mean value is between 3 (neutral) and 5 (strongly agree) (refer to Table 4-7). Hence, teachers perceive students' positive learning behaviour during mobile-assisted classroom learning. A Mann-Whitney U test analysis was conducted to test H_0— there is no significant difference in the distribution of learning behaviour among students across countries for mobile-assisted education.

Table 4-7: Mobile-Assisted Learning on Students' Behaviour – Teachers' Perception.

Country	***Learning Behaviour with Mobile Assisted Learning***	***N***	***Mean (M)***	***Standard Deviation (SD)***
Malaysia	Students demonstrate a high level of learning	69	3.49	0.74
	Students are motivated	69	3.68	0.78
	Better student collaboration	69	3.66	0.75
	Better teamwork among students	69	3.61	0.77
	Easier to make students understand	69	3.76	0.65
	Easier to get quiet students to participate	69	3.79	0.58
Indonesia	Students demonstrate a high level of learning	99	4.17	0.66
	Students are motivated	99	4.17	0.66
	Better student collaboration	99	4.08	0.69
	Better teamwork among students	99	4.05	0.66
	Easier to make students understand	99	4.02	0.65
	Easier to get quiet students to participate	99	3.69	0.86

Value 5 means strongly agree. 1 means strongly disagree

There is no significant difference for some categories in the Mann-Whitney U Test (refer to Table 4-8) and the following categories show the same test results ($p > 0.05$, so accept H_0) across both countries:

- Using mobile-assisted learning is easier to use to get quiet students to participate;
- Mobile learning makes it easier to manage different types of learners;
- Students are bored using the same technology to learn a topic;
- Students understand better with different technologies for different topics.

Table 4-8: Mann-Whitney Test on learning behaviour (teachers data).

Learning Behaviour	**Country**	**N**	**MEAN RANKS**
Students demonstrate a high level of learning	Malaysia	69	60.54
	Indonesia	95	98.45
Chi-Square = 18.14 ($p \leq 0.05$)			
Students are motivated	Malaysia	68	66.15
	Indonesia	95	93.35

Chi-Square = 11.52 (p ≤ 0.05)			
Better student collaboration	Malaysia	68	68.66
	Indonesia	95	91.55
Chi-Square = 10.79 (p ≤ 0.05)			
Better teamwork Among students	Malaysia	67	67.41
	Indonesia	95	91.44
Chi-Square = 5.88 (p ≤ 0.05)			
Easier to make students Understand	Malaysia	68	73.29
	Indonesia	95	88.24
Chi-Square = 6.1 (p ≤ 0.05)			
Easier to get quiet students to participate	Malaysia	68	85.07
	Indonesia	95	79.80
Chi-Square = 4.12 (p ≥ 0.05)			
Eases in Managing different types of Learners	Malaysia	68	86.08
	Indonesia	97	80.84
Chi-Square = 1.66 (p ≥ 0.05)			
Students understand better with different technology for different activity	Malaysia	68	79.04
	Indonesia	98	86.6
Chi-Square = 6.33 (p ≥ 0.05)			
Students are constantly Motivated	Malaysia	68	74.57
	Indonesia	98	89.7
Chi-Square = 10.83 (p ≤ 0.05)			
Students are Bored using the same technology	Malaysia	68	80.55
	Indonesia	98	85.55
Chi-Square = 0.039 (p ≥ 0.05)			

This data suggest that teachers from Malaysia and Indonesia perceive mobile-assisted learning can improve students' learning outcomes and experiences. No significant differences in test outcomes from both countries (for some categories) for different types of learners showed that learners learn better with mobile-assisted learning, primarily passive learners. A computer that arouses a high frustration level in a user can be re-designed so that users can feel positive from interaction rather than negative (Klein et al., 2002). Specific preferences and the need to access learning resources represent what the user wants the system to look like. The required functionality for the users must be included in the design to support the interaction level (Qi and Boyle, 2010). Thus, technology developers need a

paradigm shift in their design thinking process, focusing on factors that appeal and engage passive learners.

Result – Hypothesis 3: Culturally Motivated Technology is Required to Stimulate Teaching and Learning

Independent variables: teacher (gender differences and teacher oriented)

Dependent variables: learning outcomes

I used the questions in Table 4-9 to assess the presence of cultural attributes in Southeast Asian classroom learning. Table 4-9 shows the mean and standard deviation for the selected questions. The mean score for all categories in Table 4-9 shows $M > 2.9$ (neutral to agree) across both countries. Mann-Whitney U test was conducted to test H_0— there is no significant differences in the distribution of cultural learning attributes among students during mobile-assisted learning.

Table 4-9: Cultural Presence in Technology-Assisted Learning.

Country	***Cultural presence in Southeast Asian Secondary Schools***	***N***	***Mean (M)***	***Standard Deviation (SD)***
Malaysia	Students wait for teachers' instructions before exploring Mobile Assisted Learning.	69	3.21	0.92
	Students respect teachers and parents when posting comments on social media.	69	3.28	0.73
	Technology Assisted Learning adds more value to groups than the individual.	69	3.35	0.64
	Male students learn faster than female students in Technology-Assisted Learning.	69	3.45	0.64
	Students dependent on teachers during technology-assisted learning activities	69	2.91	0.82
Indonesia	Students wait for teachers' instructions before exploring Mobile Assisted Learning	99	3.55	0.81
	Students respect teachers and parents when posting comments on social media	99	3.82	0.92

	Technology-Assisted Learning adds more value to groups than individual	99	3.85	0.74
	Male students learn faster than female students in Technology-Assisted Learning.	99	3.42	0.99
	Students dependent on teachers during technology-assisted learning activities	99	3.33	0.98

Value 5 means strongly agree. 1 means strongly disagree

There are significant differences in the result for Mann-Whitney U Test (refer to Table 4-10) across all categories of the two countries ($p < 0.05$, so reject H_0) except for "Male Students Learn Faster Than Female Students in Technology-Assisted Learning," which is the same across categories of countries ($p > 0.05$, so accept H_0).

Table 4-10: Cultural presence during Technology Assisted Learning.

Cultural Presence	**Country**	**N**	**MEAN RANKS**
Male students learn faster than female students	Malaysia	66	78.51
	Indonesia	96	83.56
Chi-Square = 1.69 (p ≥ 0.05)			
Students wait for the teacher's instructions before exploring Mobile Assisted Learning	Malaysia	68	70.29
	Indonesia	97	91.91
Chi-Square = 4.4 (p ≤ 0.05)			
Students respect teachers and parents when posting comments on social media	Malaysia	68	65.79
	Indonesia	98	95.79
Chi-Square = 13.09 (p ≤ 0.05)			
Technology-Assisted Learning adds more value to groups than individual	Malaysia	68	75.22
	Indonesia	98	89.24
Chi-Square = 2.96 (p ≤ 0.05)			
Students dependent on teachers during Technology-Assisted Learning	Malaysia	68	70.81
	Indonesia	96	90.78

Chi-Square = 3.36 ($p \leq 0.05$)

The data suggest that cultural values exist among Southeast Asian students during mobile-assisted learning in the classroom. Another point to note on the existence of cultural values among students has to do with the question of students' respect for teachers and parents when commenting on social media; it shows the presence of PD between students and the senior group of people (teachers and parents) with a mean score of > 3.2 and a standard deviation between 0.7 and 0.93 for both countries. Students place teachers and parents as a group of higher authority that requires due respect. This validates Hofstede's study on PD and a feminine society. Southeast Asian countries have high PD cultures, where children are expected to be obedient to parents and those of higher status. Persons in positions of authority represent God, so their objectives should be followed. Southeast Asian countries do fall on the feminine side, where the softer aspects of the culture, such as levelling with others, being humble, and being modest, are given utmost importance (Hofstede, 1983).

However, when it involves technology-oriented learning, students seem to prefer to explore technology before being instructed in consideration of the variable "students wait for teachers' instruction before activities" ($M > 3.21$ and *SD between 0.81 and 0.92*). A significant finding is that students choose to use digital tools for their self-initiation and place teachers as facilitators, where students seek advice only when required. This finding corroborates why teachers use technology in the classroom for students' self-directed learning (Baek et al., 2008).

Comparing technology usage among male and female students in Hofstede's study on MFI, where the culture that places a high value on masculine traits stresses assertiveness, competition, and material success, was also evident in this study (Hofstede, 1983). Male students showed more interest in the use of technology-assisted learning compared to female counterparts. Concerning the variable for comparing male and female students, teachers perceived those male students dominated technology-assisted activities ($M > 3.4$ and an *SD between 0.64 and 0.99*). This is the only variable that shows similar results when comparing both countries with $p>0.05$ in the Mann-Whitney U test. This result signifies the complexity of using technology and digital tools among students. The masculine group of students are ready to explore the tools and willing to face the challenges. In contrast, the feminine group prefers to withdraw from the intricacy and convoluted technology.

4.2.5 Results - Interview

A total of 10 ICT teachers from Malaysia and Indonesia participated in the interview. The results of the interviews with teachers suggest several challenges in using technology in classrooms, including "time-consuming computer setup for each session, which leads to the minimal exploration of technological usage by teachers during lessons". Teachers identified that "there were no positive and supportive environments, such as insufficient Chromebooks, unstable Internet connections", and "insufficient professional development, which leads to the insufficient and incompetent use of technology amongst teachers in the classroom, thus affecting the passive group of teachers". Hence, customised technology training and support are required.

The types of digital tools used by teachers were identified as VLE Frog (LMS), Kahoot (software for a game/quiz), and PowerPoint with Chromebook, thus revealing the insufficient use of other technologies and digital tools in the classroom. Teachers also identified that they face challenges in managing different types of students in the classroom. They explained that their solution for managing diversified students is often "grouping active students with passive/weak students". Passive students were identified as those from rural areas who lacked technology/digital tools exploration. However, teachers observe that passive students are more willing to participate in digitally oriented lessons than in a conventional classroom. Teachers accepted that "passive students, especially students from the rural have a certain level of phobia in handling technology in the classroom and lack of confidence". Teachers acknowledged that VLE Frog simplifies their teaching; hence, this digital tool was identified as the most frequently used tool for their teaching activities. The interview summary is a word cloud in Figure 4-2.

Figure 4-2: Interview summary - Word Cloud.

4.2.6 Findings and Discussion

The results identified a few findings as stated below:

Finding 1

The professional development for teachers is adequate; however, teachers' lack of knowledge in using digital tools and technology has impacted the optimum use of these digital tools for practical activities in the classroom. Teachers are not willing to explore technology/digital tools on their own, and the professional development for teachers is not tailored and rigorous enough to cater to the optimal use of technology/digital tools for classroom activities specifically to accommodate a diversified group of students. Teachers are not competent in using technology/digital tools to cater to different needs during classroom activities. Hence, Southeast Asian Teachers can be classified with mild "Cyberphobic" characteristics, and these challenges place a disposition among teachers to explore digital tools for technology-assisted activities effectively. Teachers' belief in their personal ability to effectively use technology has potential effects on students' achievements (Rakes et al., 2006). Thus, Southeast Asian teachers require a technology educational tool integrating HCI elements with cultural friendly features to promote technology diffusion practices for classroom activities. Hofstede's cultural dimension identifies the cultural component visibility among Southeast Asian students' learning styles in the classroom.

Finding 2a. The first cultural component was observed when teachers agreed that technology-assisted learning adds more value to groups than individuals. This corroborates Hofstede's study on individualism versus collectivism (IC), which focuses on the degree to which people in Southeast Asian countries prefer to act as group members rather than as individuals (Hofstede, 1983). The essence of group collaboration which adds more value to technology-assisted learning, stresses the existence of "Cyberphobic" characteristic among Southeast Asian students hence the preference for learning in groups and thus ensuring comfortability and confidence. Students categorised as "Cyberphobic" show reluctance to explore technology and lack confidence in technology-assisted learning, thus stressing the need for collectivism-oriented study. Hence, the need for cultural friendly and easy-to-use digital tools in technology-assisted education is essential. These echoed findings from the survey of virtual reality-based learning and emotional consideration. The researchers found that environment richness, such as 3-D virtual objects in the design element, can arouse learners' interest and increase their curiosity about the subject matter (Chuah et al., 2011).

Our study also shows that students are bored using the same technology for lessons. Based on a previous survey of HCI, researchers studied students' cognitive-affective states using three educational tools. They found that engaged concentration was the norm when learning with technology, and the most persistent state was boredom. When a student is bored, it is difficult to transit out of

boredom (Baker et al., 2010). In another study, scholars identified that offering no support for the user's emotional state during or after a system failure is paramount to ignoring emotions, leading to loss of opportunity for continued interaction with the user. It is vital to consider the user's emotional state as a constant factor in the design process. Text and buttons may be overlooked and underutilised methods to create an agency (Klein et al., 2002). Students' negative emotional state affects their learning capability and impairs their ability to absorb the knowledge learned. Combining motivational and behavioural data provides insights into learners' needs, and individual differences between learners are essential mediators of the effectiveness of instructional techniques (Kizilcec and Schneider, 2015). User experience significantly impacts learners and must be considered by the designers of digital tools in the educational paradigm. The sophistication of the creation of technologies require a paradigm shift in the design for the academic domain, where enticing, motivating, and stimulating factors must be adequately addressed to encourage extensive exploration of digital tools for optimum teaching and learning—seeking the essential need for appealing and engaging features to be integrated into the design of educational technology and digital tools.

Finding 2b. The second cultural component among students is the question of "students respecting teachers and parents when commenting on social media"; it shows the existence of PD between students and the senior group of people (teachers and parents). Students place teachers and parents as a group of higher authority that requires due respect. Challenges for teachers in maintaining optimism in classroom delivery are heightened with this observation as students place high expectations on teachers' optimism in technological-assisted teaching. Teachers are perceived to be technology savvy and could provide a positive technology diffusion technique which ascertains students' smooth blending into technology-assisted learning. Thus, a simplified teaching technology would motivate educators and increase their confidence in the technology-assisted classroom. This finding corroborates with the study on what makes teachers use technology in the classroom and indicates that teachers decide to use technology primarily to meet external policies and needs rather than the belief of technology effectively in their classrooms (Baek et al., 2008).

Another point to note, if technical glitches happen weekly or monthly, then confidence in technology's worth erodes and contributes to sustaining current teaching practices among teachers (Cuban et al., 2001). Technology and digital tool developers for educational platforms must identify the need to entice education with ease of usability to motivate teachers to effectively utilise technology and digital tools by reducing time and cost. From another perspective, learning management system design has become more complex because the cross-cultural impact influences how individuals adapt to using learning management systems (Chung et al., 2013). However, little has been done to improve usability features in the learning domain. Usability measured by effectiveness, efficiency, and satisfaction is often overlooked in the development of educational platforms due to the lack of technical skills of instructors and software developers (Vrasidas, 2004).

Finding 2c. The third cultural component present in the findings deals with teachers' ability to use digital tools in technological-assisted teaching. The results showed that teachers in Malaysia and Indonesia are contented with the current professional development, which does not cater to their actual use with the optimisation of digital tools in the classroom. Hence, the low UA attitudes of teachers affect students' learning ability, leading to non-optimal learning outcomes with technology-oriented learning.

Finding 3 – Clusters

Cluster A (Gender Cluster on Group Activities)

An analysis of data using clustering techniques for both countries reveals different views among female and male students. Group activities using technology are not preferred by female students compared to male students, as shown in Figure 4-3. The mean score for the variable "Prefer group activities during technology-assisted learning" shows females with *M=3.9* and males with *M=4.12*. The variable "Collaborate better with classmates during Technology Assisted Learning" shows females with *M=4.12* and male students with *M=4.30*. "Better teamwork with Technology Assisted Learning" shows females with a lower score of *M=4.02* and male students with *M=4.10*. Hence, I can infer that the female student clusters from Malaysia and Indonesia find that technology-assisted learning does not add value to group interactions and activities compared to male student clusters.

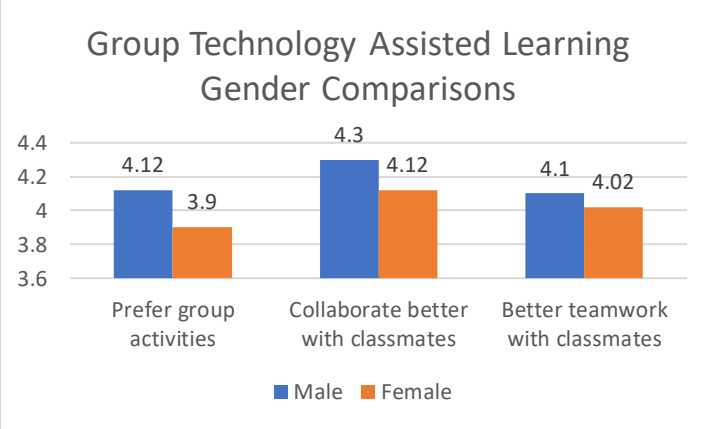

Figure 4-3: Group Technology-Assisted Learning (Gender Comparisons).

Data analysed using clustering techniques for both countries reveal different views on the part of female and male teachers. Female teacher cluster scored a somewhat lower mean for group activities with technology-assisted teaching among students than male teacher cluster, as shown in Figure 4-4. The mean score for the variable "Technology-assisted teaching has better student collaboration" shows female teachers with *M=3.88* and male teachers with *M=3.98*. The mean score for the variable "Technology-assisted teaching has better teamwork among students" shows female teachers with

M=3.83 and male teachers with *M=3.98*. Female students and teachers scored lower than male students and teachers for all group collaboration with technology-assisted teaching and learning. Hence, this suggest that female Asians have lower expectations for group activities and collaboration with technology-assisted activities than their male counterparts.

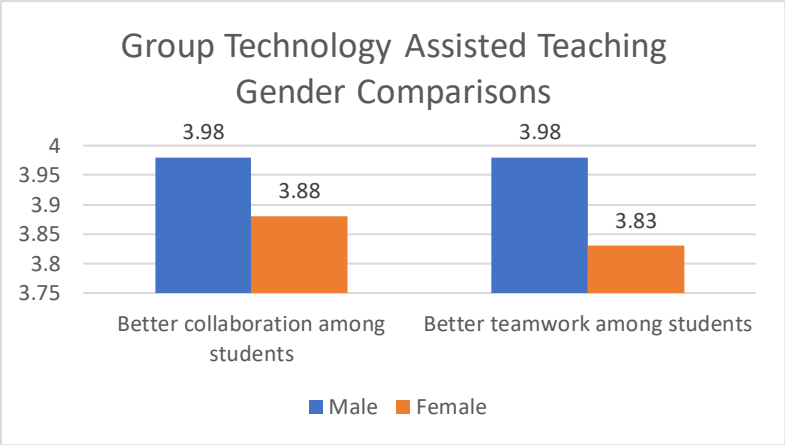

Figure 4-4: Group Technology-Assisted Teaching (Gender Comparisons).

Cluster B (Gender Cluster on Internet Use)

Data analysed using clustering techniques for both countries on the use of the Internet to develop lessons and engage in research or problem-solving reveal different views among female and male teacher clusters, as shown in Figure 4-5. Female teacher clusters scored a somewhat lower mean for the variable "Use of the Internet to develop lessons" with *M=2.45*, compared with male teachers, who scored *M=2.77*. A similar result was observed using the variable "Use of the Internet to Research/Solve problems", which shows female teachers with *M=2.53* compared to male teachers with *M=2.81*.

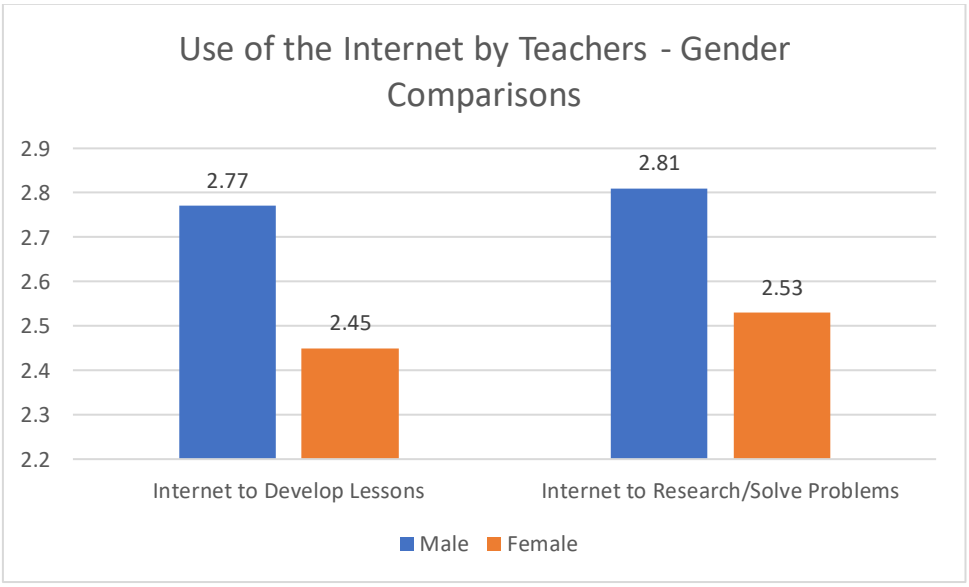

Figure 4-5: Use of the Internet by Teachers (Gender comparisons).

Female teachers and students scored lower than male teachers and students, signifying lower expectations for and minimal exploration of technology use in daily activities by females in Southeast Asia. This suggest that the female groups' minimalist exposure could reveal a hostile stance toward what prevalent technology can offer the Southeast Asian sector in the modern era.

Cluster C (Age Cluster on Flexibility)

Age clustering technique is used to observe teachers' flexible use of technology to reveal exciting views. Figure 4-6 shows that teachers between the ages of 20 and 30 had lower mean scores compared to teachers over the age of 50 for the following three variables:

- Better learning requires different technology for different activities;
- Technology facilitates managing different types of learners;
- Can change technology instantly to suit learners.

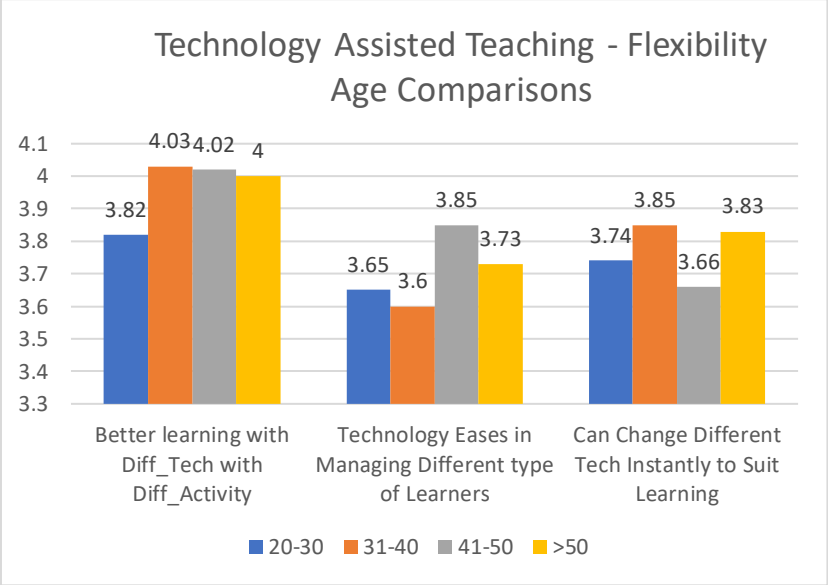

Figure 4-6: Technology-Assisted Teaching Flexibility (Age Comparisons).

The data suggest that older and experienced teachers are more flexible when employing technology-assisted teaching than their younger counterparts despite higher technology exposure among younger teachers. The younger teachers' versatility with technology might not be a factor in their approach to using technology flexibly in the classroom. Teaching experience plays a pivotal role in delivering content using technology with sophistication and knowledge.

Cluster D (Gender Cluster on Technology Competencies)

Gender clusters were used to analyse competencies among teachers using technology for instruction, as shown in Figure 4-7. Gender comparison suggest two groups for female teachers and one cluster for

male teachers. Female cluster 1 *(n=86)* scored higher (*M>4.0*) for all categories of technology-assisted teaching compared to male teachers *(n=43),* who scored between *3.4* and *3.95* for all categories. Female cluster 2 *(n=30)* scored lower (*M<2.8*) for all categories of technology-assisted teaching. This finding suggest that the female group cannot be classified as a single cluster in this context, as technology competency affects individuals' ability to position themselves as experts or non-experts. The two clusters disclose the expert and amateur female groups concerning classroom technology use. This finding also highlights that female teacher can supersede their male counterparts in supporting digital activities if they are trained to do so.

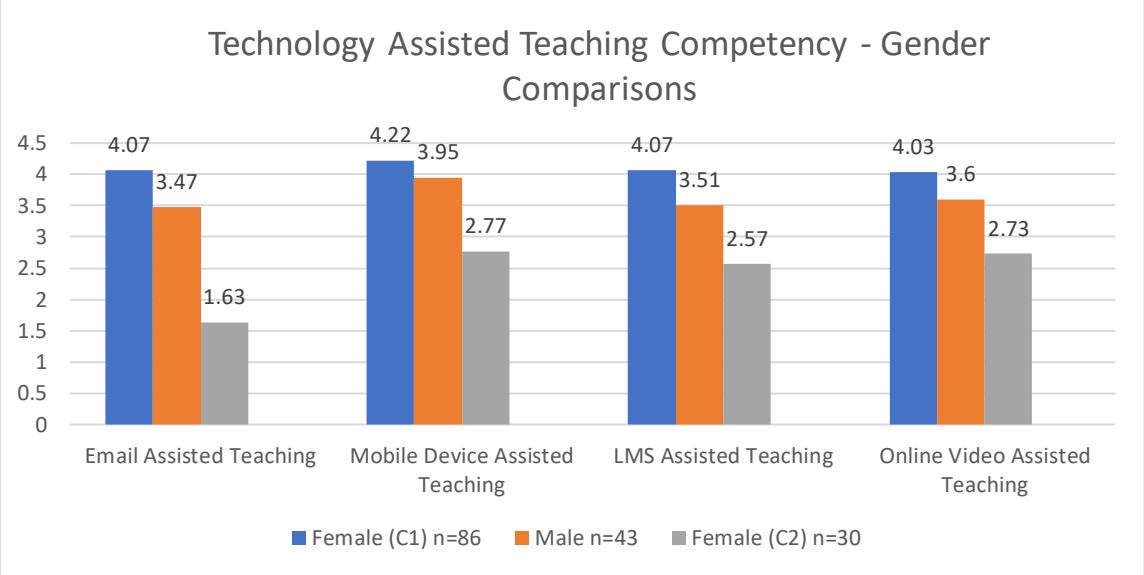

Figure 4-7: Technology-Assisted Teaching Competency (Gender Comparisons).

Hence, adaptive and simplified technology for the "cyberphobic" individuals as a preferred educational platform in Southeast Asia will conveniently stimulate and motivate teaching and learning. It is not what the technology can provide but rather the convenience and simplicity in using the technology to achieve the resultant outcome by eliminating time-consuming and complicated processes. One of the essential facets of analysing user context is understanding the user's goals toward achieving them (Oinas-Kukkonen and Harjumaa, 2018). Hence, the need to assimilate user experience in creating digital tools and technology must be recognised. When you combine freedom of interaction with rich inherent feedback, and a system tries to adapt to and learn from specific situations, you have a good recipe for an engaging experience (Andersen et al., 2005). The emphasis on efficacy factors must be the focus for the educational technology developers, highlighting the importance of design on a cultural-friendly user interface. The findings are summarised in Table 4-11 with the relevance to HCI requirements for the proposed educational technology.

Table 4-11: Summary of Findings with suggested HCI requirements.

Impact	Findings	HCI Requirements	Reference to
Teachers	Accommodating Diversified Students	Efficiently Managing Diversified students (α1)	Roy, 2012
	Time Consuming Setup	Simplified Setup (α2)	Appert et al., 2015
	Students' High Expectations	Simplified interface/features (α3)	Appert et al., 2015
	'Cyberphobic' Characteristics	**Attenuate 'Cyberphobic' Characteristics (α4)**	Desolda et al., 2017; Sundeen & Sundeen, 2013
Students	Require teacher as guidance	Self-Exploring Features (α5)	Alonso-Ríos et al., 2009; Yannier et al., 2016
	High Collectivism		
	Bored	**Improve Students' Motivation (α6)**	Lafreniere et al., 2017
	'Cyberphobia' Characteristics/Lack of confidence	Attenuate 'Cyberphobic' Characteristics (α7)	Desolda et al., 2017; Sundeen & Sundeen, 2013

4.2.7 Conclusion – Malaysia and Indonesia Schools

In conclusion, this section presents the outcome of a comparative empirical study to understand the approach and use of digital tools in classrooms among teachers and students in Kuala Lumpur, Malaysia, and Jakarta, Indonesia. Significant findings from technology-assisted teaching and learning show interactive participation with technology-savvy teachers and active learners who demonstrated a high level of teaching and learning. The opposite is observed with the non-tech-savvy teachers and passive teachers and learners.

It is also important to note in this study that the presence of the Southeast Asian learning culture, which affects the learning outcome. Firstly, the results show that students prefer group collaboration (collectivism) versus individual work (individualism) to solve problems which suggests the existence of "cyberphobic" characteristics among Southeast Asian students. Secondly, the results show that male dominance existed in technology-assisted learning; however, it is still considered a feminine society since the overall activities were modest and humble, which is an essential aspect of technology-oriented activities. Thirdly, the results suggest that students respect teachers, highlighting the pressure set on

teachers to demonstrate optimistic behaviour in the technological diffusion teaching environment for the positive technological-assisted learning attitude transformation of students. Fourthly, the results suggest that teachers agree that digital-based learning can transform passive students into active-oriented students. Fifthly, the cluster classification suggests gender and age differences in technology usage in Southeast Asian secondary schools. However, Southeast Asian teachers are not readily competent to explore and optimise digital tools for teaching purposes. They require convenient ways to boost their confidence to explore digital tools in the classroom. Finally, it should also be noted that students do not wait for instructions when exploring digital tools and feeling of bored using the same technology, which highlights the willingness of students to adapt to mobile-based learning in and outside the classroom, and this contributes to the motivational and stimulant factors that affect the teaching and learning environment. The teaching and learning environment require a convenient, easy, and efficient way to use digital tools for classroom activities. Including cultural and user-friendly features and design becomes the paramount factor for technology-assisted education in Southeast Asia secondary schools.

As this study implies, the incompatibility of educational technology does exist. It must be understood that a standardised learning model will not fit all. A diversified design for teaching and learning with technology is required to stimulate and motivate the "cyberphobic" teachers and students in Southeast Asia secondary schools. Many emerging developments in HCI emphasise the connection between physical activity and cognition and the close relationship between humans and objects in the physical world (Shepard, 2001). Situated learning is deeply rooted in bodily action, similar to individual human conceptualisation and thoughts (Rambusch and Ziemke, 2005). There is a deep connection between education and bodily activity with technology, emphasizing the importance of usability features (Alonso-Ríos et al., 2009). As technology captures the attention of the industry players, users are keen only to explore technology when it is reasonably user-friendly, which requires less effort and minimally complex architecture. The study by Lafreniere, Gutwin and Cockburn suggests that performance requirements can effectively motivate users to acquire the necessary skills to employ expert techniques. In another study, researchers suggest that incorporating the strengths of educational games and intelligent tutoring systems could provide the best option for an educational system (Long and Aleven, 2017). Similarly, Yannier, Hudson, Wiese and Koedinger suggest that the self-explanatory menu synchronises with the physical world and is a critical component in the game experiment that facilitates learning.

As schools prepare to fully support teaching and learning with technology, the factors of user-centred design must be considered in the paradigm of educational tools, and which become the main criteria to be administered by developers and designers. The requirements become more stringent for teachers and students who are passive about using technology in the educational domain. Passive educators and passive learners in technology-integrated education are a vital issue in the rural areas of Southeast Asian countries, which lack interaction with technology and digital tools. One of the

significant challenges of ICT-based learning in rural districts is the computer knowledge of teachers working in the schools; they must be trained to understand various technologies. Researchers agree that supporting composition platforms to privilege adaptability of the adopted interaction paradigm will need to accommodate domain-specific requirements. The paradigm cannot be considered the only possible solution as it would require adaptations (Desolda et al., 2017). The rural districts have unique needs and may rely on other factors and alternate funding for instructional technology needs (Sundeen and Sundeen, 2013). The study on culture has suggested the need for HCI to recognise, understand and respect the cultural values and structures if it is to collaborate with cultural practitioners (Benford et al., 2015). This study's recognition of HCI elements as part of educational technology is vital. It allows the technology developers to postulate their design to the best of the users' interest in the academic industry in Southeast Asia.

4.3 Survey of ICT Adoption in Philippines and Brunei Secondary Schools

4.3.1 Background

In this Section, I empirically investigated how teachers' and students' perceptions of cultural dimensions impact their use of technology/digital tools and learning behaviour in Philippines and Brunei secondary schools using the Technology Uses and Perception Survey (Venkatesh et al., 2012). Specifically, I investigated the impact of cultural dimensions (power distance, uncertainty avoidance, individualism versus collectivism, and masculinity versus femininity) based on teachers' and students' perceptions of using technology in the classroom (Hofstede, 1983).

The findings suggests that teachers lack competencies in integrating technology/digital tools in classroom activities as incompatibility exists. At the same time, students are willing to explore technology/digital tools with minimal teacher guidance. The results also suggest the cultural presence of collectivism and uncertainty avoidance among teachers and students, which impacted the smooth execution of digital tool integration for the teaching and learning domain in Southeast Asian classrooms.

The following three hypotheses were formulated for this study:

S1.2_H1: Insufficient Technical Training and Professional Development for Secondary School Teachers Have Led to Incompetent Technology Use
S1.2_H2: There is insufficient use of mobile and advanced technologies in Southeast Asian secondary schools
S1.2_H3: Culture affects technology-assisted learning in Southeast Asian secondary schools

4.3.2 Method

Data was collected from 10 secondary schools in Manila, Philippines, and Bandar Seri Begawan, Brunei, on demographics (age and gender), technology perceptions and technology use. Data analysis included managing cultural layers, which could lead to different learning outcomes among teachers and students on a comparative basis. The Ministry of Education in each country randomly selected the schools in the capital city. The data was collected and analysed with non-parametric tests using independent samples with a Mann-Whitney test and a Kolmogorov-Smirnov test to compare the mean rank between the two countries and descriptive statistics. The analysis included the frequency of technology use; teachers' and students' competency level in the use of technology for activities; and their perceptions of technology use in terms of motivation, collaboration, and cultural dimensions. The interview questions for teachers covered more details about teachers' perceptions of managing technology in the classroom and challenges in technology-assisted teaching and learning.

4.3.3 Data Analysis

On a 5-point Likert scale, respondents were asked to rate their overall satisfaction with using technology/digital tools in the classroom and their competency level. Scales ranged from 1 = *strongly disagree* to 5 = *strongly agree,* from 1 = *never used* to 5 = *competent,* and from 0 = *NA* to 4 = *daily*. The questionnaire was distributed to 100 randomly selected teachers and 250 Secondary two and three students from across ten secondary schools in Manila and Bandar Seri Begawan. The principals of the respective schools randomly selected the teachers and students. Overall, 328 questionnaires were completed in Philippine secondary schools, including teacher *(n = 82)* and student *(n = 246)* respondents. From the Brunei secondary schools, 333 questionnaires were completed, with teacher *(n = 92)* and student *(n = 241)* respondents. A total of 10 teachers from the Philippines and Brunei participated in the interview.

A Mann-Whitney U test, Kolmogorov-Smirnov one-sided two-sample test and descriptive statistics were used to analyse the data. The mean and standard deviation were used to examine the main effect of each variable on the use of technology/digital tools in the classroom, which impacted students' learning behaviour and cultural presence. A non-parametric test was employed (Mann-Whitney U test)

to compare the mean between the two countries and to determine the similarity of test results between the two, as well as the acceptance/rejection of the hypotheses on the perception of teachers' and students' technological use in the classroom. The findings presented in this section are based on descriptive and inferential statistical analyses with the probability set at $\leq .05$. My method and conclusions are limited to the self-reported nature of the survey questions and interview and my assumptions.

4.3.4 Results - Survey

Before the results are presented, it should be noted that the Mann-Whitney U Test was employed to analyse this study's results.

S1.2_H1: ICT usage in SEA is less than ICT usage in the west

Here I clearly identify the independent variables as "region" and "professional development" and the dependent variable as ICT use. I first analysed teachers' frequency of technology/digital tools for classroom activities by country (mean and standard deviation). There is a low mean score ($M < 2.84$) and median ≤ 3.0 for using technology/digital tools by teachers in the Philippines for activities in all categories (refer to Table 4-12). The Brunei data show a lower mean score ($M < 2.01$) and a lower median score (≤ 2.0) for all categories of technology/digital tools used in the classroom. This indicates that teachers' do not frequently explore technology/digital tools in classroom. I identified H_0: The distribution of ICT use is the same across countries. There are no differences in the utilisation of IT for education between Philippines and Brunei. Looking at the data in table 4-12 it seems the averages between the two countries are NOT significant. However, when compared to technology study in Quebec, Canada in Elementary schools with 799 teachers (Wozney et al., 2006). The Quebec study showed that 76% of teachers rated student access to computer resources as "acceptable," "good," "very good," or "excellent". While 56% of the respondents reported using computers for personal use between 1 to 5 hours a week.

Table 4-12: Frequency of Technology/digital tools in classroom by teachers.

	Philippines (N=80)			*Brunei (N=92)*		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Internet to solve problems	2.44	3.0	1.06	1.90	2.0	1.07
Internet to develop lessons	2.84	3.0	1.05	2.01	2.0	1.10
Mobile device	2.61	3.0	1.28	1.66	1.0	1.24
Learning Management System	1.36	1.0	1.21	0.91	1.0	0.78
Online Video	2.13	2.0	1.07	1.85	2.0	0.97
Collaboration tools	1.86	2.0	1.25	1.37	1.0	1.17
Email	1.56	1.0	1.25	1.43	1.0	1.13
Social Media	2.54	3.0	1.23	1.45	1.0	1.21

Value 4=daily, 3=weekly, 2=monthly, 1=never, 0=NA

This result suggests a further test required to find if insufficient professional development led to incompetent classroom use of technology/digital tools. There are no significant differences in the distribution of inadequate professional development in technology-assisted teaching across countries. An independent sample Mann-Whitney test was conducted on teachers' acceptance of sufficient professional development in technology-assisted education. In comparison to Quebec, Canada Technology use in Elementary school, teachers who reported using computers "all the time" were more likely to place themselves in the "average," "advanced," or "expert" proficiency level $\chi 2(36, N = 764) = 330.39, p < .001$.

Here there is significant difference for the results of the Mann-Whitney test (refer to Table 4-13) for the distribution of professional development for technology-assisted teaching for the two countries *($p \leq .05$).* It is also important to note that Brunei scored a lower median score (3.0) compared to the Philippines (4.0). There are significant differences between the two countries and no corelation between the categorical variables' "professional development" and "ICT use". The distribution of professional development for technology-assisted teaching across the country with $p \leq .05$. Hence, this approves H_0: Insufficient professional development has led to incompetent technology use for teachers in two countries in Southeast Asia: Philippines and Brunei. (Refer to Table 4-13).

Table 4-13: Technology Professional Development for Teachers (Test 1)

Professional Development	Country	N	MEDIAN	MEAN RANKS
Sufficient Professional Development for Technology Assisted Teaching	Philippines	80	4.0	114
	Brunei	90	3.0	60.2
Chi-Square = 16.5 (p ≤ .05)				

Further Kolmogorov-Smirnov one-sided two-sample statistics are shown in Table 4-14. The test result also indicates that the distribution of professional development for technology-assisted teaching differs across countries *(p ≤ .05)*. I used an independent variable (competency) to test the hypothesis, to verify that incompetency in digital tools has led to the insufficient use of digital tools in the classroom. To test the hypothesis, I observed the categorical variables for competency and using technology/digital tools in teaching.

I observed the variables for competency in using technology/digital tools for teaching (refer to Table 4-14) where teachers reported low competency levels for technology and digital tools in the classroom when comparing the two countries. Only the Internet is used competently by teachers in both the Philippines and Brunei, with $M > 4.0$, for research and to develop lessons. The score for the rest of the technology/digital tools shows $M < 3.8$.

Table 4-14: Technology/Digital Tool use competency level of teachers by country.

	Philippines (N=80)			*Brunei (N=92)*		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Internet to do Research Competency	4.1000	4.0	.82062	4.0652	4.0	.94699
Internet to Develop Lessons Competency	4.2125	4.0	.74109	4.0330	4.0	.88758
Mobile Device Assisted Teaching Competency	3.6625	4.0	1.31152	3.0652	4.0	1.45862
LMS Assisted Teaching Competency	3.0375	3.5	1.47934	1.9674	1.0	1.36238
Online Video Assisted Teaching Competency	3.7143	4.0	1.25506	3.4891	4.0	1.39461
Collaboration Tool Assisted Teaching competency	3.2025	4.0	1.44453	2.4286	2.0	1.46926
Email Assisted Teaching competency	2.9870	3.0	1.43723	2.4891	2.5	1.48616
Social Media Assisted Teaching Competency	3.5625	4.0	1.37651	2.5652	3.0	1.49214

Value 5=competent, 4=adequate, 3=weak, 2=very weak, 1=never used

Comparing the results for the two countries using the Mann-Whitney test results in Table 4-15 suggests no significant difference between countries ($p \geq .05$) for the following categories:

- Internet research competency;
- Competency in Internet use to develop lessons;
- Online video-assisted teaching competency.

However, the rest of the categories show significant difference for the two countries ($p \leq .05$).

Table 4-15: Mann-Whitney Test - technology/digital tools competency.

Competency	Country	N	MEAN RANKS
Internet Research	Philippines	80	86.2
	Brunei	92	86.76
Chi-Square = 0.001 (p ≥ .05)			
Internet use to develop Lessons	Philippines	80	90.59
	Brunei	91	81.96
Chi-Square = 1.117 (p ≥ .05)			
Mobile Device Assisted Teaching	Philippines	80	97.64
	Brunei	92	76.81
Chi-Square = 4.868 (p ≤ .05)			
LMS Assisted Teaching	Philippines	80	103.72
	Brunei	92	71.52
Chi-Square = 20.92 (p ≤ .05)			
Online Video Assisted Teaching	Philippines	77	88.48
	Brunei	92	82.09
Chi-Square = 0.004 (p ≥ .05)			
Collaboration Tool Assisted Teaching	Philippines	79	98.41
	Brunei	91	74.29
Chi-Square = 9.706 (p ≤ .05)			
Email Assisted Teaching	Philippines	77	93.14
	Brunei	92	78.18
Chi-Square = 1.179 (p ≤ .05)			
Social Media Assisted Teaching	Philippines	80	103.48
	Brunei	92	71.73
Chi-Square = 7.932 (p ≤ .05)			

To test H_0—that the distribution of learning behaviour among students is the same across countries during technology-assisted learning. The mean rank distribution is not significantly different across all categories and countries ($p < 0.05$, so reject H_0) (refer to Table 4-16). The results show $M > 3.22$ for all three categories for Brunei and the Philippines, which suggests that teachers acknowledge that technology can improve students' learning and understand the potential of technology and its impact on students learning outcomes (refer to Table 4-16) and that the technology/digital tools and their impact on students' learning by country, based on teachers' perceptions. Students are motivated when learning technology used in classes in Philippines (scores are significantly higher than the natural value 2.5). Students are motivated when learning technology used in classes in Brunei (score are significantly higher than the natural value 2.5). However, Table 4-12, which showed teachers' technology/digital tools frequency, indicates otherwise.

Table 4-16: Technology/Digital Tool impact students learning – (Teachers data).

	Philippines (N=80)			*Brunei (N=92)*		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Students demonstrate high level of learning when technology is used during lessons	3.96	4.0	0.770	3.22	3.0	0.742
Students are motivated when technology is used during lessons	4.24	4.0	0.75	3.67	4.0	0.728
Easier to make students understand if technology is used during lessons	4.16	4.0	0.75	3.57	4.0	0.773

Value 5 means strongly agree. 1 means strongly disagree

It is important to note that teachers' competency in using digital tools influences the use of digital tools in the classroom. A mental block in using the digital tools creatively leaves no room for improvement in making an exciting classroom activity that can motivate students to use these digital tools. Hence, I can conclude that teachers' incompetency with the use of digital tools has led to the insufficient use of digital tools in the classroom. A study in K–12 schools in the United Arab Emirates showed that negative attitudes of parents and teachers towards the importance and benefits of technology for teaching and learning are another barrier to teachers integrating technology in the classroom (Almekhlafi and Almeqdadi, 2010).

S1.2_H2: Mobile Technologies Improve Students' Learning Experiences

Independent variable: use of mobile assisted learning
Dependent variable: learn experience

The student data was used to assess mobile-assisted learning and its significant effect on their learning behaviour (refer to Table 4-17). The mean score for all categories ($M > 3$), which signifies positive learning behaviour among students during technology-assisted learning in the classroom, where the mean value is between 3 (*neutral*) and 5 (*strongly agree*). Students are motivated when learning technology in classes in Philippines (scores are significantly higher than the natural value 2.5). Students are motivated when learning technology used in classes in Brunei (score are significantly higher than the natural value 2.5). Hence, I reject H_0 – there is no significant differences between countries for mobile and advanced technologies to improve learning in Southeast Asia secondary schools. A Mann-Whitney analysis was conducted to test whether the distribution of learning behaviour among students during technology-assisted learning, the data shows no significant difference between the two countries.

Table 4-17: Mobile Assisted-Learning on students' behaviour – (Students data).

	Philippines (N=234)			*Brunei (N=240)*		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Mobile Assisted Learning Competencies	3.75	4.0	1.29	3.53	4.0	1.45
Tablet Assisted Learning Competencies	2.93	3.0	1.47	2.25	1.0	1.53
Motivated when Mobile Device is used during lessons	3.72	4.0	1.04	3.80	4.0	0.97
Use of Mobile Device allows better Collaboration with Classmates	3.91	4.0	0.93	3.84	4.0	0.96
Use of Mobile Device allows better Team-Work	3.98	4.0	0.94	3.72	4.0	1.04
Use of Mobile Device allows better understanding of topics	3.93	4.0	0.85	3.71	4.0	0.86
Use of Mobile Device constantly motivates to learn	4.05	4.00	0.98	3.81	4.0	0.87

Value 5 means strongly agree. 1 means strongly disagree

There are no significant differences in the Mann-Whitney test results for the categories 'Motivated when using mobile device', 'Collaborate better with classmates', 'Prefer group activity' and 'Bored using the same technology' ($p > 0.05$) (refer to Table 4-18). Hence, here I approve the alternate hypothesis H_1. I concluded that respondents in both countries strongly agree that mobile-assisted learning improves student learning behaviour. However, when compared between countries, the result shows statistically significant differences between the Philippines and Brunei for the categories of 'Better teamwork', 'Better understanding of topic' and 'Constantly motivated'. Hence, here I approve H_0 – there is significant differences.

Table 4-18: Mann-Whitney Test for learning behaviour by students.

Learning Behaviour	Country	N	MEAN RANKS
Motivated when using mobile device	Philippines	234	233.6
	Brunei	241	242.2
Chi-Square = 0.595 (p ≥ 0.05)			
Collaborate Better with Classmate	Philippines	234	242.9
	Brunei	240	232.2
Chi-Square = 0.006 (p ≥ 0.05)			
Better Teamwork	Philippines	234	254.9
	Brunei	240	220.6
Chi-Square = 0.465 (p ≤ 0.05)			
Better Understanding of Topic	Philippines	233	254.7
	Brunei	240	219.8
Chi-Square = 2.581 (p ≤ 0.05)			
Constantly Motivated	Philippines	231	257.6
	Brunei	240	215.2
Chi-Square = 13.477 (p ≤ 0.05)			
Prefer Group Activity	Philippines	230	225.9
	Brunei	238	242.8
Chi-Square = 8.816 (p ≥ 0.05)			
Bored Using Same Technology	Philippines	230	230.6
	Brunei	240	240.2
Chi-Square = 0.003 (p ≥ 0.05)			

Teachers' data was used to assess mobile-assisted learning and its significant effect on students' learning behaviour. The mean score for all categories in Table 4-19 shows $M > 3.2$ across both countries, where the mean value is between 3 (*neutral*) and 5 (*strongly agree*). Result showed teachers perceive students' positive learning behaviour during mobile-assisted classroom learning. Hence, there are no significant differences in the utilisation of mobile-assisted learning between Philippines and Brunei. Hence, I approve H_1 – no significant differences.

Table 4-19: Mobile Assisted-learning on students' behaviour (Teachers' data).

	Philippines (N=80)			*Brunei (N=92)*		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Students demonstrate high level of learning	3.9625	4.0	.77040	3.2283	3.0	.74278
Students are motivated	4.2375	4.0	.75042	3.6739	4.0	.72792
Better student collaboration	4.0375	4.0	.70160	3.4783	4.0	.84487
Better teamwork among students	3.9250	4.0	.70755	3.5000	4.0	.77743
Easier to make students understand	4.1625	4.0	.75379	3.5761	4.0	.77366
Easier to get quiet students to participate	3.9875	4.0	.77122	3.6522	4.0	.67016

Value 5 means strongly agree. 1 means strongly disagree

A Mann-Whitney test analysis was conducted on the distribution of learning behaviour for mobile-assisted learning among students to determine whether there are any significant differences between countries. Table 4-20 shows the Mann-Whitney test carried out for all categories. The results are significantly different for all categories except 'Students are bored using the same technology', which showed similar results. Hence, I approve H_0 – there are significant differences. The result indicates a difference in how teachers perceive the impact of mobile technology on students' behaviour in the Philippines and Brunei. However, the overall mean score ($M > 3.2$) from Table 4-20 showed that teachers generally believe mobile-assisted learning can improve students' learning outcomes and experience. It is also clear that teachers from both countries perceived that students preferred to explore different technology during classroom activities.

Table 4-20: Learning behaviour on students by teachers in technology-assisted learning.

Learning Behaviour	Country	N	MEAN RANKS
Students demonstrate high level of learning	Philippines	80	108.2
	Brunei	92	67.6
Chi-Square = 20.65 (p ≤ 0.05)			
Students are motivated	Philippines	80	104.4
	Brunei	92	70.9
Chi-Square = 25.28 (p ≤ 0.05)			
Better student collaboration	Philippines	80	103.5
	Brunei	92	71.8
Chi-Square = 6.23 (p ≤ 0.05)			
Better teamwork Among students	Philippines	80	100.5
	Brunei	92	73.3
Chi-Square = 3.04 (p ≤ 0.05)			
Easier to make students Understand	Philippines	80	105
	Brunei	92	70.4
Chi-Square = 14.66 (p ≤ 0.05)			
Easier to get quiet students to participate	Philippines	80	98.6
	Brunei	92	76
Chi-Square = 7.48 (p ≤ 0.05)			
Students are Bored using the same technology	Philippines	80	84.2
	Brunei	92	88.5
Chi-Square = 0.022 (p ≥ 0.05)			

I concluded that teachers from the Philippines and Brunei perceive that mobile-assisted learning can significantly improve students' learning behaviour. However, the techniques and methods exercised in classroom activities must consider the diversified students and their engagement levels, thus minimising student boredom. The students' learning experience with mobile-assisted learning is critical, and the experience can significantly impact students' learning outcomes and confidence. Factorising learning behaviour and user experience in software and systems design stimulate a new era of systems design. Thus, educational technology developers also require a paradigm shift in their design thinking process, where the past norm must be nullified. A diversified approach must be considered in technology-assisted learning to engage and stimulate different types of learners. When compared to the west, I used the Technology Implementation Questionnaire in Quebec, Canada (Wozney et al., 2006), to compare the results in Philippines and Brunei. To compare with the west, Quebec, Canada where Fifty-nine per cent (59%) of teachers (N=799) reported that computer technologies were integrated "occasionally" or "frequently" in their teaching activities.

S1.2_H3: Culture affects technology-assisted learning in Southeast Asian secondary schools

Independent variables: teacher (gender differences and teacher oriented)

Dependent variables: learning outcomes

I used the questions in Table 4-21 to assess the presence of cultural attributes in Southeast Asian classroom learning. Table 4-21 shows the mean and standard deviation for selected questions. The mean

score for most categories in Table 4-21 was $M > 3$ (3 = *neutral*, 4 = *agree*) across both countries, except 'Male students learn faster than female students in technology-assisted learning' for the Brunei data, where $M = 2.93$ (2 = *disagree*, 3 = *neutral*).

Table 4-21: Cultural presence in Technology Assisted Learning (Test 1).

	Philippines (N=80)			*Brunei (N=92)*		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Students wait for teachers' instructions before exploring Mobile Assisted Learning	3.4750	3.0	.82638	3.3736	3.0	.69360
Students respect teachers & parents when posting comments on social media	3.2840	3.0	.80985	3.0769	3.0	.68687
Technology Assisted Learning adds more values to groups than individual	3.8000	4.0	.70081	3.3370	3.0	.78834
Male students learn faster than female students in Technology Assisted Learning	3.2125	3.0	.97687	2.9302	3.0	.73229
Students dependent on teachers during technology assisted learning activities	3.2125	3.0	.88151	3.1522	3.0	.75498

Value 5 means strongly agree. 1 means strongly disagree.

No significant differences for the distribution of cultural learning attributes among students during mobile-assisted learning for the Mann-Whitney test (refer to Table 4-22). With ($p > 0.05$) for all categories except 'Male students learn faster than female students in technology-assisted learning' and 'Technology-assisted learning adds more value to groups than individuals, which are significantly different across countries ($p < 0.05$).

Table 4-22: Cultural presence during Technology Assisted Learning (Test 2).

Cultural Presence	Country	N	MEAN RANKS
Male students learn faster than female students	Philippines	80	92.4
	Brunei	86	75.2
Chi-Square = 13.44 (p ≤ 0.05)			
Students wait for teacher's instructions before exploring Mobile Assisted Learning	Philippines	80	89.7
	Brunei	91	82.7
Chi-Square = 1.989 (p ≥ 0.05)			
Students respect teachers & parents when posting comments on social media	Philippines	81	92.2
	Brunei	91	81.4
Chi-Square = 2.248 (p ≥ 0.05)			
Technology Assisted Learning adds more values to groups than individual	Philippines	80	100.5
	Brunei	92	74.3
Chi-Square = 4.972 (p ≤ 0.05)			
Students dependent on teachers during Technology Assisted Learning	Philippines	80	87.9
	Brunei	92	85.3
Chi-Square = 0.029 (p ≥ 0.05)			

I conclude that there is existence of cultural value among Southeast Asian students during mobile-assisted learning in the classroom. Another point to note regarding the existence of cultural values among students is the question of students' respect for teachers and parents when commenting on social media. PD exists between students and their elders (teachers and parents), with $M > 3.2$ and a standard deviation between *0.6 and 0.8* for both countries. Students view teachers and parents as a group of higher authority that requires due respect. This validates Hofstede's (1983) study on PD and a feminine society. Southeast Asian countries fall on the feminine side, where softer aspects of culture, such as humility, modesty, and levelling with others, are fundamental.

In technology-oriented learning, the variables 'Students wait for teachers' instruction before mobile-assisted education' and 'Students are dependent on teachers during technology-assisted activities' show $M > 3.0$ and a standard deviation between *0.69* and *0.88*. One significant finding is that Southeast Asian students prefer not to be detached from the local cultural norms of teacher-centred learning, and these findings are similar for both countries.

Comparing technology usage among male and female students concerning Hofstede's (1983) study on MF shows that teachers did not perceive male students showed more interest in using technology-assisted learning compared to their female counterparts. The variable for determining whether male students learn faster than female students showed a low mean score for both countries ($M < 3.3$ and standard deviation between *0.73* and *0.97*). This variable is significantly different between the two countries, where $p \leq 0.05$ in the Mann-Whitney U test.

Table 4-23 show the frequencies of technology/digital tool use by students in the Philippines and Brunei. Students' frequency of mobile device use (smartphone and tablet) is low, with the mean scores between *1.51 and 2.69* for the Philippines and between *0.97 and 1.59* for Brunei. The median ranged from *1.0 to 2.0* for all categories in both countries, except for smartphone use in the Philippines and Internet use in Brunei, which showed a median of *3.0*.

Table 4-23: Frequency of Technology/digital tools used by students.

	Philippines (N=234)			*Brunei (N=240)*		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Use of Smartphone	2.69	3.0	1.42	1.59	1.0	1.18
Use of Tablet	1.51	1.0	1.33	0.97	1.0	0.62
Use of Internet	2.14	2.0	1.38	2.26	3.0	1.15
Use of Online Video	2.32	2.0	1.26	1.83	2.0	1.09
Use of Collaboration Tools	1.84	2.0	1.28	1.53	1.0	1.02

Value 4=daily, 3=weekly, 2=monthly, 1=never, 0=NA

4.3.5 Results - Interviews

In analysing teachers' interview data, two themes emerged as challenges in using technology in classrooms. These themes were: The impact of technology usage policy in schools and the impact of cultural background.

The unstable and unreliable Internet connection at school and in the classrooms and ambiguous policy regarding the use of mobile devices in schools, where some schools allow a mobile device to be used in the classroom and others do not. There are also concerns about blocking useful websites, such as YouTube, which makes teaching more challenging. The digital tools used by teachers were identified as "Kahoot (software for games/quizzes), iPad Pro, and Easiteach using Vertable. Paper-based activities are still present where teachers must prepare them manually, at least twice a week for students.

Passive students do not dare to ask questions during lessons. Passive students have phobia of asking questions; thus, using WhatsApp, e-mail, and social media can encourage passive students to communicate more with teachers. Some students from the province do not have computer access and can be considered to have cyberphobic characteristics. A few teachers agreed that creativity in using technology-assisted teaching is a must for teachers and should be incorporated into the planning of professional development for teachers. Only ICT teachers are well equipped and competent in using technology/digital tools. Teachers need to be open-minded to use all facilities that are readily available at school. Teachers also believed that students' learning ability is affected by students' family background, social skills, language barrier, and different learning styles. The role of parents in understanding the value of technology-assisted learning is crucial. If possible, technology awareness for parents must be included as part of the professional development setup in schools.

4.3.6 Findings and Discussion

Finding 1

Teachers believed that they are competent in using technology and digital tools, and teachers also believed that the professional development plan for teachers is sufficient. However, using digital tools and technology is not optimal for classroom activities. Teachers' lack of knowledge in using digital tools and technology effectively has impacted the optimum use of these digital tools for activities in the classroom. Technology infusion for teachers' development significantly affect teachers' ability to explore new technology quickly and confidently. Hence, tailoring professional development for teachers to meet the optimal use of technology/digital tools is essential.

Another reason for the technology incompetency level for teachers is the design of the technology or digital tools, which is incompatible with the Southeast Asian teachers' expectations and preferences. A convenient and easy-to-use adaptive integrated system can simplify and motivate teaching and learning processes in Southeast Asia. HCI involvement in education can potentially have substantial real-world impacts in these situations. As such, the integration of HCI can support teachers' and students' challenges, including social and emotional interactions (Slovák and Fitzpatrick, 2015).

Design researchers have even integrated telepresence robots to allow people with accessibility challenges to attend conferences, offering user behaviour, experience and social norms for remote conference attendance (Neustaedter et al., 2018). A study to improve the efficacy of games in learning showed that tailoring the game design to players' personality types improved the effectiveness of the games in promoting positive attitudes, self-efficacy and intention to change behaviour (Orji et al., 2017). Researchers identified how teachers could tailor their classroom support to individual autistic children based on their newfound understanding of what children could do with the assistance of Artificial Intelligence (AI) agents. The use of AI agents has led to a rethinking of how technology can be designed to play an optimal role in supporting both learners and educational practitioners in achieving the desired learning outcomes and experience (Porayska-Pomsta et al., 2018). It was also shown that blind or visually impaired individuals could access instruction/communication by employing a haptic glove interface with awareness of deictic gestures over the graphics in conjunction with speech (Porayska-Pomsta et al., 2018).

Finding 2

Teachers' and students' frequency of technology/digital tool use showed a median range of 1.0 (*never*) to 2.0 (*monthly*) for collaboration tools, online video, tablet, email and learning management systems. These results suggested a significant concern about how teachers and students in Brunei utilise the technology/digital tools, and the Philippines compared to the meaningful use of technology in a study done in Washington, DC, in 2013 with 2,462 middle and high school teachers. In that study, 81% of the

teachers said all or most of their students had sufficient access to digital tools while in school (Purcell et al., 2013). Based on the Global Education Census Report (2018), with survey results collected from more than 100 countries, the United States leads in smartphone use (74%) in classrooms, compared to whiteboards as a popular tool used in Indonesia (92%) and Malaysia (90%); (Global Education Census Report, 2018). These data substantiate the low level of technology adoption in the classroom among countries in Southeast Asia compared to Western regions due to incompatibilities of educational tools.

Teachers and students agree that using the same technology creates boredom among the learners. They also agree that students are more motivated, collaborated better with classmates and preferred group activities when mobile devices are used for learning. However, the interview results highlighted the concerns of students from remote provinces who attended the public schools in the capital city. These students showed a lack of experience with technology/digital tools. As a result, they required more assistance and can be identified as passive learners with 'cyberphobic' characteristics.

In addition to the lacked exposure to technology/digital tools, the challenges for teachers in handling passive and active learners in classroom activities place teachers in a demoralised state among students who anticipated clear learning directions from their 'mentor' teachers. This finding promotes the idea of tailoring technical professional development and awareness of adaptive technology for teachers to meet the daily challenges in technology-assisted teaching. Another point noted in this study is that students view teachers and parents as a group of higher authority that requires due respect. This study showed the PD between students and teachers, where students wait for teachers' instructions before exploring mobile-assisted learning depending on teachers during technology-assisted learning. Thus, attachment to cultural values placed students in a contented state of knowledge. The students preferred not to be detached from the cultural norms, this point can be considered as a pragmatic approach to be provisioned in Southeast Asian educational models to create a comfortable yet motivating learning platform for students. In the development of educational media, the measurements of usability by effectiveness, efficiency and satisfaction are often overlooked due to the instructors' and software developers' lack of technological skills (Vrasidas, 2004). Hence, educational technology developers need to reduce the complexity of system features, promote user experience, enjoyment and convenience of system use and tailor teachers' professional development to the cultural attributes of Southeast Asia.

To summarise the results from this study, suggest the development of culture-centred ICT teaching and learning tool, "Culture-Centred Teaching and Learning Process" is introduced for Southeast Asia, as shown in Figure 4-8. The technology infusion techniques for teachers and students can be modified with the inclusion of cultural-friendly attributes to prepare them to face the new challenges of the educational world with AI and augmented-reality classroom learning in the near future.

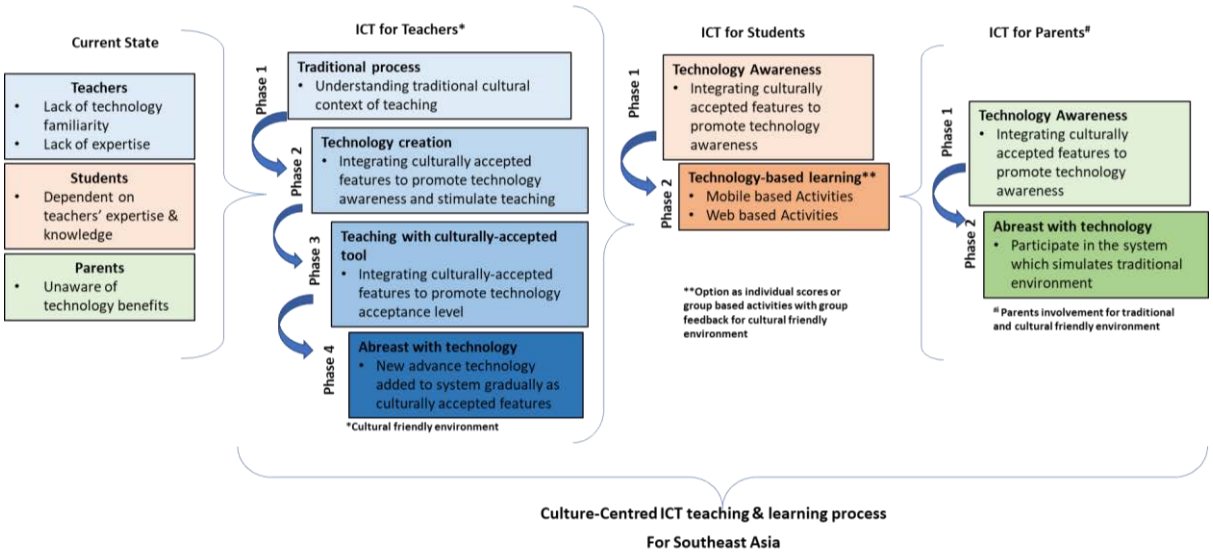

Figure 4-8: Culture-Centred Teaching and Learning.

4.3.7 Conclusion – Philippines and Brunei Schools

In this chapter, I presented the outcome of a comparative empirical study to understand the approach and usage of digital tools in classrooms among teachers and students in Manila, Philippines, and Bandar Seri Begawan, Brunei. It is essential to note that the presence of Southeast Asian learning culture affects the learning outcome. Teachers agreed that mobile technology could encourage passive teachers and students to be more active. There were two groups of female teachers: those who were competent in using the Internet and technology-assisted teaching, superseding male teachers' competency level, and those who were incompetent in these methods. These differences affect students' technology-assisted learning outcomes. Teachers must be competent adapting to technology-assisted teaching and customise their delivery to the challenges faced in the classroom. This study implies that the contrivance of diversified teaching and learning with technology integration is required to stimulate and motivate students with cultural norms in the teaching and learning environment in Southeast Asian secondary schools. The design of everyday use, terms and concepts for easy use by teachers and students is an essential factor to consider for the educational domain (Rogers, 2004). The benefits of using mobile social networking apps are characterised by perceived enjoyment (Qin et al., 2018).

The integration of HCI in the Southeast Asian secondary school systems will be of foremost importance and the responsibility of educational system design developers. One goal for the HCI discipline is to go beyond the specifics of guidelines (Shneiderman, 2013) and to support cultural interactions in the specific educational domain. Although technology captures the attention of the industry players, users are only keen to explore technology when it is reasonably user-friendly, which requires less effort and minimally complex architecture. Resources that are presented clearly allowed

students to be engaged in ICT-based learning, enabling them to gain knowledge and their utilisation (Roy, 2012). HCI practitioners and theorists must adopt the theory of embodied cognition for better designs (Kirsh, 2013). The primary concern in integrating HCI attributes into the design of educational platforms is the preparedness of Southeast Asian teachers to use technology and digital tools aligned with Southeast Asian cultural details. However, there are limitations to this section of my study. Only Philippine and Brunei data was used for the comparative analysis. I recommend that similar studies be carried out in other parts of Southeast Asia to substantiate my findings in future.

4.4 Analysis of Four Countries – Teachers' Perspective

4.4.1 Background - Cultural Differences and Emotions

In this section I discuss the cultural differences and emotions. My definition on cultural emotion is an individual mental state and emotional attachment that is stimulated during cultural related events or activities. The South Asian conception of the consciousness is somewhat different to emotion researchers in North America. South Asians have been influenced by local symbolic elaboration, which translates into mental experiences that they regard as essential in their culturally constituted world. For Americans, embarrassment or shame could result in avoidance, silence, or withdrawal in the context of South Asian norms (Shweder et al., 1993). Cultural differences exist for some aspects of emotions, and one such aspect is emotional arousal levels. In western or individualistic cultures, high-arousal emotions are promoted, whereas, in Eastern or collectivist cultures, low-arousal feelings are valued (Lim, 2016; Russell, 1989; and Scollon et al., 2011). The cultural emotion differences are explained better by Lim, (2016) who states that high arousal emotions are ideal and effective in the Western culture, where people try to influence others. By contrast, in Eastern culture, low-arousal emotions are desirable when adjusting and conforming to other people (Lim, 2016). Kacen and Lee (2002) conducted a cross-cultural study comparing Caucasians and Asians. The researchers used an arousal scale composed of four bipolar items, which consist of emotion adjectives representing different arousal levels. The result showed Caucasians were more likely in the high-arousal emotional states (i.e., stimulated, excited, frenzied and aroused) than Asians. In comparison, Asians are more likely to be in low-arousal emotional states (i.e., relaxed, calm, sluggish, unaroused) (Kacen and Lee, 2002).

The conception of happiness is also perceived differently between Americans and the Chinese. Lu and Gilmour conducted a cross-cultural study on the conception of happiness. They found that American conception of happiness emphasized on being upbeat, whereas the Chinese conception of happiness focused on being solemn and reserved (Lu and Gilmour, 2004). The arousal level of ideal affect differs by culture. People are motivated to behave in certain ways so that they feel the emotions they want to experience. Therefore, people in certain culture tend to experience the emotional state that are considered ideal in their culture (Tsai, 2007).

Anxiety

Neuroticism appears centrally related to emotional expression in dealing with the expression of anxiety-based emotions whose negative traits included tension, nervousness, doubt, and temperamentality (Yik and Bond, 1993). Many researchers who have studied the role of computer-related anxiety in e-learning acceptance have concluded that computer anxiety is associated with avoidance or less use of e-learning systems or technologies (Park et al., 2012; Purnomo and Lee, 2013; Igbaria and Parasuraman, 1989; Venkatesh et al., 2003).

Computer anxiety plays a vital role in e-learning adoption in higher education institutions (Alenezi and Karim, 2010). Which means anxious individuals using computers are more likely to be reluctant to adopt e-learning systems (Al-alak and Alnawas, 2011; Fazil and Ward, 2016). A study in 2017 on foreign language enjoyment and anxiety observed teacher and learner behaviour during a classroom activity. It was observed that foreign language classroom anxiety is less related to teaching practices than foreign language enjoyment. It also suggested that unusual classroom activities such as debates and group presentations can boost students' happiness; hence, increasing happiness which lowers students' anxiety levels (Dewaele et al., 2018; Christensen, 2002).

Fun, happiness, and anxiety

When a class is perceived as fun, students may be more likely to persist with struggling and taking educational risks to improve their learning. Students also felt happier when they can accurately re-create an activity that they have previously experienced. Design-specific research methods are required to understand individuals' happiness and translate such understanding into the design (Brey et al., 2014; Kiener et al., 2013; Hennessy, 2000).

Contentedness and engagement

Competitive elements such as motivation are the most critical determinants of playing computer games. The students' preference for exciting and competitive games enabled them to be more confident and engaged to master the game and to reach the activity's desired outcome (Vorderer et al., 2003). These factors of contentedness and excitement during the activity can be suggested as the potential for stress-relieving and excitement results (Wood, 1993).

Constructing hypotheses

In this section, I empirically investigated how teachers' perceptions of technology-assisted teaching impact their use of e-learning and how it affects students' learning in secondary schools in Malaysia, Indonesia, the Philippines, and Brunei. To accomplish this, I utilised the Technology Uses and Perception Survey (Venkatesh et al., 2012) and Technology Acceptance Model (Davis, 1986). Specifically, I investigated the impact of cultural dimensions (uncertainty avoidance of cultural emotions) based on teachers' perceptions using educational tools and technology in the teaching domain on the transformation from being contented with classroom-based learning to reducing teachers' and students' anxiety levels concerning e-learning and to improve technology use (Technoid). The five constructs of the emotions tested are: Fun (H1), Motivating (H6), Excited (H5), Contented (H4), and Engaged (H2), which will improve technology use (Technoid) (H3).

Questions from teachers' surveys were used to construct hypotheses

The feeling of engagement and motivation turned out to be more important than the joy and pleasure of creating for students (Loureiro et al., 2013). **(S1.3_H1 and S1.3_H6)**

S1.3_H1: Uncertainty avoidance impacts the state of having Fun (affects the perception of having fun with technology).
Variables used:

- Students demonstrate a higher level of learning – Fun*_1;*
- There is more student collaboration – *Fun_2;*
- There is more teamwork among students – *Fun_3;*
- It is easier to make students understand the topic – *Fun_4;*
- It is easier to get quiet students to participate – *Fun_5*.

S1.3_H6: Uncertainty avoidance impacts the state of being Motivated (affects motivation to use technology).
Variables used:

- Students are more motivated – *Motivated_1;*
- Students are constantly motivated during technology-assisted learning – *Motivated_2*.

A comfortable (contented), engaging, and safe learning environment must be established to develop students' thinking and problem-solving skills (Yaman and Yalçın, 2004; Greenwald and Farnham, 2000). **(S1.3_H2 and S1.3_H4)**

S1.3_H2: Uncertainty avoidance impacts the state of being engaged (affects perceived ease of use of technology).
Variable used:

- Students wait for instructions before exploring mobile-assisted learning (e.g., LMS). – *Engaged_1;*
- Students use the collaboration tools to share and post questions to teachers without being instructed. – *Engaged_2;*
- Students wait for teachers' instructions before proceeding with technology-assisted classroom activities. – *Engaged_3;*
- Students are very dependent on teachers during technology-assisted classroom activities. – *Engaged_4*.

S1.3_H4: Uncertainty avoidance impacts the state of being contented (affects mobile technology use).
Variable used:

- Students prefer traditional classroom learning over technology-assisted learning. – *Contented_1*

Fun leads to happiness (Lu et al., 2001). Delight can reduce anxiety (Poursina et al., 2013). Having fun can reduce anxiety (Ortiz et al., 2015). **(S1.3_H3)**

S1.3_H3: Uncertainty avoidance impacts the use of technology (affects intention to use technology).
Variables used:

- Internet for developing lessons – *Technoid_1;*
- Mobile devices (e.g., smartphones) – *Technoid_2;*
- Learning management systems (e.g., online blackboard) – Technoid*_3;*
- Online videos (e.g., YouTube) – *Technoid_4.*

The aim of excitement in specific situations arises from activities (Lohaus and Hessling, 2003). **(S1.3_H5)**

S1.3_H5: Uncertainty avoidance impacts the state of being excited (affects perceived usefulness of technology).
Variables used:

- Using different technology for different activities helps students better understand the topic (e.g., YouTube for a science activity). – *Excited_1;*
- Using different technology eases the management of different types of learners (e.g., active, passive, weak, shy). – *Excited_2.*

Figure 4-9 depicts the proposed model with cultural emotions. I suggest the hypotheses and their possibilities of causal effects on cultural emotions. I will test the causal effects and their significance.

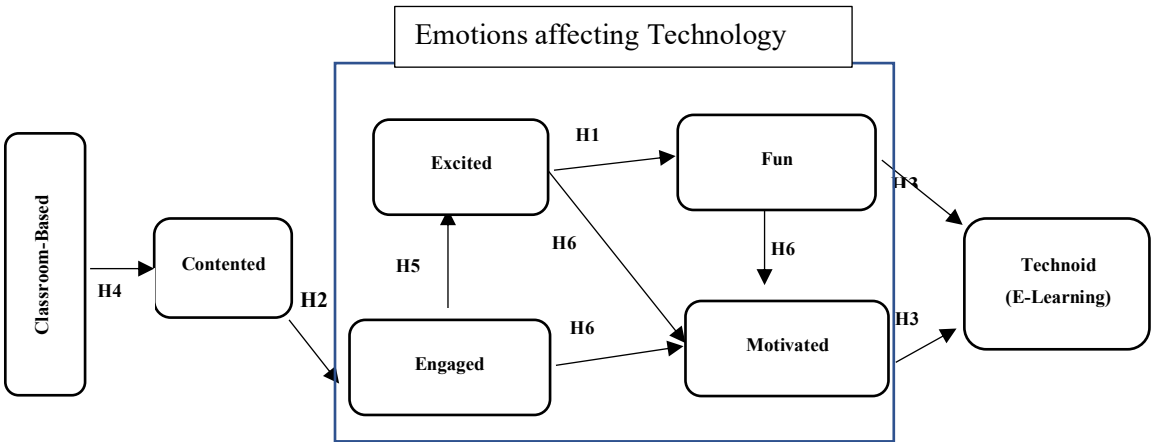

Figure 4-9: Relationship between emotion constructs leading to Technoid.

4.4.2 Method

Data used for this section was collected from 20 secondary schools across Malaysia, Indonesia, the Philippines, and Brunei on demographics (age and gender), technology perceptions, and technology use. Each country randomly selected the schools in the capital city by the Ministry of Education. Questions covered were on the frequency of technology use, teachers' competency level in the use of technology for activities, and their perceptions of technology use in terms of motivation, collaboration, and cultural dimensions. The questionnaire was translated into Malay language and Bahasa Indonesia to suit most teachers in Malaysia and Indonesia secondary schools respectively. An Indonesian and Malaysian teacher was involved in the translation process. The proofreading was carried out by an expert in the respective Ministry of Education.

4.4.3 Data Analysis

I used a 5-point Likert scale, and respondents were asked to rate their overall satisfaction with using technology/digital tools in the classroom and their competency level. Scales ranged from 1 = *strongly disagree* to 5 = *strongly agree*, from 1 = *never used* to 5 = *competent*, and from 0 = *NA* to 4 = *daily*. The questionnaire was distributed to 400 randomly selected teachers and 1,000 randomly selected students from across 20 secondary schools in the capital cities of Malaysia, Indonesia, the Philippines, and Brunei. The principals of the respective schools conducted the task of a random selection of teachers and students. Since this section of this chapter emphasises teachers' perceptions, only teacher data will be analysed for this study. Overall, 342 teachers completed questionnaires across the four countries (n = 82 respondents in the Philippines, n = 92 respondents in Brunei, n = 69 respondents in Malaysia, and n = 99 respondents in Indonesia).

Both descriptive and inferential statistics were applied to compute the mean, standard deviation, frequency, Pearson's correlation coefficient, one-way analysis of variance (ANOVA), and PLS-SEM bootstrapping using SmartPLS. The findings presented in this section are based on the probability set at ≤ 0.05. Firstly, I reported the ANOVA test results for comparing the mean values of dependent and independent variables between countries. This analysis is required to observe the mean values between countries to identify the similarities and significant differences before I propose a model to support the data. The same factors identified as dependent and independent variables were used to build the best-fit model using SmartPLS. This model is based on the collected data from the four countries, specifically from teachers' perspectives.

4.4.4 Results

ANOVA on these scores yielded significant variation among conditions. A post hoc Tukey test for four of the dependent factors showed that there were no significant differences between Malaysia and

Brunei, and the Philippines and Indonesia, except for the last dependent factor (Fun_5), where Malaysia, Indonesia, and Brunei grouped into the same category (refer to Table 4-24).

Table 4-24: (S1.3_H1): Uncertainty avoidance impacts the state of having Fun.

		Students demonstrate a higher level of learning (Fun_1)		**There is more student collaboration (Fun_2)**	
Country	*N*	*M*	*SD*	*M*	*SD*
Malaysia	69	3.5	0.74	3.7	0.75
Indonesia	96	4.2	0.66	4.1	0.66
Philippines	81	3.96	0.77	4.04	0.70
Brunei	92	3.23	0.74	3.5	0.84
ANOVA	***F (3,332) = 31.2, P = 0.000***			***F (3,331) = 13.5, P = 0.000***	

1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*

	There is more teamwork among students (Fun_3).			**It is easier to make students understand the topic (Fun_4).**		**It is easier to get quiet students to participate (Fun_5).**	
Country	N	M	SD	M	SD	M	SD
Malaysia	69	3.6	0.78	3.8	0.54	3.8	0.59
Indonesia	96	4.05	0.66	4.14	0.63	3.7	0.86
Philippines	80	3.9	0.71	3.9	0.7	4.2	0.75
Brunei	92	3.5	0.78	3.6	0.78	3.6	0.78
ANOVA	***F (3,330) = 13.5, P = 0.000***			***F (3,334) = 6.1, P = 0.000***		***F (3,331) = 3.4, P = 0.02***	

1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*

ANOVA on engagement scores yielded significant variation among conditions, and a post hoc Tukey test for the following dependent factors showed no significant differences between Malaysia, the Philippines, and Brunei (Engaged_1 and Engaged_3), as well as between the Philippines and Indonesia (Engaged_2 and Engaged_4). There are no significant differences between some countries for all factors (refer to Table 4-25).

Table 4-25: (S1.3_H2): Uncertainty avoidance impacts the state of being Engaged.

	Students wait for instructions before exploring mobile-assisted learning (Engaged_1).			**Students use collaboration tools to share questions without being instructed (Engaged_2).**		**Students wait for teachers' instructions before proceeding with the technology-assisted classroom activities (Engaged_3).**		**Students are dependent on teachers during technology-assisted activities (Engaged_4).**	
Country	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Malaysia	68	3.2	0.92	3.2	0.84	3.4	0.74	2.9	0.82
Indonesia	98	3.6	0.81	3.3	1.12	3.8	0.74	3.33	0.98
Philippines	80	3.4	0.88	3.4	0.78	3.4	0.83	3.2	0.88
Brunei	90	3.2	0.73	2.9	0.78	3.4	0.69	3.1	0.75
ANOVA	***F (3,332) = 3.34, P = 0.019***			***F (3,333) = 3.19, P = 0.024***		***F (3,332) = 5.73, P = 0.001***		***F (3,332) = 3.22, P = 0.023***	

1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*

ANOVA of technology use scores yielded significant variation among conditions, and a post hoc Tukey test for the following dependent factors showed no significant differences between Malaysia, Indonesia, and the Philippines (Technoid_2). The analysis also implies that all countries scored a low mean value of $M<2.85$ for all factors (refer to Table 4-26), except for Malaysia's Learning Management System (LMS) use which showed $m=3.19$. Brunei's mean score was the lowest for all four factors ($M < 2.01$). Brunei scored a mean value of $m=0.91$ for Learning Management (LMS) which revealed the use of LMS from never to not applicable. This finding contradicts the data presented by UNESCO that Internet-assisted instruction shows Brunei at 100%.

Table 4-26: (S1.3_H3): Uncertainty avoidance implications on the use of technology.

	Use of the Internet for developing lessons (Technoid_1)			**Mobile devices use (Technoid_2)**		**Learning management systems use (Technoid_3)**		**Online videos use (Technoid_4)**	
Country	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Malaysia	69	2.32	0.92	2.64	1.33	3.19	1.04	2.44	0.9
Indonesia	99	2.69	1.06	2.62	1.36	2.77	1.27	1.9	1.14
Philippines	80	2.84	1.05	2.61	1.28	1.36	1.21	2.13	1.07
Brunei	92	2.01	1.10	1.66	1.24	0.91	0.78	1.85	0.97
ANOVA	***F(3,337) = 11.19, P = 0.000***			***F(3,331) = 12.04, P = 0.000***		***F(3,326) = 81.2, P = 0.000***		***F(3,333) = 5.5, P = 0.000***	

Value: 4 = *daily*, 3 = *weekly*, 2 = *monthly*, 1 = *never*, 0 = *NA*

ANOVA on contentedness scores yielded no significant differences among conditions between countries, with F(3, 332) = 0.28 and P = 0.84 (refer to Table 4-27).

Table 4-27: (S1.3_H4): Uncertainty avoidance impacts the state of being contented.

	Students prefer traditional classroom learning over technology-assisted learning (Contented_1).		
Country	*N*	*M*	*SD*
Malaysia	69	2.75	0.85
Indonesia	99	2.79	1.09
Philippines	80	2.83	0.94
Brunei	92	2.87	0.73
ANOVA	***F(3,332) = 0.28, P = 0.84***		

1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*

ANOVA on excited scores yielded significant variation among conditions, and a post hoc Tukey test for the following dependent factors showed no significant differences between Malaysia and Brunei (Excited_1 and Excited_2) and the Philippines and Indonesia (Excited_1 and Excited_2). There are no significant differences between some countries for all factors (refer to Table 4-28).

Table 4-28: (S1.3_H5): Uncertainty avoidance impacts the state of being Excited.

	Using different technology for different activities helps students better understand the topic (Excited_1).			**Using different technology eases the management of different types of learners (Excited_2).**	
Country	*N*	*M*	*SD*	*M*	*SD*
Malaysia	68	3.9	0.54	3.76	0.65
Indonesia	96	4.02	0.63	4.02	0.65
Philippines	80	4.14	0.70	4.16	0.75
Brunei	92	3.7	0.70	3.57	0.77
ANOVA	***F(3,334) = 6.1, P = 0.000***			***F(3,321) = 4.5, P = 0.004***	

1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*

ANOVA on these scores yielded significant variation among conditions, and a post hoc Tukey test for the first dependent factor (Motivated_1) which showed no significant differences between

Malaysia and Brunei and no significant differences between the Philippines and Indonesia (refer to Table 4-29).

Table 4-29: (S1.3_H6): Uncertainty Avoidance impacts the state of being Motivated.

	Students are more motivated when technology is used during lessons (Motivated_1).			**Students are constantly motivated during technology use (Motivated_2).**	
Country	*N*	*M*	*SD*	*M*	*SD*
Malaysia	69	3.68	0.78	3.79	0.56
Indonesia	96	4.17	0.66	4.01	0.74
Philippines	80	4.24	0.75	4.12	0.70
Brunei	92	3.67	0.73	3.74	0.69
ANOVA	***F (3,331) = 14.7, P = 0.000***			***F (3,333) = 11.6, P = 0.000***	

1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*

Post-hoc Tukey's HSD tests indicated Brunei had significantly lower mean scores for all dependent factors than Malaysia, the Philippines, and Indonesia. This finding contradicts UNESCO's statistics on ICT infrastructure in secondary institutions, with Internet-assisted instruction showing Brunei at 100%. The post hoc test reveals no significant differences between some countries for some factors (Engaged_1, Engaged_3, Contented_1, Motivated_1, Motivated_2, and Technoid_2); hence, cultural similarities in Southeast Asian countries do exist and affect the perceived use of e-learning tools.

These constructs and combined data from all four countries were used to tabulate the path coefficients and p-values for dependent variables and t-values for independent variables to obtain a best-fit e-learning model for Southeast Asia in PLS. PLS-SEM was used to model the theoretical framework. PLS-SEM was selected as it provides many advantages and to test theoretically supported linear and additive causal models (Haenlein and Kaplan, 2004). This technique is suitable for developing theories (Chin, 1998). The structural path significance in bootstrapping was used.

4.4.5 Analysis of the Model

Figure 4-10 illustrates the path associated with the proposed constructs. The valid constructs for transforming from (classroom-learning) Contented to (Technoid) Technology use. The PLS results in Table 4-30 indicates that Contented ($\beta Contented \rightarrow Engaged = 0.369, p < 0.001$) leads to Engaged ($\beta Engaged \rightarrow Excited = 0.572, p < 0.001$) and Excited ($\beta Excited \rightarrow Fun = 0.535, p < 0.001$). Contented $\rightarrow$ Engaged ($R^2 = 0.136$) $\rightarrow$ *Excited* ($R^2 = 0.327$).

The PLS equation revealed Excited and Fun as predictors for Motivated ($R^2 = 0.780$), Excited ($\beta Excited \rightarrow Motivated = 0.380, p < 0.001$), and Fun ($\beta Fun \rightarrow Motivated = 0.620, p < 0.001$), and

Motivated ($\beta Motivated \rightarrow Technoid = 0.301, p < 0.001$) as the predictors for Technoid. Excited ($R^2 = 0.327$)→ Fun ($R^2 = 0.286$) → Motivated ($R^2 = 0.780$) shows a higher association compared to Excited → Motivated. To improve technology use (Technoid), the construct of happiness can be utilised. Engagement is not a predictor of happiness as was originally hypothesised. Fun is not a direct predictor to improving technology use (Technoid). The determinant to improve technology use (Technoid) is happiness, i.e., which also showed the highest coefficient of determination ($R^2 = 0.780^{**}$). Therefore, manipulating happiness in e-learning design would positively stimulate teachers' and students' technology use.

Table 4-30: Findings of the research hypothesis.

Hypothesis	**Factor**	***T-Value***	***P-Value***	β	**Findings**
S1.3_H1: Uncertainty avoidance impacts the state of being Fun (affects perceived Fun with technology).	Students demonstrate a higher level of learning (Fun_1).	*98.87*	$P < 0.05$	$\beta = 0.535^{**}$	Supported
	There is more student collaboration (Fun_2).	*34.83*	$P < 0.05$		
	There is more teamwork among students (Fun_3).	*22.67*	$P < 0.05$		
	It is easier to make students understand the topic (Fun_4).	*50.3*	$P < 0.05$		
	It is easier to get quiet students to participate (Fun_5).	*20.24*	$P < 0.05$		
S1.3_H2: Uncertainty avoidance impacts the state of being engaged (affects perceived ease of use of technology).	Students wait for instructions before exploring mobile-assisted learning (Engaged_1).	*20.86*	$P < 0.05$	*0.369*	Supported
	Students use the collaboration tools to share and post questions to teachers without being instructed (Engaged_2).	*12.57*	$P < 0.05$		
	Students wait for teachers' instructions before proceeding with the technology-assisted classroom activities (Engaged_3).	*10.03*	$P < 0.05$		
	Students are very dependent on teachers during technology-assisted classroom activities (Engaged_4).	*39.6*	$P < 0.05$		
	Internet for developing lessons	*22.66*	$P < 0.05$		Supported

S1.3_H3: Uncertainty avoidance impacts the use of technology (affects intention to use technology).	(Technoid_1)			*β = 0.301*	
	Mobile devices (Technoid_2)	*7.18*	*P < 0.05*		
	Learning management systems (Technoid_3)	*15.36*	*P < 0.05*		
	Online videos (Technoid_4)	*9.08*	*P < 0.05*		
S1.3_H4: Uncertainty avoidance impacts the state of being contented (affects mobile technology use).	Students prefer traditional classroom learning to technology-assisted learning (Contented_1).	*0.00*	*P = 0.84*	-	Not Supported
S1.3_H5: Uncertainty avoidance impacts the state of being Excited (affects perceived usefulness of technology).	Using different technology for different activities helps students better understand the topic (Excited_1).	*67.78*	*P < 0.05*	*0.572***	Supported
	Using different technology eases the management of different types of learners (Excited_2).	*28.65*	*P < 0.05*		
S1.3_H6: Uncertainty avoidance impacts the state of being Motivated (affects motivation to use technology).	Students are more motivated when technology is used during lessons (Motivated_1).	*19.0*	*P < 0.05*	*β = 0.620** and β = 0.380*	Supported
	Students are constantly motivated during technology use (Motivated_2).	*63.48*	*P < 0.05*		

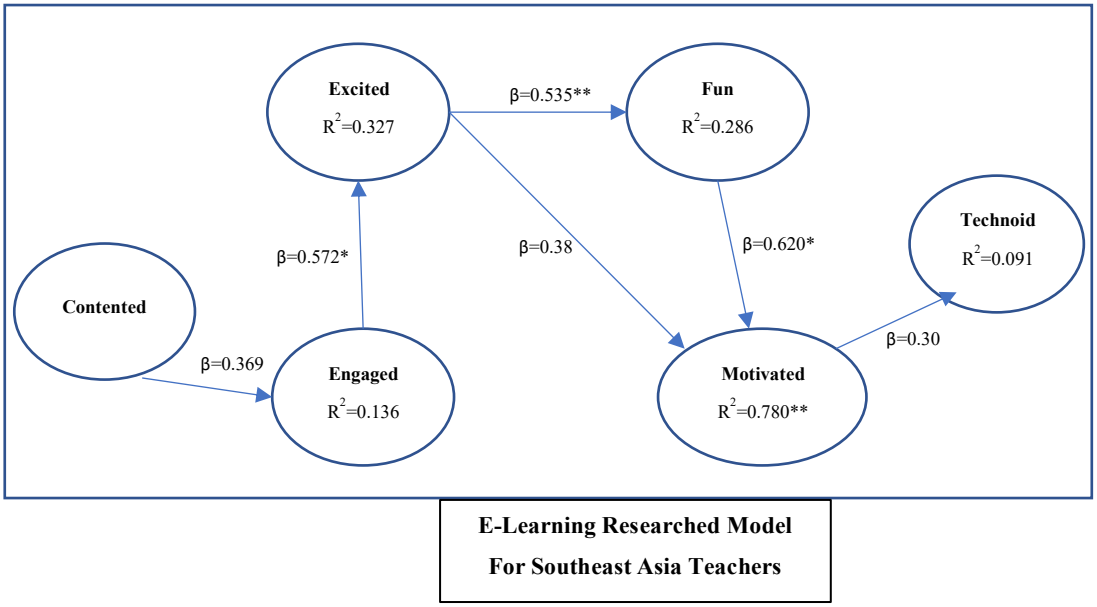

Figure 4-10: E-learning researched model for Southeast Asia Teachers.

4.4.6 Discussion

E-Learning adoption requires an extensive design transformation for a successful infusion in the Southeast Asian region. Based on the literature, researchers have suggested the need for learning behaviours and emotions to be integrated into e-learning models; however, there is a lack of cultural emotion studies related to e-learning platforms. There are strong ties between cultural norms and emotions in Southeast Asians' and their daily activities. Southeast Asians' belief and tradition strengthen their emotions, which can positively manifest in their daily activities (Murata et al., 2013).

The results of this study suggested that the connection of cultural emotions and cultural dimensions are necessary constructs of the e-learning platform. The causal effects of cultural emotions aimed towards reducing anxiety levels for teachers and students to promote technological use (Technoid). These proposes a new paradigm in the design of e-learning platforms. In the proposed model in Figure 4-10, I suggest a relationship between cultural emotions and my hypotheses, stating that there is a possible causal effect of the state of being contented leading to being engaged. Being engaged leads to being excited and being excited leads to having fun and being motivated. Therefore, being engaged could lead to excitement, motivation, and fun. A non-stressful situation could work wonders for anyone, as being excited during activity could lead to successful completion of the activity, creation of having fun for oneself, and eventually transformation to a motivated user. Fun and happiness can reduce anxiety level for technology users resulting in improved ICT use (Technoid). However, no positive correlation was suggested in PLS for Engaged leading to Fun and Motivated, or having Fun to technology use (Technoid).

The researched e-learning model suggests a strong causal effect for Engaged *(β = 0.572**)* → *Excited (β = 0.535**)* → Fun (*β = 0.620**)* → Motivated (*R^2 = 0.780**)*. These factors strongly contribute to the transformation from being contented (classroom-learning) to having a reduced anxiety level and improved technology use (Technoid) in e-learning design. The technology adoption techniques in Southeast Asia must take a different infusion approach as the previous approaches have instilled laxity in adopting them. Previous researchers (Venkatesh and Davis, 1996) have argued the inclusion factors of perceived ease of use and usefulness, highlighting successful utilisation. However, it lacked an important pillar for Southeast Asian technology pessimists toward successful technology use and sustainability.

Southeast Asians value their cultural norms and tradition, hence there is a need to position this cultural value as a strong candidate in this study. Cultural emotions stimulate teachers' and students' sentiments toward their cultural essence postulates ease of acceptance. Teachers and students will be prepared to explore the uncertainties without hesitation as willingness intensifies with emotional stimulants. The infusion of technology preparedness can be enhanced through accelerating technology acceptance with emotional motivations. Many researchers have emphasised on technology acceptance; however, the elements of cultural emotional stimulus lacked positioning (Tarhini et al., 2015; Teo et al., 2008; Gogus et al., 2012).

An unprecedented global crisis such as the COVID-19 pandemic can further push Southeast Asian regions backwards if they are unprepared for the robust infusion techniques of e-learning platforms. These proposed factors can significantly stimulate and boost teachers' emotions for continuous use of educational technology and E-Learning platform in Southeast Asia.

4.4.7 Conclusion

In this section, I proposed a new e-learning research model for Southeast Asia based on cultural emotions and suggested the need for a paradigm shift in designing e-learning platforms for Southeast Asian secondary education. The proposed e-learning model is the suggested foundation for designing and building all educational tools and e-learning systems to stimulate teaching in Southeast Asian regions and overcome the adversity faced today.

4.5 Analysis of Four Countries - Students Perspective

4.5.1 Background - Emotions in Asia

In this section, I analysed the students' data with relevance to emotions. Asians' cultural identity and cohesiveness, affects their emotional levels. In a recent study on the state of Southeast Asia 2019, the results show that 72.6% of Southeast Asian felt that the tangible benefits of ASEAN are not touched, and 44% of the respondents share their concern over ASEAN becoming increasingly disunited (Tang et al. 2019). Such a cohesive cultural identity is seen in South Asians' homes in the United Kingdom, where traditional Asian landscapes, decorations, and narratives showed a connective cultural significance and are emotionally valued by the family (Tolia-Kelly 2004). Culture shaped how people express their emotions in specific cultural contexts, and emotions can be influenced by cultural factors (Turner and Stets 2005; Matsumoto and Ekman 1989).

In their cultural dimension study on subjective well-being among Chinese adults, Ku, McKenna and Fox (2007) identified psychological themes, which included positive emotions of happiness, engagement, excitement, peacefulness, satisfaction, and self-contentment. Researchers have also observed that Asian cultures value relaxed and excited emotional states rather than energetic ones (Hansen 1988). In a similar context, Diener and Biswas (2011) identified that low-level excitement, contentment, and low arousal of happiness were presented in Asian contexts. In contrast, hot excitable, positive emotions were favoured in North American contexts (Diener and Biswas-Diener 2011). Culture shock is the consequence of strain, anxiety, and confusion in a new environment, as well as a feeling of the loss of a familiar cultural environment (Oberg 1960; Rhinesmith 1985). Hence, the cultural emotional plays a vital role in all contexts. Thus, emotions supported cultural activities can ultimately reflect as social activities (Ratner 2000; Kaptelinin and Nardi 2012), that can promote social well-being.

A critical factor for psychological support in Southeast Asia is understanding cultural differences in how emotions and beliefs are expressed (Hechanova and Waelde 2017). Cultural emotions are a deep-rooted element among Southeast Asians. Hence, stimulating positive Southeast Asian cultural emotions during technology activity could result in positive use of technology-assisted learning.

Constructing Hypotheses

In this section, I empirically investigated how students' perceptions of technology-assisted learning affected their use of e-learning. The study examined how ICT affected students' learning in secondary schools in Malaysia, Indonesia, the Philippines, and Brunei, using guidance from the *Technology Uses and Perception Survey* (Venkatesh et al. 2012) and Technology Acceptance Model (Davis 1986). Specifically, I investigated the effect of the cultural dimension of uncertainty avoidance with cultural emotions based on students' perceptions of using educational tools and technology in the learning

domain. The goal of this chapter is to reduce students' anxiety level during the use of e-learning tools, transitioning from being contented with classroom-based learning to reducing students' anxiety levels during e-learning use. The six constructs of emotions tested are (Anxious affects Technology use), Technoid (S1.4_H3), Fun (S1.4_H1), Motivated (S1.4_H6), Excited (S1.4_H5), Contented (S1.4_H4), and Engaged (S1.4_H2).

Questions from the Student Survey Used to Construct Hypotheses

The following hypotheses were proposed.

S1.4_H1: Uncertainty Avoidance affects the state of having Fun. The variables used were:

- Better collaboration with classmates – *Fun_1;*
- Better teamwork among students – *Fun_2;*
- Better understanding of the topic – *Fun_3.*

S1.4_H2: Uncertainty Avoidance affects the state of being Engaged. The variables used were:

- Anticipate Internet lessons – *Engaged_1;*
- Deep understanding of different technologies for different activities – *Engaged_2;*

S1.4_H3: Uncertainty Avoidance impacts the use of technology (state of being anxious). The variables used were:

- Internet for research – *Technoid_1;*
- Learning management systems (e.g. online blackboard) – *Technoid_2;*
- Mobile device learning (e.g. smartphone) – *Technoid_3;*
- Online video learning (e.g. YouTube) – *Technoid_4.*

S1.4_H4: Uncertainty Avoidance affects the state of being Contented (involves the use of mobile technology). The variables used were:

- Students prefer traditional classroom learning to technology-assisted learning – *Contented_1*

S1.4_H5: Uncertainty Avoidance affects the state of Excited. The variables used were:

- Bored using the same technology – *Excited_1;*
- Learn better when using different technology – *Excited_2.*

S1.4_H6: Uncertainty Avoidance affects the state of being Motivated (affects motivation to use technology). The variables used were:

- Students are more motivated when using mobile devices – *Motivated_1;*
- Students are constantly motivated during technology-assisted learning – *Motivated_2.*

Figure 4-11 depicts the proposed model with cultural emotions. Hypotheses and their causal effects on cultural emotions are suggested. The causal effects and their significance will be tested.

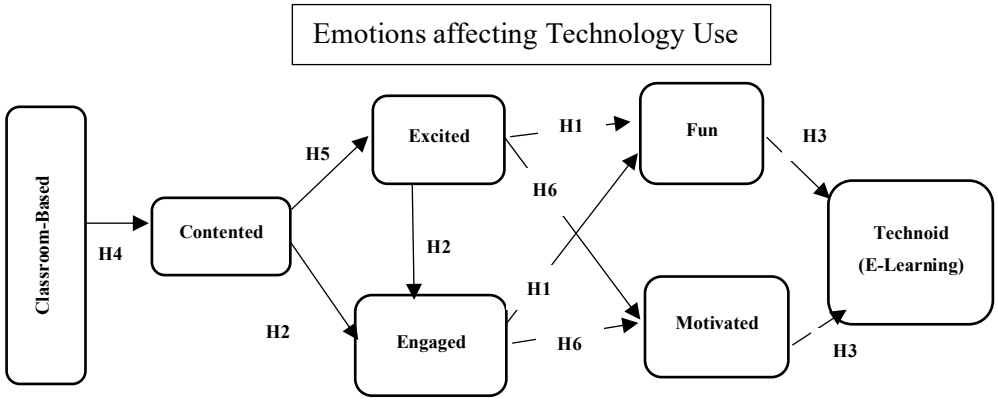

Figure 4-11: Relationship among the six constructs of emotions leading to Technoid.

4.5.2 Method

For this study, several Southeast Asian countries were identified and contacted: Singapore, Malaysia, Vietnam, Indonesia, Brunei, the Philippines, and Thailand. However, the approval for data collection was received from the Ministry of Education (MOE) of Malaysia, Indonesia, Brunei, and the Philippines. The MOE in Malaysia, Brunei, Indonesia, and the Philippines randomly selected five schools from their capital cities. A total of 20 secondary schools participated in this study. Data was collected based on demographics (age and gender), technology perceptions, and technology use. Questions were based on the frequency of technology use, students' technology competency level, and their perceptions of technology use in terms of motivation, collaboration, and cultural dimensions. The questionnaire was translated into Malay language for Malaysian schools and Bahasa Indonesia (Indonesian language) for the Indonesian schools to facilitate students' comprehension of survey questions. The translation of survey questions was carried out by an Indonesian and a Malaysian teacher. Proofreading of the translated survey questions was completed by an expert from the Ministry of Education of the respective country.

4.5.3 Data Analysis

I used a 5-point Likert scale for the questionnaire and the respondents were asked to rate their overall satisfaction in using technology/digital tools in the classroom and their competency level. Scales ranged from 1 = *strongly disagree* to 5 = *strongly agree,* from 1 = *never used* to 5 = *competent,* and from 0 = *N/A* to 4 = *daily*. The questionnaire was distributed to 1,000 randomly selected students from across the 20 secondary schools in the four countries. The principals from each school conducted a random selection of students to participate in the study. Overall, 978 secondary school students completed the questionnaires across the four countries: *(n = 246)* respondents in the Philippines, *(n = 241)* respondents in Brunei, *(n = 232)* respondents in Malaysia, and *(n = 259)* respondents in Indonesia.

The findings presented in this section are based on the probability set at ≤ .05. First, I reported the ANOVA test results to compare the mean values between countries' dependent and independent variables. Both descriptive and inferential statistics were applied to compute the mean, standard deviation, frequency, Pearson's correlation coefficient, one-way ANOVA, and PLS-SEM Bootstrapping using SmartPLS.

The mean values between countries must be compared to identify the similarities before a model is proposed to support the data collected for all four countries. The best-fit model was built in SmartPLS using the factors of dependent and independent variables. This model is based on the collected data from the four countries, specifically from students' perspectives. My method and findings are limited to the survey questions' self-reported nature and assumptions.

4.5.4 Results

The result of ANOVA test scores yielded significant variation among conditions, and a *post hoc* Tukey test for three of the independent factors showed that the Philippines and Brunei were similar for the factor Fun_1, the Philippines and Indonesia were similar for the factor Fun_2, and no significant differences between Indonesia and Brunei for the factor Fun_3 (see Table 4-31). Malaysia scored higher than *M>4.00* for all three independent factors.

Table 4-31: (S1.4_H1): Uncertainty Avoidance affects the state of having Fun.

	Better collaboration with classmates (*Fun_1*)			**Better teamwork among students (*Fun_2*)**		**A better understanding of the topic (*Fun_3*)**	
Country	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Malaysia	232	4.39	0.787	4.27	0.864	4.14	0.848
Indonesia	250	4.07	0.746	3.88	0.851	3.70	0.793
Philippines	234	3.91	0.932	3.98	0.938	3.93	0.845
Brunei	240	3.85	0.958	3.72	1.04	3.70	0.867
ANOVA	***F (3,952) = 18.7, P=0.000***			***F (3,948) = 14.6, P=0.000***		***F (3,974) = 12.96, P=0.000***	

1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree.*

The results of ANOVA on the 'engagement' scores yielded significant variation among the conditions. A *post hoc* Tukey test for the following independent factors showed some similarity between Indonesia and Brunei (*Engaged_1*) and between the Philippines and Indonesia (*Engaged_2*). There are no significant differences between some countries for all factors (see Table 4-32). Malaysia scored higher than *M>4.00* for both independent factors.

Table 4-32: (S1.4_H2): Uncertainty Avoidance affects the engagement state.

	Anticipate Internet lessons (*Engaged_1*)			**Deep understanding of different technologies for different activities (*Engaged_2*)**	
Country	*N*	*M*	*SD*	*M*	*SD*
Malaysia	232	4.5	0.702	4.19	0.790
Indonesia	250	3.84	1.03	3.95	0.764
Philippines	234	3.67	1.14	3.86	0.959
Brunei	240	3.88	1.02	3.77	0.886
ANOVA	***F (3,974) = 36.13, P=0.000***			***F (3,974) = 13.18, P=0.000***	

1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree.*

The ANOVA test results on the factor of 'Technoid' (Anxiety impacting technology use) score yielded no significant differences among conditions between countries for *Technoid_1* or *Technoid_3*, with *F(3,974) = 1.78* and *P = 0.15*, and *F(3,974) = 2.22* and *P=0.084*, respectively. A *post hoc* Tukey test for the following independent factors showed some similarity between Malaysia and the Philippines for the factor *Technoid_4*. There was a significant difference for the factor *Technoid_2* (see Table 4-33).

Table 4-33: (S1.4_H3): Uncertainty Avoidance impacts technology use.

	Internet for research (Technoid_*1*)			**Learning Management Systems (*Technoid_2*)**		**Mobile device learning (*Technoid_3*)**		**Online video learning (*Technoid_4*)**	
Country	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Malaysia	231	4.18	0.581	3.61	1.18	3.58	1.34	3.66	1.05
Indonesia	259	3.99	0.891	3.32	1.43	3.80	1.16	3.25	1.42
Philippines	246	4.02	1.12	4.06	1.13	3.75	1.29	3.63	1.11
Brunei	240	4.07	1.05	2.92	1.44	3.53	1.45	3.13	1.41
ANOVA	***F(3,974) = 1.78, P=0.150***			***F(3,974) = 32.9, P=0.000***		***F(3,974) = 2.22, P=0.084***		***F(3,974) = 10.8, P=0.000***	

1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree.*

The ANOVA test result on 'contented in classroom' score yielded significant differences among conditions between countries for *Contented_1* (see Table 4-34). However, a post hoc Tukey test for the following independent factors showed no significant differences between Malaysia and Brunei.

Table 4-34: S1.4_H4: Uncertainty Avoidance affects the state of being Contented.

	Students prefer traditional classroom learning to technology-assisted learning (*Contented_1*)		
Country	*N*	*M*	*SD*
Malaysia	228	2.64	1.19
Indonesia	250	3.19	0.99
Philippines	231	3.62	0.97
Brunei	240	2.74	1.18
ANOVA	***F(3,945) = 39.63, P=0.000***		

The ANOVA test results on the factor of 'Excited' yielded significant variation among conditions, and a *post hoc* Tukey test for the following independent factors showed no significant differences between Malaysia and the Philippines (*Excited_1*), as well as among the Philippines, Indonesia, and Brunei (*Excited_2*; see Table 4-35). Malaysia scored higher than *M>4.00* for the factor *Excited_2*.

Table 4-35: S1.4_H5: Uncertainty Avoidance affects the state of being Excited.

		Bored using the same technology (Excited_*1*)		**Learn better when using different technology (*Excited_2)***	
Country	*N*	*M*	*SD*	*M*	*SD*
Malaysia	229	3.08	1.144	4.2	0.852
Indonesia	250	3.22	0.917	3.72	1.03
Philippines	230	3.08	1.02	3.79	0.938
Brunei	240	3.16	1.03	3.79	0.996
ANOVA	***F(3,974) = 2.72, P=0.043***			***F(3,974) = 14.12, P=0.000***	

The ANOVA test result on the factor of 'Motivation' yielded significant variation among conditions, and a *post hoc* Tukey test for the following independent factors showed no significant differences between Indonesia, Brunei, and the Philippines (*Motivated_1*) and Indonesia and Brunei (*Motivated_2*; see Table 4-36). Malaysia scored higher than *M>4.2* for both *Motivated_1* and *Motivated_2*.

Table 4-36: S1.4_H6: Uncertainty Avoidance affects the state of being Motivated.

	Students are more motivated when using mobile devices (*Motivated_1*)			**Students are constantly motivated during technology-assisted learning (*Motivated_2)***	
Country	*N*	*M*	*SD*	*M*	*SD*
Malaysia	232	4.37	0.853	4.23	0.765
Indonesia	250	3.80	0.880	3.85	0.836
Philippines	234	3.72	1.04	4.05	0.990
Brunei	241	3.81	0.973	3.81	0.875
ANOVA	***F(3,974) = 27.47, P=0.000***			***F(3,974) = 11.65, P=0.000***	

For *Technoid_2* (LMS), Brunei had the lowest score, *M<2.95*, and the Philippines had the highest score, *M>4.0*, among all countries (see Table 4-33). The Philippines scored higher than Brunei for three out of the four categories. This finding contradicts the earlier statistics from UNESCO that Internet-assisted instruction was used in Brunei at a rate of 100% and in the Philippines at 28% in 2012. The *post hoc* test revealed no significant differences between some countries for some factors (*Fun_3*, *Engaged_1*, *Technoid_1*, *Technoid_2*, *Excited_1*, *Excited_2*, *Motivated_1*, and *Motivated_2*); hence, cultural similarities among Southeast Asian countries do exist and affected the perceived use of e-learning tools.

I used these constructs to tabulate the path coefficients and P-values for dependent variables and T-values for independent variables to obtain a best-fit e-learning model for Southeast Asia in PLS, combining the data from all four countries. PLS-SEM was selected to model the theoretical framework because it provides many advantages, including the ability to test theoretically supported linear and additive causal models (Haenlein and Kaplan 2004). The structural path significance in bootstrapping was used.

4.5.5 Analysis of the Model

Figure 4-12 illustrated the path associated with the proposed constructs, including the construct for the transformation from Contented to Technoid. The PLS results in Table 4-37 indicated that Contented ($\beta Contented \rightarrow Excited = 0.178, p < 0.001$) leads to Engaged ($\beta Excited \rightarrow Engaged = 0.560, p < 0.001$), Excited leads to Motivated ($\beta Excited \rightarrow Motivated = 0.193, p < 0.001$), and Excited leads to Fun ($\beta Excited \rightarrow Fun = 0.269, p < 0.001$). Engaged leads to Fun ($\beta Engaged \rightarrow Fun = 0.479, p < 0.001$). The association path is Contented → Excited ($R^2 = 0.032$) → Engaged ($R^2 = 0.314$) → Motivated ($R^2 = 0.625$) → Technoid ($R^2 = 0.031$).

The PLS equation revealed Excited and Engaged as predictors for Motivated ($R^2 = 625$), Excited ($\beta Excited \rightarrow Motivated = 0.193, p < 0.001$), and Engaged ($\beta Engaged \rightarrow Motivated = 0.666, p < 0.001$). It also revealed Motivated ($\beta Motivated \rightarrow Technoid = 0.176, p < 0.001$) as the predictor for Technoid. Excited ($R^2 = 0.032$)→ Engaged ($R^2 = 0.314$) → Motivated ($R^2 = 0.625$) showed a higher association than Excited → Motivated. Technoid can be achieved using the construct of Happiness. Even though the path showed significant values for Excited ($\beta Excited \rightarrow Engaged = 0.560^{**}$)→ Engaged ($\beta Engaged \rightarrow Fun = 0.479^{**}$), Fun is not a predictor for Technoid for students' e-learning design, as was originally hypothesised (H3), and Contented is not a predictor for Engaged, as was originally hypothesised (H2). Fun is not a direct predictor of lowering Anxiety leading to Technoid. The determinant in achieving Technoid is Happiness, which showed the highest coefficient of determination ($R^2 = 0.625^{**}$). Therefore, manipulating happiness in e-learning design would positively stimulate students' technology acceptance level.

Table 4-37: Findings of the Research Hypothesis.

Hypothesis	**Factor**	***T-Value***	***P-Value***	*β*	**Findings**
S1.4_H1: Uncertainty Avoidance affects the state of being Fun.	**Better collaboration with classmates (*Fun_1*)**	*51.19*	*P < 0.05*	*β = 0.269* and *β = 0.479***	Supported
	Better teamwork among students (*Fun_2*)	*79.49*	*P < 0.05*		
	A better understanding of the topic (*Fun_3*)	*47.00*	*P < 0.05*		

S1.4_H2: Uncertainty Avoidance affects the state of being Engaged.	**Anticipate Internet lessons (*Engaged_1*)**	*59.04*	*P < 0.05*	*β = 0.560***	Supported
	Deep understanding of different technologies for different activities (*Engaged_2*)	*79.56*	*P < 0.05*		
S1.4_H3: Uncertainty Avoidance affects the state of being Anxious (affects intention to use technology).	**Internet for research (Technoid_*1*)**	*17.67*	*P = 0.15*	*β = 0.176*	Partially Supported
	Learning management systems (*Technoid_2*)	*3.99*	*P < 0.05*		
	Mobile device learning (*Technoid_3*)	*14.73*	*P = 0.084*		
	Online video learning (*Technoid_4*)	*6.62*	*P < 0.05*		
S1.4_H4: Uncertainty Avoidance affects the state of being Contented (affects the use of mobile technology).	**Prefer traditional classroom learning to technology-assisted learning (*Contented_1*)**	-	*P < 0.05*	-	Supported
S1.4_H5: Uncertainty Avoidance affects the state of being Excited.	**Bored using the same technology (*Excited_1*)**	*25.87*	*P < 0.05*	*β = 0.178*	Supported
	Learn better when using different technology Used (*Excited_2)*	*127.06*	*P < 0.05*		
S1.4_H6: Uncertainty Avoidance affects the state of being Motivated (affects motivation to use technology).	**Students are more motivated when using mobile devices (*Motivated_1*)**	*83.05*	*P < 0.05*	*β = 0.666** *and* *β = 0.193*	Supported
	Students are constantly motivated during technology-assisted learning (*Motivated_2)*	*83.43*	*P < 0.05*		

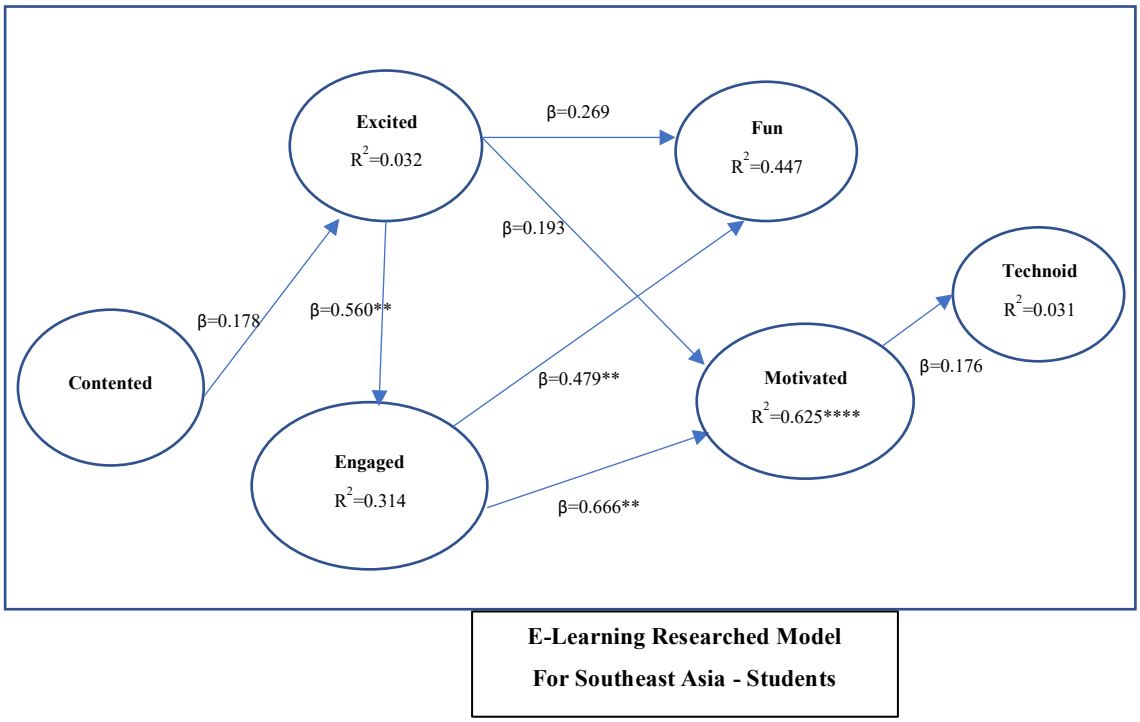

Figure 4-12: E-learning researched model for Southeast Asian students.

4.5.6 Discussion

Adopting e-learning techniques involves an ideological approach encompassing significant cultural and emotional values. Integrating cultural emotional activities into the design of e-learning postulates the strong and long-lasting bond that cultural activities offer Southeast Asian students. The proposed design solution will stimulate students' emotions positively and trigger high-level technology acceptance, nullifying negative anxieties. The findings corroborated an earlier study on emotions in which happiness was directly and positively related to the use of information technology (Beaudry and Pinsonneault 2010).

The path recommended in this study showed that Contented → Excited → Engaged → Motivated → Technoid, which identified critical constructs associated with e-learning design. Cultural activities, cultural games, and childhood games that promote cultural emotions and attachments could trigger somewhat positive emotions. The results showed that having Fun does not affect students' anxiety level directly in using technology (Technoid) and has no positive association, as was initially hypothesised. Students' happiness, however, is an essential determinant in reducing the anxiety levels of technology use (Technoid). Hence, the high association path of Excited → Engaged → Motivated can be easily achieved when students are comfortable working with closely associated elements or components, such as cultural icons or pictures. Even adults unfamiliar with the platform require short warm-up sessions to cultural activity to become engaged. In similar contexts, students need an

emotional attachment interface that could elicit their emotions towards continued use of an e-learning tool. The comfort level of an individual increases when closely associated elements are explored. The activity must be an easily accomplished goal and students can experience relief from an unpleasant emotional state. This finding resonates with an earlier study on emotions in which people could eradicate anxious emotions when they feel relax and become engaged in activities that excites them with reassuring thoughts (Bandura 1999). With that being said, self-disclosure is one of the most influential factors in students' happiness (Jafari et al. 2004), and cultural background does affect self-disclosure (Chen and Nakazawa 2012).

Interestingly, my finding showed that Fun does not lead to happiness. Fun cannot be used as a predictor to control Anxiety (leading to Technoid). In previous studies on factors affecting the use of e-learning, the emphasis was very much on student fun (Cole et al., 2014; Zhang et al., 2006). This created a gap between fun and emotional attachment in e-learning platforms, and this gap can only be bridged by using cultural and traditional associations. Stress can also be reduced when participating in leisure activities and engaging in a meaningful activity (Iwasaki et al. 2005).

Among students, happiness is an imperative element that can instill joy and lead to quick adoption of e-learning tools that results to successful learning outcome. However, the e-learning platform was not designed with an intrinsic approach triggering excitement, engagement, or happiness among students, who could otherwise obtain joy in traditional game activities. The fear and anxiety associated with using an e-learning platform can be diminished through familiarity with traditional and cultural association and activities.

By observing traditional game activities, children tend to display happiness during traditional games. It also revealed that such games and activities can be euphoriant, which can be pleasant and stimulate emotions (Jaouen et al., 2009). In a study observing the effect of 44 traditional Thai games and sports, researchers found that traditional games helped develop players' mental values, making them more fun, cheerful, happy, and self-motivated (Gomaratut 2009). A study in Indonesia proved that using traditional games during learning activities was associated with significant development among students, who could positively stimulate social-emotional aspects (Tatminingsih 2020). Corroborating these findings, a study in Malaysia observed that playing traditional games give students joy and amusement and increases students' level of learning (Mohamed and Tajuddin 2018).

The design of e-learning platforms has moved over time towards feature-rich elements rather than the intrinsic nature of emotional support for and well-being of the users. This emphasis has led to potential recognition of the richness of the technology's features. Still, it failed thus far to support the fundamental elements required for users' enticement towards the learning tool.

4.5.7 Conclusion

The implications of this model are (i) Redesigning future e-learning platforms to stimulate learning to solve the problem of slow ICT adoption in Southeast Asia, (ii) To facilitate and improve positive emotions in activities and nullify negative emotions, thus influencing their learning outcome; (iii) Creates a cultural emotional attachment towards E-Learning platforms thus breaks the barrier of uncertainty avoidance among Southeast Asian students using E-Learning platforms.

E-learning integrated with cultural emotions could potentially increase the level of use among Southeast Asian teachers and students due to the personal touch and attachment to familiar elements. Triggering cultural emotions in activities create a positive and a well-balanced Southeast Asian student that presents strong cultural foundation and cultural values.

Summary of Findings and Proposal for Next Section (Chapter Five)

It is a missed opportunity that such cultural factors have not been fully considered in designing teaching and learning tools and technologies. Integrating cultural emotions in the design of e-learning could positively affect teachers and students and sustain a more optimistic interaction level on the use of technology. Based on the findings from the literature review and the comprehensive survey:

I discovered that **there are Cultural barriers** in the current ICT tools and that it is incompatible with SEA teachers and students as per findings in the literature review in Section 2.2, 2.3, 2.4, and 2.5. Presence of cultural emotions as per findings from 4.4 and 4.5.

Findings from Chapter Two (Sections 2.2, 2.3, 2.4 and 2.5):

a. SEA values, including a strong focus on race, religion, customs, and practices, are incompatible with Western values and approaches, thus hindering adaptation to western-influenced technology;
b. Customs, such as traditional rites, music, arts (e,g., silk painting, batik, handicraft, kite flying) and **festivals** are incompatible with western customs, styles, artefacts, and presentation;
c. **SEA** practices, such as showing respect to their traditions, auspicious practices, emphasising the importance of family, artistic practices, using hands and chopsticks for eating, respect for the elders and God, humble greetings and gestures, and focus on auspicious events conflict with westernised practices, such as emphasising individualism, placing less importance on the advice of elders, and less focus on auspicious occasions.

Finding from Chapter Four (Sections 4.4 and 4.5):

d. Discovered cultural emotions during ICT use from data analysed from teachers' and students' perspectives.

I propose **Cultural themes with a cultural emotional metaphor** for ICT design for Southeast Asia secondary schools. This proposed new cultural emotional metaphor will be designed and evaluated in the next Section (Chapter Five).

Note on publication:

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Chapter 5 Outline

5. Study One - Festive Theme as New Cultural Metaphor: Impact of Cultural Themes
5.1 Introduction
5.2 Background
5.3 Method
5.3.1 Brainswarming sessions
5.3.2 Focus Group
5.3.3 Pre-Design Survey
5.3.4 Pre-Design Interview
5.4 Formulation of Hypotheses
5.5 Prototype Design
5.6 Data Analysis
5.7 Results
5.8 Discussion and Conclusion
5.9 Summary of Findings and proposal for Next Section (Chapter Six and Seven)

5 Study One - Festive Theme as New Cultural Metaphor: Impact of Cultural Themes

Based on the findings from the literature review (Section 2) and the comprehensive survey (Section 4), I discovered that **there are Cultural barriers** in the current ICT tools and that it is incompatible with SEA teachers and students as per findings in the literature review (Section 2.2, 2.3, 2.4, and 2.5). Hence, in this chapter, I propose cultural prototype to be developed and evaluated in Southeast Asia secondary schools. The cultural prototype will be **based on festive-themed** to assess the impact of a cultural-themed educational tool among teachers and students in Indonesia. Three groups of experiments were set up; "the festive cultural theme", "the control theme", and "a classroom-based learning"; to test students' learning outcomes. The results showed improved learning outcomes and learning experiences among students in the "festive cultural theme group" and "classroom-based learning group", with no significant differences between the two experiments. Table 5-1 summarises what this study aims to achieve. It states the research question, aims, and hypothesis this chapter is designed to address.

Table 5-1: Summary of what this study aims to achieve.

Summary of what this study aims to achieve:
Research Question 3: Emotional cultural objects are preferred icons and metaphors in educational technology?
Aim 3 – Develop and evaluate Southeast Asia specific cultural ICT design **Cultural theme** and Cultural Activity
Hypothesis 2: Southeast Asia cultural values and interaction are the preferred design for ICT

5.1 Introduction

The comprehensive survey findings revealed the presence of traditional mindsets and cultural elements among teachers and students: (i) Teachers lacked exposure to integrate and to use technology/digital tools in the classroom. (ii) Students explored technology/digital tools with minimal guidance from teachers. (iii) Students preferred teacher-centred instruction and classroom-based learning. The results from the comprehensive survey and focus groups (discussed in this chapter) were used as the basis in this study to design a mobile educational game-based activity with a traditional festive cultural theme to test the level of academic technology acceptance among teachers and students. This study evaluated the impact of cultural themes in a mobile game–based activity on students' learning outcomes. Three groups of experiments were set up; "the festive cultural theme", "the control theme", and "a classroom-based learning"; in experiment-oriented learning to test the students' learning

outcomes. The findings showed that there were no significant differences between “festive cultural theme group” and “classroom-based learning group” when the results of learning outcomes were measured. The finding also postulates the incompetence of “the control theme”, which uses standard designs to evaluate students learning outcomes. To the best of my knowledge, such a study has not been undertaken previously. It is the first to connect students’ and teachers’ cultural characteristics with the technological/digital tools used in Southeast Asian secondary education.

The remainder of this chapter is structured as follows: Section 5.2 focuses on the background of the culture-centred learning system and the research questions. Section 5.3 describes the method and design for the hypotheses and evaluation technique used in Jakarta, Indonesia. Section 5.4 presents the results from the data gathered on the three research questions, Section 5.5 discusses the key research findings and Section 5.6 presents the conclusion.

5.2 Background

In an increasingly globalised, competitive, and knowledge-intensive world, the arts and culture represented by them are taken for granted and often neglected in the domain of software design. The culture of various regions significantly influenced learning styles, particularly the abstract or the reflective learning styles, which depends on group collectivism, uncertainty avoidance, and assertiveness (Hofstede, 1983). Cultural barriers do affect the learning ability and creativity of users (Joy and Kolb, 2009), (Vadivel et al., 2017). Furthermore, the analysis of ICT in teaching and learning with Shulman’s model (Shulman, 1987) (Webb, 2002) had demonstrated significant difficulties encountered due to the rapid development of the tools. In a similar context, Southeast Asia has its own set of challenges due to its culturally diversified ethnic groups, especially groups from the rural minorities where minimal exposure to digital tools is the fundamental issue (Moser et al., 2017).

As Southeast Asia schools prepare to support educational tools use in teaching and learning, the factors of the user-centered design must be considered for educational tools, and this becomes a vital criterion for developers and designers. As most ICT designs were developed in the western world, the question arises if these technologies and digital tools can produce the same results when applied in different cultures (Shulman, 1987). The criteria become more stringent for teachers and students who are passive about using technology in the educational domain. Passive educators and passive learners lack interaction with technology and digital tools in the rural areas of Southeast Asian countries and this becomes a paramount issue. Researchers agreed that encouraging a platform to support the adaptability of interaction will need to accommodate domain-specific requirements. Rural areas have unique needs and may rely on other factors for instructional technology (Sundeen and Sundeen, 2013).

5.3 Method

To find out Southeast Asian teachers' and students' ICT cultural design preferences, I carried out a pre-design phase focus groups in this study. Firstly, a Brain swarming session (Hadjileontiadis, 2014) was carried out with SEA students; secondly, a pre-design survey was completed with SEA students; thirdly, a pre-design survey was carried out with SEA teachers; and fourthly, a pre-design interview was completed with SEA students and an interview with the co-founder of Yamakindo, Indonesia. The results of the focus groups were used to design the festive-themed prototype which was evaluated in Indonesia.

5.3.1 Brainswarming Sessions

I invited James Cook University students of Asian origin—Vietnamese, Indonesian, and Indian—between the ages of 17 and 21 to participate in a brain-swarming session on technology design and preferences for an educational system. I briefed students on the aim of the educational system and the following questions to stimulate their ideas:

1. What childhood activities or games have impacted you most?
2. Which cultural factors positively affect how you learn, and why?
3. Which cultural values do you observe in class (secondary school)?
4. What cultural values should be present in technology used in the classroom?
5. If you are allowed to transform the technology used in the classroom, what factors would you consider about Southeast Asian culture?

Students were assigned papers, whiteboards, coloured stickers, coloured markers, and pens to present their design preferences and ideas creatively. The brain-swarming session had lasted for approximately two hours. Students presented educational technology design ideas at the end of the brain swarming session. The ideas included: user interface must be simple; use of attractive colours; customisation for users (theme); **more fun activities**; user interface must look attractive; easy to understand instructions; something that teaches basic things; features that can stimulate their creativity; and **use of the social game to make the activity** more fun.

5.3.2 Focus Group (Technology Interface): Students

I conducted a short pre-design survey to gather Asian students' preferences and User Interface Experience (UIX). Twenty Asian students from James Cook University were invited to participate in the focus group on technology interface. Respondents were from Myanmar, Singapore, and Vietnam between the ages of 17 and 24. The survey (Appendix A) consists of seven questions on the features of the User Interface (UI), the interface's effect on Users' eXperience (UX), the interface's ease of use,

and students' motivation, enjoyment, and learning experiences. Refer to the focus group results in Table 5-2.

Table 5-2: Results for students: Features of UI on UX.

UI on UX	***N***	***Mean (M)***	***Standard Deviation (SD)***
Easy-to-use UI motivates learning	20	4.05	0.605
Colourful UI stimulates the learning experience	20	4.05	0.759
Colourful UI improves the learning experience	20	3.90	0.788
Simple UI will enhance the learning experience	20	4.20	0.616
Easy-to-use UI is effective and fun	20	4.15	0.587
Quick downloading and uploading of materials enhance the learning experience	20	4.20	0.696

*Note: A value of 1 signifies Strongly Disagree while a value of 5 represents Strongly Agree

Note: Refer to Appendix F for the Focus group questionnaire.

A short focus group was conducted to gather Asian students' preferences in UI and UX. 15 Asian students were invited to participate in the pre-design survey. Icons and buttons for a technology interface were evaluated. Respondents were from Singapore, Indonesia, Myanmar, and Malaysia and were between the ages of 16 to 25 (*n=4* Indians, *n=2* Malaysian, *n=9* Chinese/Buddhist). Survey on icons and buttons consists of six questions on cultural icons and buttons that promoted cultural motivation, enjoyment, and a good learning experience. Results were mapped to the respondents' origin to identify their respective cultural preferences. Students' choices were strongly connected to their culture, festivals, and country pride, as shown in Table 5-3 for evaluation results.

Table 5-3: Results for students: Evaluation of metaphor.

Evaluation of Icons and buttons	***N***	***Statistics***
1)Would these pictures **motivate** you or make you **comfortable** if they appear as the background of the buttons on an educational application/tool?     (a) (b) (c) (d)	15	73% (c) 13% (d)
Linking respondent background (religion/festival) to a selection of choice in question 1: **2 Malay students were selected – (b)** **4 Indian students were selected – (a) and (d)**		

2)Which backgrounds would **motivate** you or make you **comfortable** if they appeared on an educational application/tool?     (a) (b) (c) (d)     (e) (f) (g) (h)	15	33% (c) 20% (e) 20% (g)
Linking respondent background (religion/festival) to selection choice in question 2: **4 Myanmar and Indonesian students were selected – (c)** **2 Malaysian students selected - (c) and (e)**		
3)Which buttons would make you **comfortable** if they appeared on an educational application/tool?    (a) (b) (c) (d)	15	47% (b) 27% (a) 20% (c)
Linking respondent background (religion/festival) to selection choice in question 3: **2 Malaysian students – (a)** **4 Indian students – (c)**		
4)Which one of the following types of music would you want to hear in the educational application/tool during an outdoor activity? (a) Western Cowboy (b) Local_Malay	15	60% (b)
5)Would you prefer animations (moving pictures) in an educational application/tool? Yes No Not sure (a) (b) (c)	15	60% (a)
6)Would you prefer to see more localised (e.g., from Southeast Asia) images on an educational application/tool (e.g., local festivals, local iconic buildings)? Yes No Not sure (a) (b) (c)	15	60% (a)

5.3.3 Pre-Design survey (Technology Interface): Teachers

A short focus group was conducted to gather Asian teachers' preferences in UI and UX. Ten secondary school teachers were invited to participate in the pre-design study on a technology interface. Respondents were from Malaysian secondary schools. The survey (Appendix G) consists of seven questions on features of the UI, their effect on UX, the interface's ease of use, and teachers' motivation, enjoyment, and teaching experience. The summary of teachers' pre-design survey on UI and UX is shown in Table 5-4.

Table 5-4: Results for Teachers: Features of UI on UX.

UI on UX	***N***	***Mean (M)***	***Standard Deviation (SD)***
Do you agree that using technology motivates learning?	10	5	0.00
Do you agree that an easy-to-use user interface (UI) for Learning Management Systems (LMS) will cut down on setup time?	10	4.6	0.49
Do you agree that a colourful user interface (UI) in an educational tool/technology will encourage and attract teachers to use the tools?	10	4.8	0.40
Do you agree that a colourful user interface (UI) in an educational tool/technology will improve teachers' teaching experience?	10	4	0.89
Do you agree that a simple user interface (UI) design for an educational tool/technology will enhance teaching?	10	4.8	0.40
Do you agree that an easy-to-use user interface (UI) for an educational tool/technology is essential to facilitate teaching?	10	5	0.00

*Note: A value of 1 signifies Strongly Disagree while a value of 5 represents Strongly Agree

The following questions/variables scored higher mean *(m)* score > 4.5

1. Do you agree that using technology motivates learning?
2. Do you agree that an easy-to-use user interface for Learning Management Systems (LMS) will cut down on setup time?
3. Do you agree that a colourful user interface in an educational tool/technology will encourage and attract teachers to use the tools?
4. Do you agree that a colourful user interface in an educational tool/technology will improve teachers' teaching experience?
5. Do you agree that a simple user interface design for an educational tool/technology will enhance teaching?
6. Do you agree that an easy-to-use user interface for educational tools/technology is essential to facilitate teaching?

5.3.4 Pre-Design Interview on Technology Tools for Education in Southeast Asia

A short pre-design interview was conducted with eight Southeast Asian students from James Cook University. Students were invited to participate in the pre-design discussion on technology tools for secondary education in Southeast Asia. Candidates for the interview were from Myanmar and Indonesia and between the ages of 17 and 24.

The summary of the interview is stated below and word cloud in Figure 5-2:

- 'Teachers from rural schools mostly deal with relatively fewer students. Therefore, they find manual grading and student management easier because some online grading systems like **Blackboard are too complex** to navigate and take too much time to learn all the functions. We need to make the UI more user-friendly, straightforward, and light. Most schools have limited access to technology; thus, their machines can only handle small programs, and their internet connection is not that fast. The system should run fast in low spec machines';
- 'Students preferred to take notes using a laptop or other gadgets, but not everyone owns a laptop in rural islands. Most students owned a smartphone at least; thus, the system must be able to access from smaller devices (responsive). Lecture notes and homework should be posted online so students can access them from anywhere using their preferred gadgets';
- 'I grew up in big cities like Jakarta. People are more open to changes because we already have the technology; it's only a matter of how to implement it to improve students' learning experiences. Most teachers and students **are not used to modern technology in rural schools**. Therefore, to encourage them to start using technology, the system should be simple enough for them to understand and use';
- 'User interface needs to be simple and attractive with more instructions for new users and fewer steps to complete tasks, with native language support';
- 'The system should give students easy access to different study materials to save time, and the interface should provide the simplest menu, with more instructions and reminders if required.'
- 'There should be a straightforward graphical user interface, and **classical games** should be used to teach and **motivate students**.

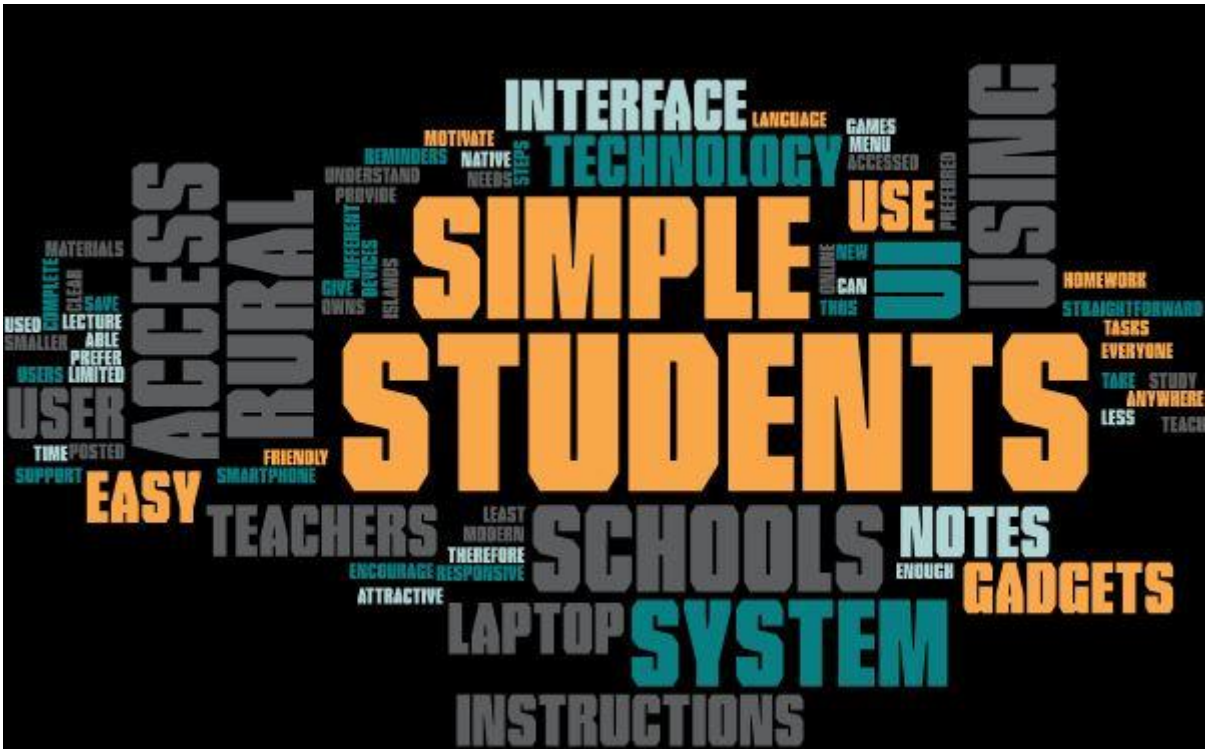

Figure 5-1: Word Cloud on Pre-Design Interview (Students).

Interview with Co-Founder of Social Enterprise at Indonesia Independent and Creative Foundation (YAMAKINDO): Blanche Pearl Harun

Yamakindo is an independent foundation in Tangerang, Indonesia, with a mission 'to empower people, promote a better environment, develop natural resources, and promote harmony and peace for all'. Tangerang is about 29 kilometres from the capital city of Indonesia. This foundation organises activities and mini seminars for youths and children at their organisation and in villages in various rural areas, including character building, awareness and prevention of malnutrition, elimination of stigma and discrimination against leprosy, and construction of libraries in rural areas, example in Nias.

I had an opportunity to request an interview with the co-founder Ms Blanche Pearl Harun, on 11 August 2018, to understand the critical issues faced in using technology by students between the ages of 13 and 18 for their daily activities. These students participate in Yamakindo activities regularly. Interview result showed that issues encountered with Indonesian students are (aged 13-17 years):

Cultural barriers

- 'Students treat their parents as mentors, and parents who are not educated tend to misguide their children;
- 'Students are afraid to explore new technology; in fact, both adults and children are afraid to use IT/computers';
- 'An orthodox culture is being observed by the younger group, which leads to a non-progressive younger generation';

- ‘Students lack the positive attitude needed to excel’;
- ‘People in Indonesia prefer to complete tasks in groups rather than individually;
- ‘Students from the outskirts (villages/rural areas) face more challenges and negative influences from the use of technology (e.g., the internet)’;
- ‘The age group of 13-18 years is a vulnerable group that can be influenced and misguided’;

5.4 Formulation of Hypotheses

The literature review, comprehensive survey and focus groups aided with the formulation of two Hypotheses discussed below:

In the school domain, the analysis revealed that schools must demonstrate creativity in using technology and innovation in training teachers to coordinate technology with the Asian learning culture. The study showed that mobile game–based e-learning is highly effective compared with regular project-based lessons (Huizenga et al., 2009) and that students who use mobile devices can engage and collaborate better (Webb, 2002), (Heflin et al., 2017). Therefore, Hypothesis 1 was identified as:

S2_H1: Mobile technologies can improve learning outcomes and students’ learning experiences

There are cultural learning differences between Asian and Western students, which, coupled with Hofstede’s cultural dimensions affect Southeast Asian teachers ability to teach and students learning behaviour in a technology-assisted classroom. Therefore, Hypothesis 2 was identified as:

S2_H2: Culturally motivated technology is required to stimulate teaching and learning

5.5 Prototype Design

This study assessed students’ learning outcomes using a mobile game–based activity with a cultural theme. This study had two phases: The first phase (focus group) which involved 16 Southeast Asian students aged 16–25 years who answered six questions on design preferences (on types of icons/buttons, music, and background images) that motivates them in using educational application tool. The result showed that 14 students’ selected choices were closely knitted to their culture and traditions.

The second phase involved creating an educational application prototype (interactive mobile game) with a festive cultural theme and a control theme. Three experiments on interactive mobile game-based learning were set up using a festive cultural theme, a control theme, and classroom-based learning for 84 students aged 13-15 years from three secondary schools in Jakarta, Indonesia. Thirty-four students ($n = 34$) participated in the festive cultural theme activity, 26 students ($n = 26$) participated in the control theme activity, and 24 students ($n = 24$) participated in the classroom-based learning

activity. All students were invited to complete a pre-test and a post-test question on photosynthesis and to complete a user experience survey.

The first experiment involved students' learning about photosynthesis using an interactive mobile game–based activity with a festive cultural theme. Students selected the festival they celebrate. The prototype was designed for Christmas, Ramadhan, Lunar New Year, Diwali, and Vesak. The Science topic of Photosynthesis questions was tailored and presented in a festive theme design with specific festive music, festive design, and with vibrant coloured decorations, as shown in Figure 5-2 for Ramadhan festive theme and Figure 5-3 for Lunar New Year festive theme.

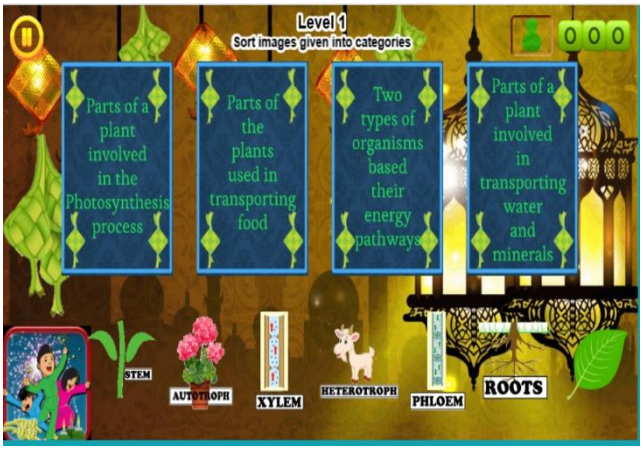

Figure 5-2: Ramadhan festive theme.

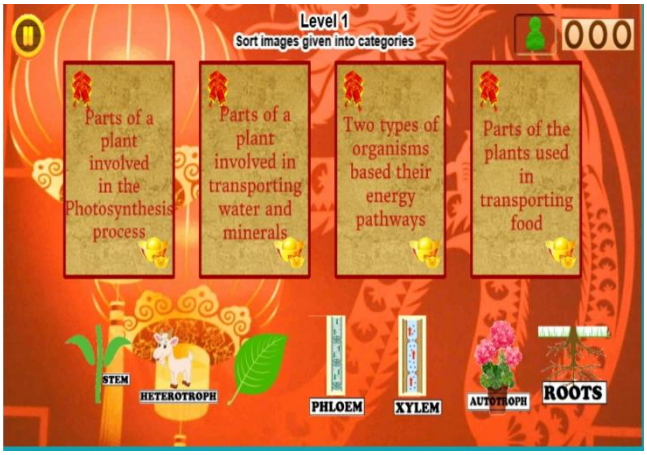

Figure 5-3: Lunar New Year festive theme.

For the second experiment, the same Science topic of photosynthesis was presented to 26 students using a mobile game of a control theme, as shown in Figure 5-4 (Control theme [Generic]).

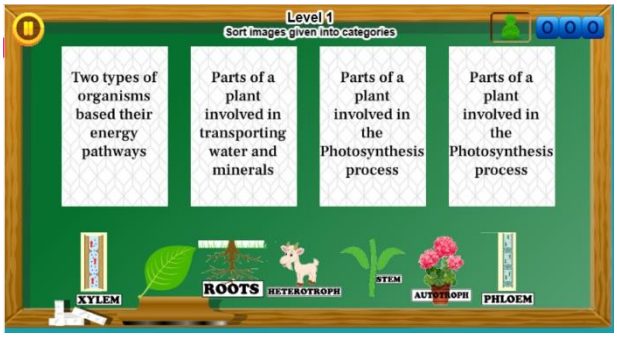

Figure 5-4: Control theme (Generic).

For the third experiment, 24 students participated in a classroom-based learning activity where a teacher delivered the same Science topic of photosynthesis in a classroom environment using traditional methods. Data was collected from the three experiments (culture, control, and classroom), and results were compared using the differences (achievement) of the pre-test and post-test results (achievement = post-test – pre-test) among the participants.

5.6 Data Analysis

To facilitate the interpretation of the questions, I used an independent translator to translate the English version of questionnaire to Bahasa Indonesia for Indonesian secondary schools, and their equivalency was compared. For this study, to assess user experiences and learning outcomes, 84 students ($n = 84$) aged 13–14 years from three secondary schools in Jakarta participated in three experiments to learn the scientific topic of photosynthesis using mobile game-based learning with a festive cultural theme, a control theme, and classroom-based learning. To measure the learning outcome, students were asked to answer seven pre-test questions on photosynthesis before and after the activity. The questions were selected and designed based on the science syllabus for Southeast Asian secondary schools. A mean score results with confidence interval were used to measure the learning outcomes. Students also participated in a post-activity survey to assess their learning experiences. They were asked to rate their overall levels of satisfaction with the design of the prototype and their learning experiences on a 5-point Likert scale (where 1 = strongly disagree and 5 = strongly agree).

5.7 Results

Result – S2_H1: Mobile technologies can improve learning outcomes and students' learning experiences

The findings from the comprehensive survey showed that teachers are not willing to explore the westernised digital tools which are not catered to their traditional and cultural-oriented activities. The UA cultural index can be observed in this finding. The findings showed that teachers have enough professional development. However, the infrequent use of digital tools for classroom activities is a concern for Southeast Asia. Whereas this is perceived differently in western schools, where the survey result showed the United States leads in smartphone use (74%) in classrooms, compared to whiteboard use in Indonesia (92%) and Malaysia (90%) (Cambridge Assessment International Education, 2020). The digital educational tools explored by the teachers were not locally attractive and it lacks local cultural presence. Thus, teachers have minimal exploration with digital educational tools and their actions have seriously affected students' learning abilities. This is important to note that teachers' infrequent use of digital tools influence students learning outcome and affects the motivation of students in the classroom, thus leading to student boredom.

To further support this result, I evaluated the learning experience using a mobile device in this study, (refer to Table 5-5). Motivation and fun during the activity showed a higher mean score for interactive mobile game-based learning than traditional classroom learning.

Table 5-5: Students' learning experience during activity (Study 1).

Learning experiences	***Activity***	***N***	***Mean (M)***	***Standard Deviation (SD)***
Motivation during the activity	Classroom	24	4.25	0.794
	Control (Using standard mobile interactive game)	26	4.27	0.827
	Culture (Using festive-theme mobile interactive game)	34	4.31	0.738
Fun during the activity	Classroom	24	3.96	0.624
	Control (Standard theme)	26	4.19	0.749
	Culture (Festive theme)	34	4.12	0.743

Southeast Asian students perceived that mobile-assisted learning can improve learning outcomes and learning experiences. The experiment results showed that students found that mobile game–based activities are fun and they feel motivated compared to traditional classroom activity. Specific preferences, accessibility of learning resources, and functionality are featuring that those users want to see included in mobile-based learning (Rakes et al., 2006). Thus, technology developers require a paradigm shift in their design thinking process to consider factors that appeal to and engage Southeast Asian learners.

Result – S2_H2: Culturally motivated technology is required to stimulate teaching and learning

Findings from the focus group showed that Southeast Asian students using mobile-assisted learning prefers to see cultural elements and icons to some extent. Another point to note on students' upholding cultural values has to do with the question of students' respect for teachers and parents when commenting on social media; it showed the existence of PD between students and senior groups of people such as teachers and parents with $M > 3.2$ and $SD = 0.73–0.93$ for all countries. Students view teachers and parents as people with higher authority who require due respect. This validated Hofstede's PD and MF indexes. Southeast Asian countries have high PD index, where children are expected to obey parents and those with superior status.

The ANOVA test result showed no significant differences between groups with a *p-value* = *0.169 ($p \geq 0.05$)* (Refer to table 5-6).

Table 5-6: ANOVA test result

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.071944	2	0.035972	1.823385	0.169173	4.926671
Within Groups	1.36125	69	0.019728			
Total	1.433194	71				

However, in the case of technology-oriented learning, students seem to prefer exploring technology before being instructed, as shown by the variable students wait for teachers' instruction before activities ($M > 3.21$ and $SD = 0.81–0.92$). The fact that students choose to use digital tools on their own initiative and consider teachers as facilitators whom they seek advice and only when needed is a significant finding which underlines reasons for teachers to use technology in the classroom for students' self-directed learning (Baek et al., 2008).

To further support the point noted above, the results from this study showed that improved learning outcomes among students in the festive theme group compared to the control theme group.

There are no significant differences for the learning outcome or results for students' during both festive themes and classroom learning with *M = 14.12%* and *M = 14.16%* respectively (refer to Table 5-7). The standard deviation for the festive theme learning outcome showed a *SD = 12.82* which is lower than for classroom learning which *SD = 17.67* and with a narrower confidence interval of [0.09, 0.18]. Compared to the control theme group, which achieved only *6.54%* for the achievement mean score and the festive theme group showed a higher achievement mean of *14.12%*.

Table 5-7: Students' achievement in different activities.

Evaluation component	*Activity*	*N*	*Pre-Test Mean (M)*	*Post-Test Mean (M)*	*Achievement Mean (M)*	*Standard Deviation (SD)*	*95% CI*
Achievement	Classroom	24	34.17%	48.33%	**14.16%**	**17.67**	[0.07, 0.21]
	Control (Standard theme)	26	44.23%	50.77%	6.54%	8.92	[0.03, 0.10]
	Culture (Festive theme)	34	29.41%	43.53%	**14.12%**	**12.82**	[0.09, 0.18]

Seventeen teachers evaluated the festive theme prototype (refer to Table 5-8). Their learning experiences was evaluated, result showed high means scores (*M > 4.3*) and low standard deviation *(SD = 0.5–0.9)*.

Table 5-8: Prototype evaluation by teachers using culture (festive theme).

Experiences	***N***	***Mean (M)***	***Standard Deviation (SD)***
Motivation level during activity	17	4.65	0.60
Excitement level during activity	17	4.59	0.51
Happiness level during activity	17	4.47	0.62
Enjoyment level during activity	17	4.59	0.62
Fun level during activity	17	4.47	0.72
Satisfaction level during activity	17	4.35	0.86
Overall rating	17	4.47	0.87

5.8 Discussion and Conclusion

The result for teachers' professional development in the comprehensive survey showed adequate training; however, the digital tools' design failed to attract the attention of Southeast Asian teachers' best exploration, thus, impacting optimal use of digital tools in the classroom for better learning

experiences. The design of technology/digital tools is not tailored to support an optimum use for Southeast Asian classroom activities; furthermore, accommodating a diversified group of students adds to the challenge. I could suggest that this finding supports the need for culture-friendly teaching tools for Southeast Asian teachers. Traditional and culturally influenced elements such as festivals, festive music, traditional games, traditional events, and festive decorations significantly impact human emotions. These elements are close to their hearts and instill somewhat calmness and happiness that sets teachers and students to an identity where they belong. These elements can be used as the design determinants for future educational technology tools.

This study demonstrated that students perceived that both festive-themed game-based learning and classroom-based learning provides the same learning ambience and context. Combining the festive-theme game-based application with classroom-based learning can further enhance learning, and it would add value to the traditional classroom teaching. Teachers would be willing to explore and experiment with technology and teaching tools if the design of the tools met their perceptions of convenience and comfort. Moreover, teachers' belief in their ability to use technology effectively and this will potentially affect students' achievements (Roy, 2012). A study on emotional state, showed that offering no support for the user's emotional state during or after a system failure is paramount to ignoring emotions, leading to loss of opportunity for continued interaction with the user. It is vital to consider the user's emotional state as a constant factor in the design process. Text and buttons may be overlooked and underutilised methods to create an action (Hassenzahl, 2018). Students' negative emotional state affects their learning ability and impairs their ability to absorb the knowledge learned. Combining motivational and behavioural data provides insights into learners' needs, and individual differences between learners are essential mediators of the effectiveness of instructional techniques (Kizilcec and Schneider, 2015). User experience significantly impacts learners and must be considered by the designers of digital tools.

Students view teachers and parents as people with higher authority who require due respect. Teachers' face more challenges as students place high expectations on teachers' confidence with technological-assisted teaching. Teachers are perceived to be technology-savvy and could employ a practical technology-integrating technique to facilitate students' smooth immersion in technology-assisted learning. Thus, a simplified teaching technology would motivate educators and increase their confidence in a technology-assisted classroom. This finding substantiates the study on what makes teachers use technology in classrooms. It reveals that teachers use technology primarily to meet external policies and needs, not because they believe in technology's effectiveness in their classrooms (Baek et al., 2008). Educational technology developers must entice and motivate teachers and education sector with the ease of usability and reduced time and cost for effective use of educational digital tools. However, little has been done to improve usability features in the learning domain. Usability measured by effectiveness, efficiency, and satisfaction is often overlooked in the development of educational

platforms (Davis, 1989), which makes it challenging for teachers to present complex concepts and to motivate students during technology-assisted learning.

Hence, an adaptive and simplified technology infused with influential cultural elements is a preferred educational platform for Southeast Asia that will stimulate and motivate teaching and learning. What is essential is not what technology can provide but rather the comfort and acceptance of using it to achieve the desired outcome. Hence, the need to assimilate user experiences in creating digital tools and technology must be recognised and efficacy factors must be the focus of educational technology developers, highlighting the importance of design emphasis on culture friendly HCI features.

This chapter presented the design and evaluation results of festive themes educational tools in Indonesia. The findings suggest good interactivity and high-level involvement with technology-oriented learning when cultural values are embedded in technology design and this design improves students learning outcome. Including cultural aspects and user-friendly features in the design of educational tools is the paramount factor for technology-assisted education in Southeast Asian secondary schools.

5.9 Summary of Findings and Proposal for Next Section (Chapter Six and Seven)

Summary of findings from Comprehensive survey (Sections 4.4 and 4.5):

a. SEA students are less anxious when ICT (e.g., mobile learning, LMS, online videos) is used during technology-assisted learning and when teachers guide technology-assisted learning;
b. A variety of cultural emotional states, such as anxiety (using technology), excitement (technology interaction), relaxation (guided by the teacher), and engagement (interacting with classmates) are present among SEA students when using ICT;
c. SEA Students are engaged and satisfied (classmate interaction). When students interact with their classmates with ICT, SEA students feel engaged and satisfied instead of anxious. They report better collaboration with classmates, better teamwork, understanding the topic better, and learning better with different technology, which identifies cultural orientation among Southeast Asian students;
d. **SEA** Students are more **relaxed and excited with the teacher present.** SEA students are more flexible and enthusiastic in the classroom when the presence of and when teacher guides them during technology-assisted learning.

Summary of findings from Study 1 (Festive theme as a new cultural metaphor):

Conclusions of this Chapter (Sections 5.5 and 5.6):

a. SEA students' learning outcomes improved significantly in the classroom and mobile learning when "festive theme" activities were used;

b. Cultural themes do have a “silent positive impact” on SEA students’ learning outcomes;
c. Students reported an improved learning experience with mobile learning with minimal negative interactions. SEA Students rated both “standard theme” activities and “festive theme” activities similarly, as both have minimal negative interactions;
d. SEA teachers' cultural emotional states were higher when “festive theme” ICT with a local setting was used for teaching and learning.

I further discovered that to optimise and accelerate ICT use, educational tools/ICT must incorporate elements that invoke deep cultural emotions by involving Southeast Asian teachers and students in cultural activities. This can be achieved by infusing traditional learning activities with cultural values that Southeast Asians are familiar. I proposed the use of **cultural activities as a new cultural metaphor**. The following section further describes and discusses cultural activities and their impact.

Note on publication:

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Chapter 6 Outline

6. Study Two - Cultural Activities as New Cultural Metaphor in Southeast Asia Secondary Schools

6.1 Introduction

6.2 Background on Cultural Activities

6.3 Role of Cultural Games Among Southeast Asians

6.3.1 Role of Auspicious Activities Among Southeast Asians

6.4 Method

6.4.1 Selection of Cultural Activity and Auspicious Activity as Metaphor

6.4.2 Prototype Design - Metaphors of Playing and Designing Cultural Activities

6.5 Formulation of Hypotheses

6.6 Evaluating Culture-Centred ICT Design in Indonesian and Bruneian High Schools

6.6.1 Experiment Design

6.6.2 CFA and SEM Design – Culturally Compatible ICT

6.7 Evaluation Procedure

6.7.1 Setting 1: Traditional Activity vs Cultural Activity (Auspicious and Non-Auspicious)

6.7.2 Results for Setting 1

6.7.3 Setting 2: Comparing Non-Auspicious Activity vs Auspicious Activity

6.7.4 Results for Setting 2

6.7.5 Discussion on Setting 1 and 2

6.8 Conclusion

6.9 Proposal for Next Section (Chapter Seven)

6 Study Two - Cultural Activities as New Cultural Metaphor in Southeast Asia Secondary Schools

6.1 Introduction

In this chapter, I designed and evaluated non-auspicious and auspicious cultural activities as a new cultural metaphor. The evaluation result showed cultural activity provoked silent emotions among students, resulting in high learning achievements. Cultural activities and culturally designed ICT tools can be **silent motivators** for SEA students that improved learning outcomes, teaching and learning experiences. The table below summarises the aim of this chapter. Table 6-1 summarises what this study aims to achieve. It states the research question, aim and hypothesis for which this chapter is designed to address.

Table 6-1: Summary of what this study aims to achieve.

Summary of what this study aims to achieve:
Research Question 4 - Cultural related activities and design improve teaching/learning experience and learning outcome?
Aim 3 – Develop and evaluate Southeast Asia specific cultural ICT design (cultural theme) and **Cultural Activity**
Hypothesis 3: Southeast Asian Cultural values and activities can improve the teaching and learning experience.

6.2 Background on Cultural Activities

Most studies in the literature review are concerned with integrating technology advancement as the general requirement for the design of digital tools. Software designers have failed to observe the reason for the low acceptance and usage of digital tools in Southeast Asian countries in relation to cultural aspects. The Southeast Asian countries, with their history of trade and immigration, are rich in cultural diversity, cultural practices, the arts, and the material culture. Informal socialising while eating or drinking and other activities are still central to the public culture of the region.

6.3 Role of Cultural Games Among Southeast Asians

Historically, games were popular in SEA and many pre-colonial pastime games required craft skills. Furthermore, leisure practices, festivals, and important religious activities are still observed in Southeast Asia. Games and activities such as kite flying and top spinning, to name a few, are still considered

important activities and plays a vital role among Southeast Asians (Power et al., 2006). These laid-back cultural activities are still the preferred mode of interaction with peers, which represents a certain extent of self-belonging. There is a lack of studies that focuses on integrating cultural values in the educational digital world that appeals teachers and students.

Countries with a rich culture and traditions, such as Asian countries, who embrace their cultural values and therefore can be an important factor to be considered in the digital arena. For example, some studies emphasised improving the quality of education by tapping into locally available resources to introduce local realities into the educational system and thus enhance students' identity and belonging (Power et al., 2006). However, this aspect does not entice students towards educational systems. 'The most common reason kids tune out is that the work is too hard for them' (Qi and Boyle, 2010). This enables us to rethink the design of the digital world with culturally themed elements in the educational arena. Culture affects the teaching and learning environment and, ultimately, students' learning outcomes.

Leisure activities in SEA often have close ties with religious and spiritual beliefs and are shaped by local beliefs and practices. Festivals and important dates on the religious calendar brought leisure and religion together to form the activity and performances featured in SEA culture. Many activities practised even today in music, games, festivals, and competitions featured the late colonial qualities. During leisure time, women engaged in pragmatic activities in the domestic sphere, which include embroidery, batik, and other handicrafts. Women throughout the region practiced arts and crafts which are familiar to them. State schools also incorporated these local activities, where students are taught to make kites, textiles, puppets, and local crafts and perform the music and dance associated with the local culture (Moser et al., 2017).

6.3.1 Role of Auspicious Activities Among Southeast Asians

Southeast Asians have great respect for their cultural values and beliefs. Auspicious events and activities are still observed and as an integral part of Southeast Asian culture. For example, an auspicious start to the new year is not just significant in the Chinese tradition but in the Hindu tradition as well. New Year is an essential celebration among the Chinese and Hindus based on their respective auspicious dates and religious calendar. The hungry ghost festival traditionally falls on the 15th day of the seventh month of the lunar calendar. Throughout the seventh month, many Chinese observed the festival by offering food, joss sticks and candles. It is also practised in Singapore and Malaysia to hold the celebrations during the seventh lunar month, including dinner, auctions, and stage performances. The auction of "auspicious objects" from religious items usually begin during a multi-course dinner (Barnes, 2021). The mid-autumn festival, also known as the Mooncake festival, is held on the 15th day of the 8th month of the Chinese calendar. During this festival, families make open-air offerings to the moon. One of the most entertaining activities is making a lantern of different materials, colours, or

shapes (Castrillón, 2021), which is also practiced in schools as part of art and craft and during cultural activity.

In a similar context, Hindus have their own belief and auspicious events. Hindus celebrate their New Year auspiciously based on the Hindu calendar. For Hindus, the New Year is a day that welcomes a new atmosphere and is celebrated happily by the community (Arjawa and Jayantiari, 2020). The New Year for Hindus means that Hindus must be able to take lessons from their past to meet a better future with careful planning in the present. The New Year is celebrated by Hindus living in different regions with visits to temples and lighting lamps to welcome the New Year auspiciously (Swardika et al., 2015).

Similarly, people in Thailand celebrated Songkran (Thai Traditional New Year), one of Southeast Asia's most popular water festivals celebrated with colourful cultural activities from generation to generation (Asia News Monitor, 2010). During the Songkran festival, people participated in many activities, including splashing of water on one another, watching the Buddha parade, dancing, and playing the local Thai games (Jimmy, 2015).

Cultural activities and cultural festivals can evoke deep cultural emotions (Berger, 2012). Southeast Asians look forward for these activities. The activities in which users participate could further amplify the effect of connecting users to the deep emotional cultural experiences or moods. Compared to a typical ordering or sorting game or activity used in computer games which only instills user experiences. Cultural activities such as playing gasing (top) or creating a wau (kite) and auspicious activities such as building a lantern or designing a lantern could evoke emotional and cultural experiences beyond simple cultural artefacts and metaphors.

6.4 Method

To solve the problems of low ICT usage and the significant resistance from teachers and students, I proposed cultural and auspicious activities to be used as part of ICT activities and as metaphors. In this chapter, I selected a cultural activity and an auspicious activity as metaphors. Cultural Activity metaphors were proposed, designed, and evaluated in secondary schools in Brunei and Indonesia. Once the approval from the Ministry of Education of Brunei and Indonesia was obtained, the secondary schools were identified, and the schools were contacted for collecting data. The principals and teachers were briefed on the data collection and evaluation process. The responsibility of selecting the students was assigned to the respective Science teachers. Students between the age of 13 and 16 were selected to participate in the evaluation exercise, pre-test, post-test, and survey questions on user experiences.

6.4.1 Selection of Cultural Activity and Auspicious Activity as Metaphors

The selection of cultural games and activities was decided based on the focus group. The aim of the first focus group is to understand students' cultural game requirements which can improve the learning experience. The aim of the second and subsequent focus groups is to ensure the cultural elements used

in the prototype that can stimulate **Cultural Pride (CP)** and **Cultural Motivation (CM)**. Students answered six cultural-related questions as stated below. Questions were translated to Bahasa Indonesia to facilitate understanding.

1. Which images would culturally motivate you or make you comfortable if they appeared as button backgrounds on educational apps/tools?
2. What background would create cultural pride or comfort you if it appeared in educational apps/tools?
3. What is "Cultural Pride" to you?
4. What is "Cultural Motivation" to you?
5. What cultural items will motivate you?
6. What cultural objects will increase your pride in yourself?

Images below Figure 6-1, 6-2 and 6-3 are some of the works of students from the first focus group on solving students learning experiences on cultural aspects.

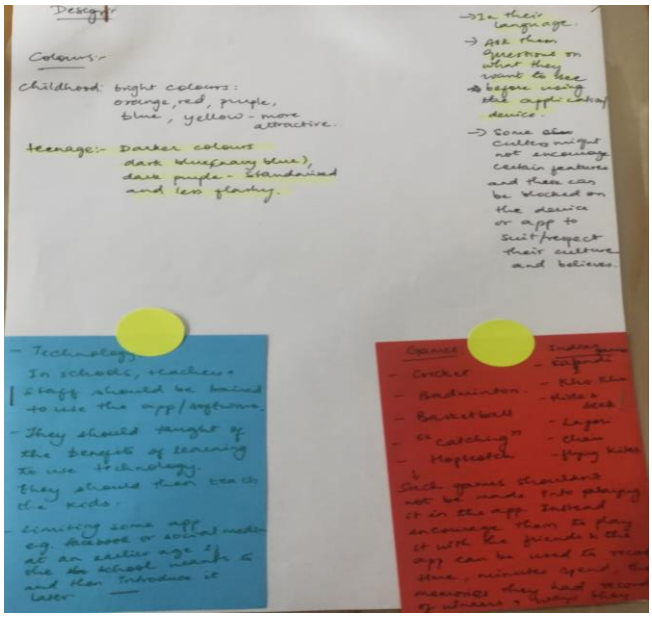

Figure 6-1: 1st Asian student's design – creative design focus group.

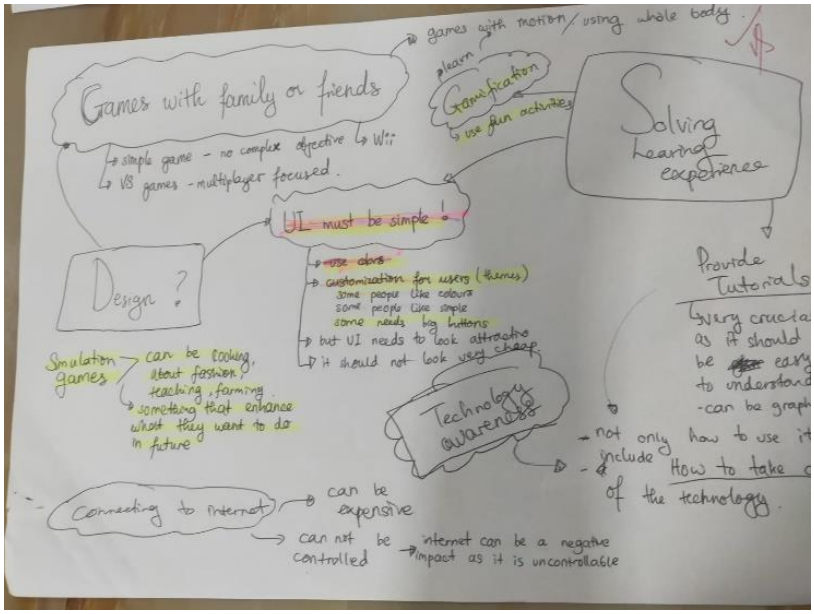

Figure 6-2: 2nd Asian student's design – creative design focus group.

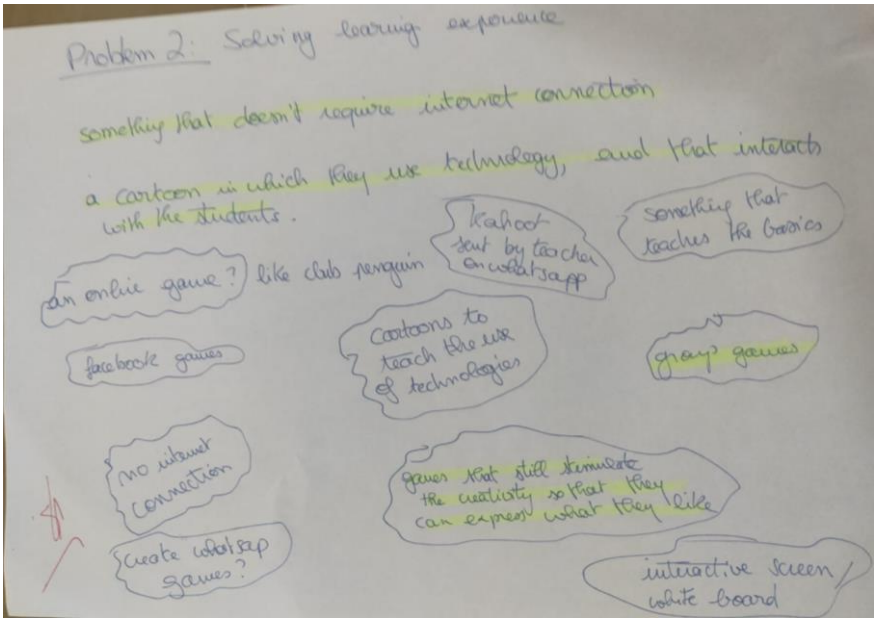

Figure 6-3: 3rd Asian student's design – creative design focus group.

The decisions on selecting cultural metaphors and cultural activities were made based on the results and outcomes of the focus groups. Several traditional games were identified, including Congkak, Gasing, Sepak Takraw, Moon kite flying (Wau), Batik art design and marble play. Refer to Appendix A for focus group results and a summary of cultural/traditional games and cultural activities with descriptions and gameplay. The following is a decision scheme that outlines how the cultural games and activities were identified. Based on the proposed cultural games and activities, two popular and widely used cultural games and activities in SEA were selected for the cultural activity model/prototype:

i) Gasing, the popular game played in the villages of SEA, was chosen as the cultural metaphor for this study and identified by the focus group participants;

ii) Batik Art Design with moon kite (wau bulan) was chosen as the cultural metaphor for this study. This selection was made because of the game's popularity amongst the participants in the focus group and during festivals.

6.4.2 Prototype Design - Metaphors of Playing and Designing Cultural Activities

In this context, the Gasing metaphor simulates the spin action and animated movements. The movement of gasing coordinates with animated learning content. The activity allows the student to spin the gasing and the gasing points to the respective part of the plant, with questions posted. This lets students be involved in the activity by watching the movement of the gasing as it spins around. This animation entices students to be involved in the action as they learn. This promotes a better learning experience as students are more interested in the gasing (cultural) activity.

When the question is answered correctly, gasing transforms to colourful batik-designed gasing. The transformation of the gasing to a colourful batik-designed gasing is another form of creative use of the cultural metaphor. The spined gasing stops spinning and drops off for incorrect answers. This resembles the actual phenomenon of the cultural activity – spinning and movement. The spinning of gasing synchronises with the background cultural music resulting in rich coordination of the cultural learning experiences. The use of gasing as a cultural metaphor and its interaction is illustrated in Figure 6-4.

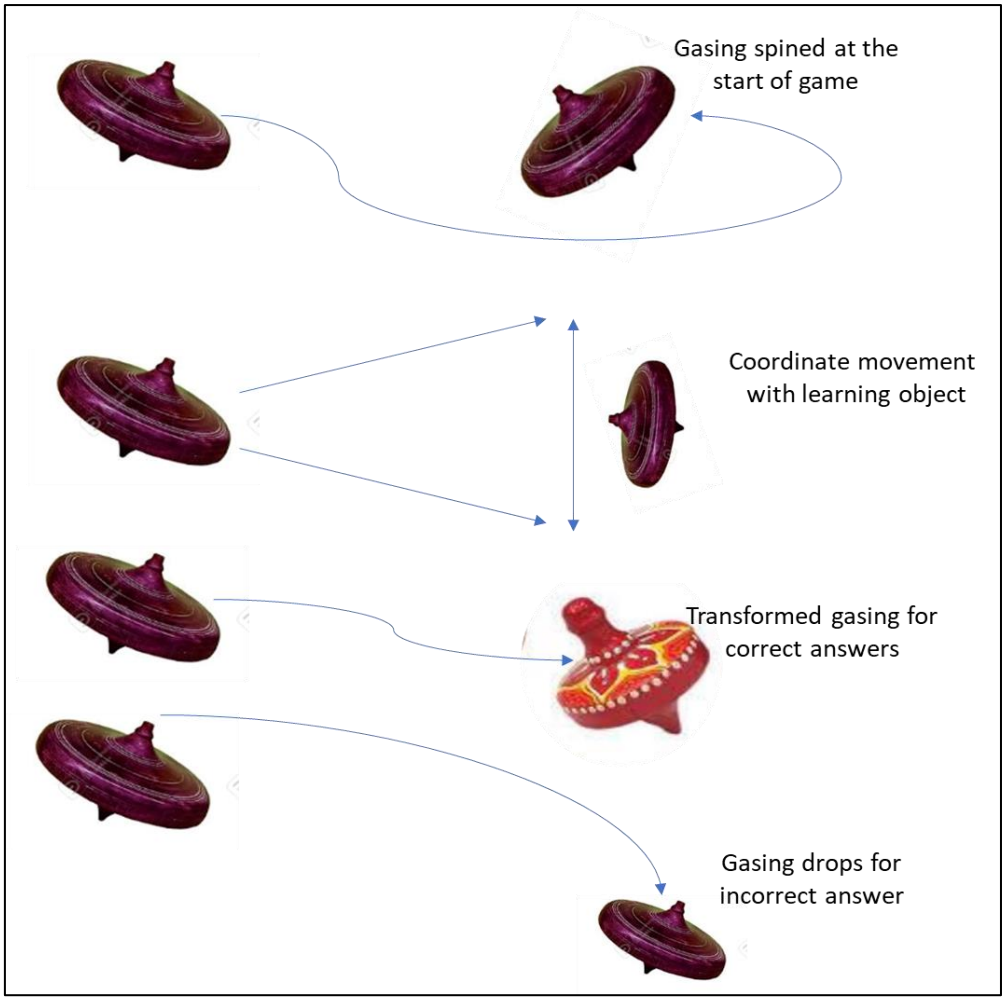

Figure 6-4: Illustration of gasing interactions in the prototype.

Figure 6-5 shows the auspicious activity, where students can design an auspicious object with images and descriptions of what they have learned in the Science topic. In this situation, Photosynthesis from the Science topic was used for this prototype. The flexibility of designing the auspicious object relies on the student's creativity. The game of designing an auspicious object resembles the activity in preparation of an auspicious occasion. Students designed an auspicious object such as a lantern or kite, for an auspicious activity. In this activity, students design the auspicious object with images that they have learned, such as parts of plants, Eg. xylem, phloem and chlorophyll, as students develop the auspicious object by dragging the images learned, an auditory explanation of the features of the plant and a call-out displays with a description. The process of a simple auspicious activity is illustrated in Figure 6-6—the flexibility of making or designing an auspicious object which sets no boundary. The idea was inspired by a simple batik design (silk painting). Cultural assimilation produces different designs via creativity. No restrictions are imposed for specific output or what to make. These further posits the cultural pride in respect to cultural traditions with flexibility.

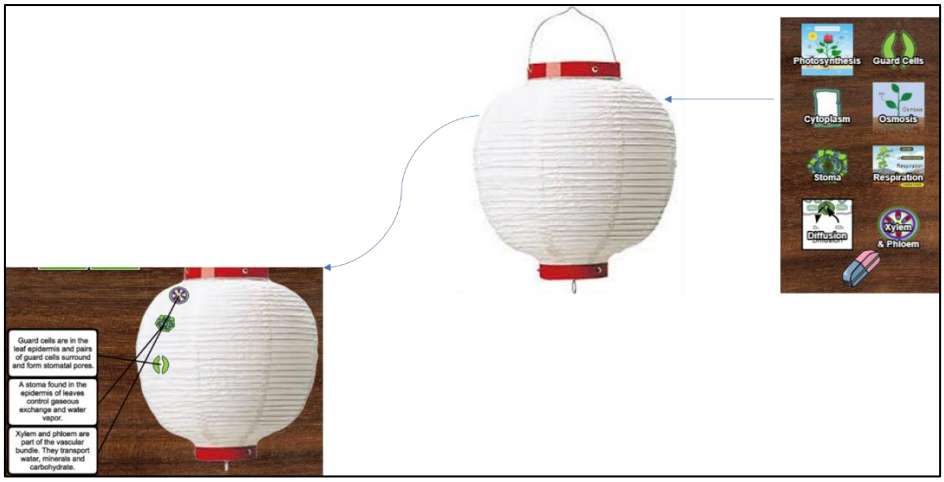

Figure 6-5: Illustration of auspicious activity with an auspicious object.

Figure 6-6: Auspicious activity.

What made this project somewhat different from other representations of culture was the involvement of a game in the cultural domain. In this context, the cultural metaphor was not simply used for decorative items. The metaphor was part of the game triggering a unique representation of cultural identity that promotes learning in an animated cultural activity and creative design. Where we can say, the east meets west approach or traditional meets modern approach. It connects to the contemporary cultural vernacular. This amplifies learning with unique cultural representation within the company of modernised platforms which explores new techniques with old practices. The model is illustrated in Figure 6-7.

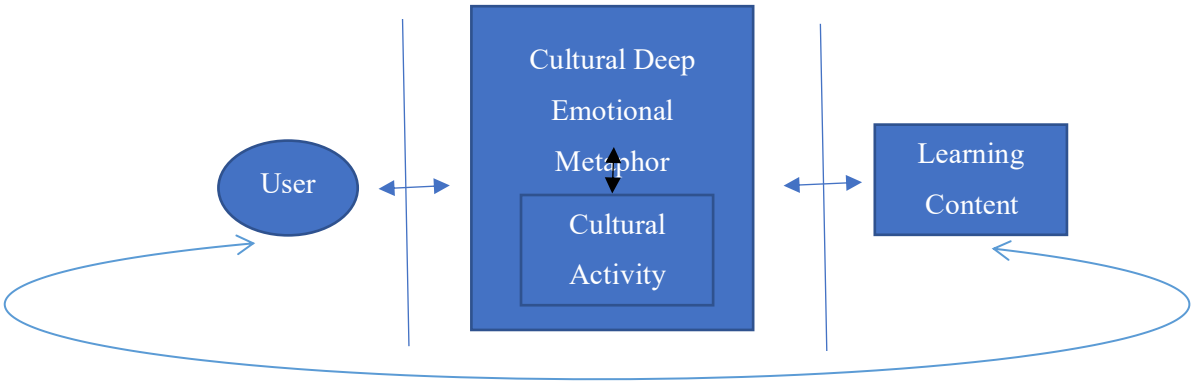

Figure 6-7: Graphical illustration of cultural activity as a cultural metaphor.

Cultural activity is used as a mediator and as the primary mode of interaction—cultural activity is presented here as new cultural metaphors to trigger cultural emotions. Cultural activity metaphors and cultural metaphors are used as a cultural lens to view the learning content. The cultural metaphor is used as a triggering point for cultural activity, and the cultural activity metaphor is used to promote learning (E.g., animation). Cultural metaphors in this prototype are used as hints. Students recognised the cultural metaphor used as hints as part of a cultural reward or gift. In this context, the 'Ang Pow' (red packet), and ketupat (rice dumplings), were used to display somewhat rewards (hints). In the real world, the rice dumplings have a delicious rice cake wrapped in woven palm leaves and 'Ang Pow' (red packet), which contains a monetary gift. Students are more involved in the game process as it portrays a cultural and traditional setting.

Their play can evoke an experience that resembles their real-life events and activities. They feel more connected with the game as they understand the relevance of each part of the activity. The knowledge gained via this activity is not solely education but more towards a culturally integrated activity that stimulates and motivates learning while playing.

An example of the actual prototype is shown in Figures 6-8 and 6-9. Students are to start the game by clicking Spin. The gasing will spin, move, and point to the question and different parts of the animated plant and showed the movement of water and gas in the stoma, xylem, roots, and phloem. The gasing continues to spin until an answer is selected. If the answer is correct, the gasing transformed to a designed (batik print) gasing, as shown in Figure 6-6. A hint can be used in doubt, which describes the keyword in question, as shown in Figure 6-6. The gasing drops to the ground when the answer is incorrect.

Figure 6-8: non-auspicious activity with gasing metaphor.

Figure 6-9: non-auspicious activity with batik-designed gasing and hint.

The traditional activity was designed with standard drag and drop technique. Students are to drag and match the correct answer to the question. If the answer is correct, the system reads the response. When the answer is incorrect, the solution dissolves, and the student can attempt again, and a western theme is used as the background music. The Bahasa Indonesia version is shown below in Figure 6-10.

Figure 6-10: Traditional activity.

6.5 Formulation of Hypotheses

53 Indonesian students between the age of 14 to 16 years participated in a focus group and completed a set of questionnaires on the context of understanding cultural requirements and expectations on cultural pride and cultural motivation. The result from the focus group was used to formulate five hypotheses based on the categories of Cultural Motivation; Cultural Stimulants/Emotions; Cultural Pride; Stimulate Teaching/Learning; Improve Learning Outcomes and ICT Utilization.

The formulation of the hypothesis for each category is stated below:

Cultural Motivation

S3_H1A: Cultural Activity triggers Cultural Emotion - Cultural Engagement;

S3_H1B: Cultural Activity triggers Cultural Emotion – Cultural Fun (Joy);

S3_H1C: Cultural Activity triggers Cultural Emotion – Cultural Excitement;

S3_H1D: Cultural Activity triggers Cultural Emotion – Cultural Relaxation.

Cultural Stimulants/Emotions

S3_H2A: Cultural Engagement triggers “Cultural Pride”;

S3_H2B: Cultural Fun (Joy) triggers “Cultural Pride”;

S3_H2C: Cultural Excitement triggers “Cultural Pride”;

S3_H2D: Cultural Relaxation triggers “Cultural Pride”;

Cultural Pride and Stimulates Learning

S3_H3: “Cultural Pride” stimulates learning

Improve Learning Outcomes and Experiences

S3_H4: “Cultural Pride” stimulates learning, improves learning experience in SEA

Improve ICT Utilization

S3_H5: “Cultural Pride” stimulates learning and is vital to improving ICT utilisation in SEA

Justification of the Hypotheses

Study (Vadivel et al., 2020) shows cultural barriers are one of the main factors that affect poor learning outcomes and experience. Table 6-2 lists the main Hypotheses categories and relevant sources for justifications. Figure 6-11 shows the overall process of this study.

Table 6-2: Hypotheses Categories

Hypothesis Categories	**Source**
Cultural Motivation	Salili and Hoosain, 2007 Ginsberg, 2005
Cultural Emotions and Stimulants	Garner, 2010
Cultural Pride	Gibson and Barr, 2015

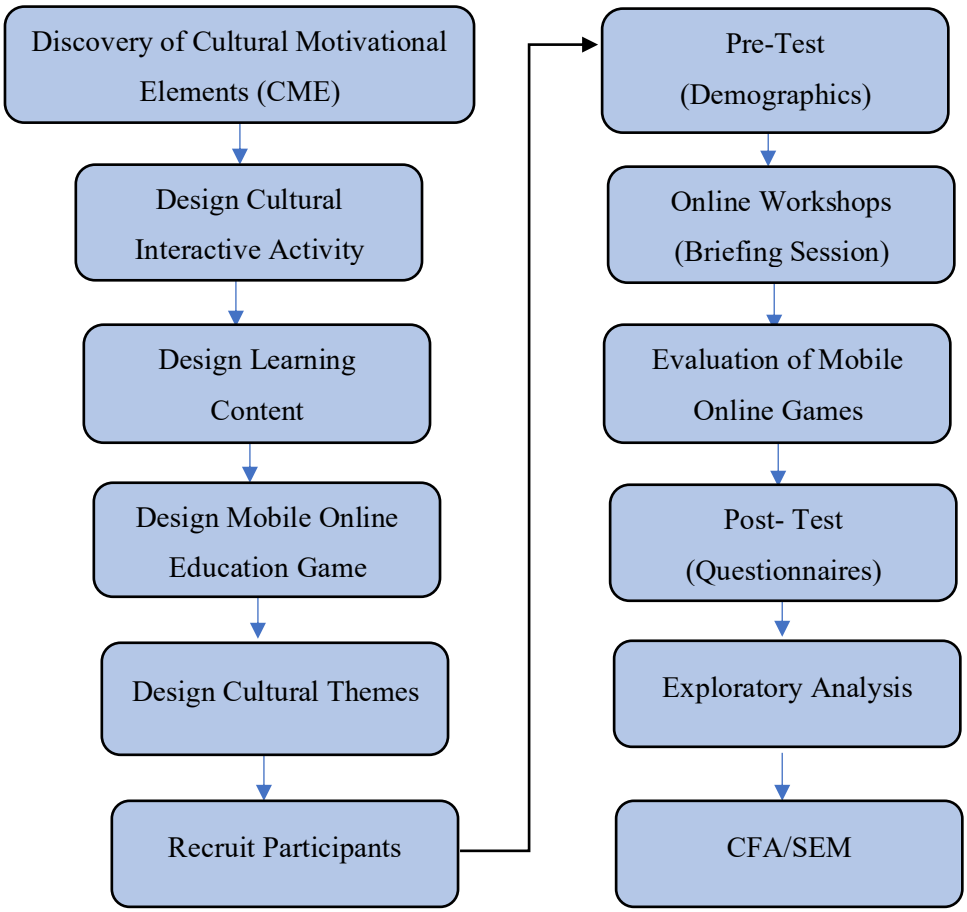

Figure 6-11: Overall processes of the proposed method.

6.6 Evaluating Culture-Centred ICT Design in Indonesian and Bruneian High Schools

The objective of this study was to evaluate the proposed prototype which was developed based on the findings from the Comprehensive survey, Study One and focus groups results. These studies and the existing literature were used to formulate the following five hypotheses and the Structural Equation Model (SEM) for Culturally Compatible ICT. The evaluation is based on a case study to evaluate the proposed prototype in high schools in Brunei and Indonesia. Twenty science teachers and 150 students

were recruited to participate in this study. The Ministries of Education in Brunei and Indonesia were contacted to identify two schools in their capital cities and obtain the approval to evaluate the prototype and collect data. Approval was given within a month by the Ministries of Education in Indonesia and Brunei, and the schools were identified. The school principals were contacted via email and phone calls for reconfirmation. The principals appointed the science teachers to oversee this project. Correspondence continued with the respective science teachers, and a briefing session with the individual teachers was achieved via Zoom. The procedures for evaluating the prototype and data collection were explained to the teachers who will administer the experiment at the respective schools. Information sheets and consent forms were emailed to these teachers to be distributed to and completed by their students. Briefings on the procedures for evaluating the prototype were conducted with teachers via Zoom. The survey, pre-test, and post-test were emailed to the respective schools and science teachers for verification. Teachers who administered the experiment also participated in the evaluation of the prototype and completed the survey. The survey, pre-test, and post-test were made available on Google Forms for convenience of data collection.

6.6.1 Experiment Design

Pre and Post-Tests Design

Students had to complete 12 pre-tests and 12 post-test questions before and after the activity. Pre-test and post-tests were presented to students via Google Forms for the convenience and to facilitate data collection. Pre-test and post-test questions for the Indonesian high schools were translated into Bahasa Indonesia by an Indonesian translator. See Appendix B for the pre and post test questions.

Experiment Design

A set of self-administered survey questions were prepared to obtain users' experiences for this study. The survey was carried out online via Google Forms for teachers and students. On a five-point Likert scale (where 1 strongly disagree and 5 strongly agree), respondents were asked to rate their overall level of satisfaction during the activity/experiment. Survey questions and test questions were translated to Bahasa Indonesia for Indonesian high school students. Bruneian high schools were given the English version of the survey, pre-test, and post-test questions. A cover page briefly explained the procedure of the study and instructions for completing the questionnaire. It was clearly stated that participation was voluntary and that responses would be kept strictly confidential. Questions were designed to address concerns about cultural motivations, emotions, stimulants, teaching and learning experience, and specific prototype preferences.

Three mobile game prototypes were developed:

The 1st prototype is the Traditional Activity mobile game - The first game includes *traditional game* features. I identify the term "Traditional" as western influence ICT, which provides for general ICT characteristics which consists of western background music; simple drag and drop answers; and basic western theme as background image.

The 2nd prototype is the interactive non-auspicious cultural activity mobile game - The second game incorporated the five ICT cultural guiding principles (guiding principles are explained in chapter 7) for a non-auspicious activity. The evaluation is based on a *non-auspicious* cultural activity to measure students experience while playing the activity.

The 3rd prototype is the interactive auspicious cultural activity mobile game - The third game incorporated the five ICT cultural guiding principles (guiding principles are explained in chapter 7) for an auspicious activity. The evaluation is based on an *auspicious activity* that will measure students experience while designing what they have learned on an auspicious object (e.g., wau/kite, lantern).

Two settings of experiments were setup:

Setting 1: to test between conditions (Traditional activity vs Cultural Activity)

i) **Experiment 1:** Traditional Activity;
ii) **Experiment 2:** Interactive cultural activity (non-auspicious and auspicious activity).

Setting 2: to test within conditions (non-Auspicious activity vs Auspicious activity)

i) **Experiment 1:** Non-Auspicious activity;
ii) **Experiment 2:** Auspicious activity.

An estimated of 150 students were selected to evaluate the prototype. Student respondents from both countries were between the age group of 13 and 15 years old. About 15 teachers from both countries were invited to participate in the experiment of cultural interactive activity and auspicious activity.

6.6.2 CFA and SEM Design – Culturally Compatible ICT

Constructs and variables used for the Structural Equation Model (SEM) and Confirmatory Factor Analysis (CFA) are stated in Table 6-3. PLS-SEM was selected because of its ability to test theoretically supported linear and additive causal models (Haenlein and Kaplan, 2004). The proposed CFA model constructed for Culturally Compatible ICT is stated below:

Figure 6-12 shows the CFA model: *Cultural Motivation (cultural guidelines)* → *leads to Cultural Stimulants/Emotions,* which →trigger *Cultural Pride. Cultural Pride* → *stimulates learning* which → improves *learning outcomes and experiences*, hence improving ICT utilisation. Justifications for the questionnaire are stated in Table 6-4.

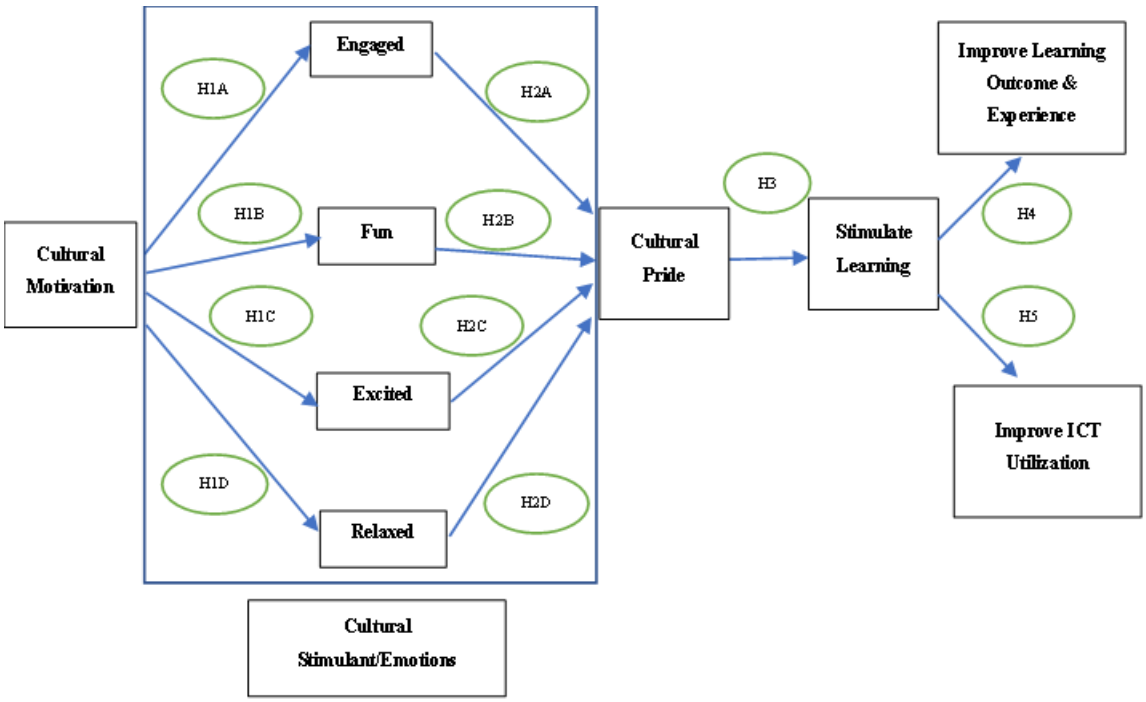

Figure 6-12: CFA Model – Culturally Compatible ICT

Table 6-3: Constructs and Variables used in Confirmatory Factor Analysis (CFA).

Hypothesis	**Factors and Constructs**
S3_H1: Cultural Activity triggers Cultural Emotion	(S3_H1) Cultural Motivation → (S3_H1A): Cultural Motivation triggers Cultural Engagement (S3_H1) Cultural Motivation → (S3_H1B): Cultural Motivation triggers Fun (Joy) (Emotion) (S3_H1) Cultural Motivation → (S3_H1C): Cultural Motivation triggers Excitement (Emotion) (S3_H1) Culturally Motivation → (S3_H1D): Cultural Motivation triggers Relaxation (Emotion)
S3_H2: "Cultural Emotions" trigger "Cultural Pride"	(S3_H1A) Cultural Engagement → (S3_H2) Cultural Pride (S3_H1B) Cultural Fun (Joy) (Emotion) → (S3_H2) Cultural Pride (S3_H1C) Cultural Excitement (Emotion) → (S3_H2) Cultural Pride (S3_H1D) Cultural Relaxation (Emotion) → (S3_H2) Cultural Pride
S3_H3: "Cultural Pride" stimulates learning	(S3_H2) Cultural Pride → (S3_H3) Stimulates Learning
S3_H4: "Cultural Pride" stimulates learning, improves learning experience in SEA	(S3_H3) Cultural Pride-stimulated learning → (S3_H4) Improves learning experience
S3_H5: "Cultural Pride" stimulates learning, and is vital to improving ICT utilisation in SEA	(S3_H3) Cultural Pride-stimulated learning → (S3_H5) Improves ICT utilisation

Table 6-4: Questionnaire Groupings and Sources for Questionnaire.

Questionnaire Item	**Source**
S3_H1 Cultural Activity triggers Cultural Emotion Q1) How fun is this game? Q2) Did you feel engaged during the activity? Q3) How would you rate your happiness level during the game? Q4) How would you rate your excitement level during the game? Q5) How would you rate your satisfaction level during the game? Q6) How would you rate your relaxation level during the game? Q7) How would you rate your level of calmness during the game?	Yu and Denham, 2019 Susanti et al., 2020 O'Keeffe, 2012 Kam et al., 2009 Janhonen-Abruquah et al. 2014 Wrench and Garrett, 2021
S3_H2 "Cultural Emotions" trigger "Cultural Pride" Q8) How will you rate your "cultural motivation" during the activity? Q9) How will you rate the level of "cultural pride" during the game?	Oyibo et al., 2018 Huhmarniemi and Jokela, 2020
S3_H3 "Cultural Pride" stimulates learning Q10) How would you rate your anxiety level during the activity? Q11) How would you rate your teaching/learning experience?	Carlson et al., 2011
S3_H4 "Cultural Pride" stimulates learning, improves learning experience in SEA Q12) Do you prefer this type of activity for all learning subjects? Q13) Do you agree that this activity improved your learning experience?	Halimah and Abdillah, 2021 Ma, Q., 2017
S3_H5 "Cultural Pride" stimulates learning and is vital to improving ICT utilisation in SEA Q14) Do you agree that the interface is useful? Q15) Do you agree it is convenient to use the interface? Q16) Do you agree that the interface is user-friendly?	Gay, G., 2018 Hardy and Laszloffy,1995 Greenberg and Buxton, 2008

6.7 Evaluation Procedure

6.7.1 Setting 1: Traditional Activity vs Cultural Activity (Auspicious and Non-Auspicious)

Bruneian High Schools

Teachers were briefed on the procedure to evaluate the prototype. The procedure covered the setup of the traditional and cultural experiment; the number of students participating in the experiments; and the number of activities in each experiment (Figure 6-13). Teachers were invited to evaluate the cultural prototype through an online workshop. The invited teachers successfully participated in the cultural activity and completed the survey.

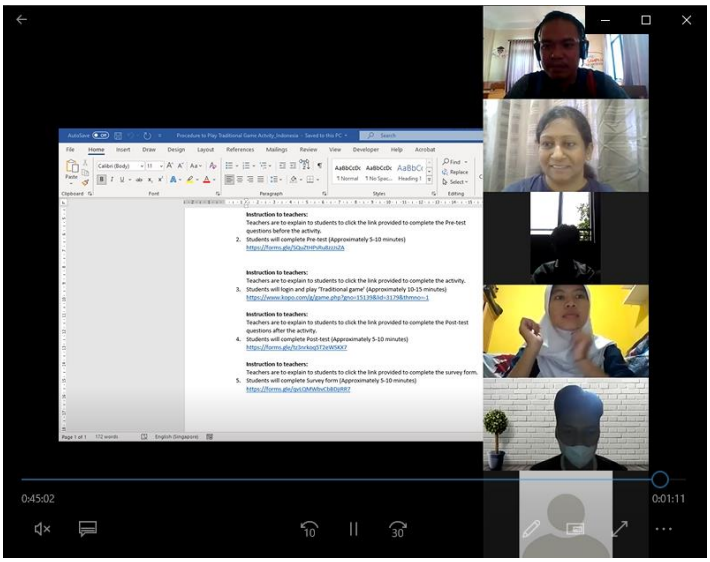

Figure 6-13: School teachers Online Workshop (briefing session).

The evaluation of the prototype in Bruneian schools was carried out in the computer labs, assisted by four teachers. Instructions for completing each activity were explained via Zoom (over a big screen), refer to Figures 6-14 and 6-15 for this experiment. Students' actions could be observed as the instructions were read. Students first completed the pre-test questions, followed by the cultural activity which is the Spin the Gasing followed by the auspicious cultural activity. A different group of students were involved in the traditional activity for the traditional activity experiment. Students from both groups (cultural acidity and traditional activity) concluded this activity by completing the post-test questions and the survey questions.

Figure 6-14: Bruneian school students are completing the cultural activity.

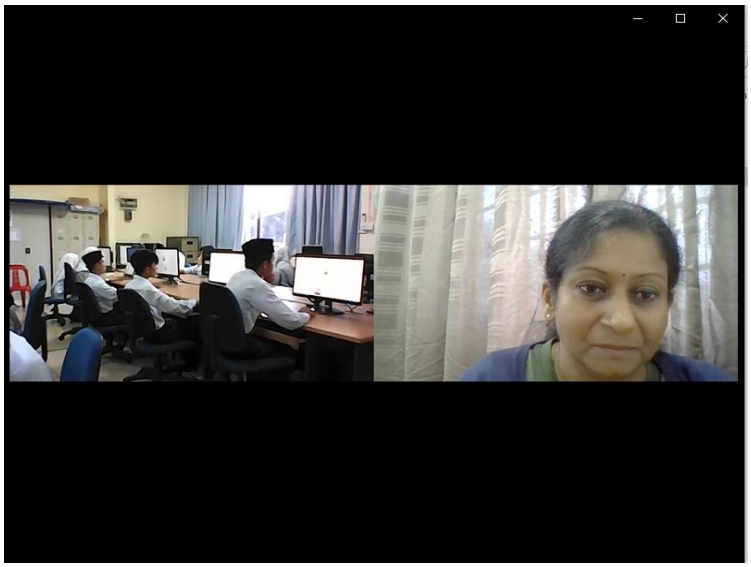

Figure 6-15: Bruneian schools are experimenting.

Indonesian High Schools

Teachers were briefed on the evaluation procedure (refer to Figure 6-16), the setup of the experiments are similar the Bruneian schools which are traditional activity experiment and cultural activity experiments. Teachers were invited to evaluate the cultural prototype through an online workshop where teachers were briefed on the prototype experiment. Invited teachers participated in the cultural activity and completed the survey.

Figure 6-16: School teachers Online Workshop (briefing session).

The prototype evaluation in Indonesian schools was carried out via Zoom, assisted by a teacher (Figure 6-17). Teachers set up two breakout rooms for two groups: one breakout room for the cultural activity and the other for the traditional activity. Instructions to complete each activity were explained via Zoom. Students first completed pre-test questions, followed by playing the cultural activity which is the Spin the Gasing and the auspicious activity for the cultural experiment. A different group of students participated in playing the traditional activity for the traditional experiment. Both groups concluded the experiment by completing the post-test questions and the survey questions.

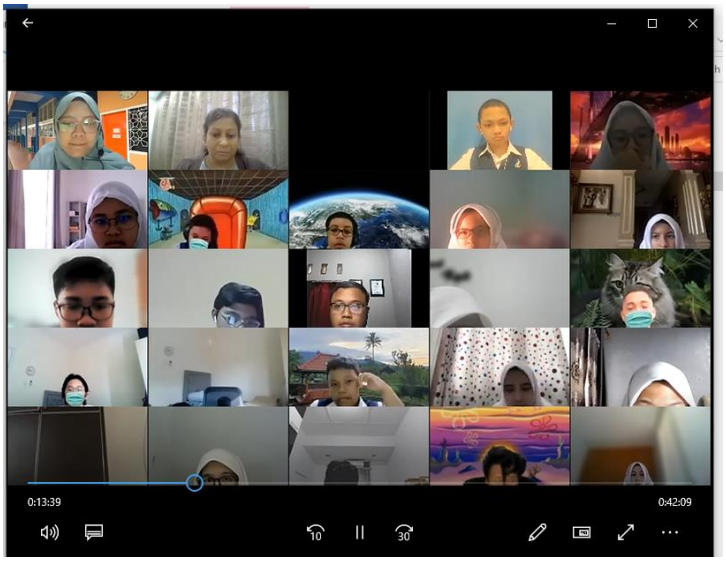

Figure 6-17: Indonesian high schools are completing the cultural activity.

6.7.2 Results for Setting 1

A total of 133 students (*N=133)* from Brunei and Indonesia completed the prototype experience survey, with *N=57* completed the experience survey on the traditional activity and *N=76* completed the experience survey on the cultural activity. Table 6-5 shows the *mean score* and *SD* for both activities. The mean score for the cultural activity is higher when compared to the mean score for traditional activity for the following constructs: Teaching/Learning Experience (*m=4.09, SD=0.84*), Satisfaction Level (*m=3.96, SD=0.86*), Cultural Pride (*m=3.83, SD=0.96*), Cultural Motivation (*m=3.68, SD=0.94*), Interface is Useful (*m=4.10, SD=0.84*), Improved Learning Experience (*m=4.08, SD=0.85*) and Convenient Interface (*m=3.92, SD=0.86*). The construct for Anxious showed a lower mean average for the cultural activity (*m=3.08, SD=1.09)* when compared to the mean average of traditional activity (*m=3.21, SD=0.89*). These findings suggest that the students who participated in the cultural activity were less anxious when compared to those who participated in the traditional activity. Cultural activity respondents were more satisfied, had better learning experiences, and were more culturally motivated with higher cultural pride. Cultural activity respondents also reported that the interface was useful and convenient and reported higher overall satisfaction compared to the traditional activity respondents.

Table 6-5: Students Prototype Experience.

Questions - Prototype Experience	**Traditional Mean *(N=57)***	**Traditional SD *(N=57)***	**Cultural Mean *(N=76)***	**Cultural SD *(N=76)***
Did you feel engaged during the activity?	3.89	0.89	3.69	1.00
Rate the level of fun you had during the activity.	4.14	0.86	3.85	1.09
How would you rate your teaching/learning experience?	4.02	0.88	4.09	0.84
How would you rate your happiness level during the game?	3.82	1.02	3.80	1.08
How would you rate your excitement level during the game?	3.87	0.98	3.75	1.03
How would you rate your satisfaction level during the game?	3.71	0.91	3.96	0.86
How would you rate your relaxation level during the game?	4.05	1.03	3.77	1.08
How would you rate your level of calmness during the game?	3.89	0.82	3.84	1.04
How will you rate your level of "cultural pride" during the game?	3.57	0.95	3.83	0.96

How will you rate your anxiety level during the activity?	3.21	0.89	3.08	1.09
How would you rate your level of "cultural motivation" during the activity?	3.66	0.92	3.68	0.94
Did you lose motivation when your answer was incorrect?	3.27	1.21	3.27	1.25
Did you lose motivation due to negative interactions caused by incorrect answers?	3.30	1.01	3.11	1.11
Do you feel unguided when there are no HINTS?	3.41	1.29	3.08	1.29
Do you prefer this type of activity for all learning subjects?	3.98	1.21	3.79	0.96
Do you agree that the interface is useful?	4.00	1.00	4.10	0.84
Do you agree that this activity improved your learning experience?	4.02	1.02	4.08	0.85
Do you agree it is convenient to use the interface?	3.75	0.96	3.92	0.86
Do you agree that the interface is user friendly?	4.13	0.88	4.11	0.88

T-score Test Results

The T-test results in Table 6-6 suggest that pre-test *(M=6.35, SD=2.47)* and post-test *(M=9.56, SD=2.69)* of cultural activity with significant results and improved learning outcome with $t(39) = 6.8$, $p<0.01$. The traditional activity T-test score for pre-test *(M=5.21, SD=2.38)* and post-test *(M=8.19, SD=2.37)* show significant results and improved learning outcomes with $t(52) = 8.9$, $p<0.01$. The T-test results within the condition show substantial consequences for both activities. However, the t-test results for cultural activity show a more significant t-score when compared to traditional t-test result.

One sample t-test was done on the differences (gain) of pre-test and post-test to test between conditions. The result was compared between conditions and results showed significant improvement for cultural activity (gain) *(M=3.62, SD=2.4)* with $t(38) = 4.1$, $p<0.001$ when compared to traditional activity (gain) *(M=2.98, SD=2.4)* with $t(50) = 2.8$, $p=0.007$.

Table 6-6: T-score test result.

Paired sample T-Test (Testing within the condition)					
Activity	**Pre-test (M, SD)**	**Post-test (M, SD)**	**T-score**	**df**	**p-value**
Non-Auspicious and Auspicious	*6.35, 2.47*	*9.56, 2.69*	*6.8*	*39*	*0.00*
Traditional	*5.21, 2.38*	*8.19, 2.37*	*8.9*	*52*	*0.00*
One sample T-Test (Testing between conditions)					
Activity	**Mean**	**SD**	**T-score**	**df**	**p-value**
Non-Auspicious and Auspicious (Gain)	*3.62*	*2.45*	*4.11*	*38*	*0.000*
Traditional (Gain)	*2.98*	*2.47*	*2.82*	*50*	*0.007*

CFA Model for Interactive Cultural Activity

A 2-tailed Pearson correlation was carried out using SPSS for cultural activity constructs to observe any significant correlation between the constructs as hypothesised. Results are presented in Appendix C. Correlated constructs with a substantial value of *0.001,* is displayed in Table 6-7. Only significant correlation values were used to plot the CFA model.

Table 6-7: Significant Correlation Values.

Hypothesis	**Correlation Constructs**	**Significant Correlation Value****
S3_H1: Cultural Activity triggers Cultural Emotion	(S3_H1) Cultural Motivation → (S3_H1A): Cultural Motivation triggers culturally Engaged (S3_H1) Cultural Motivation → (S3_H1B): Cultural Motivation triggers Fun(joy) (Emotion) (S3_H1) Cultural Motivation → (S3_H1C): Cultural Motivation triggers Excitement (Emotion) (S3_H1) Culturally Motivation → (S3_H1D): Cultural Motivation triggers Relaxation (Emotion)	S3_H1 → S3_H1A *(r=.514**, p<0.001)* out S3_H1 → S3_H1B *(r=.554**, p<0.001)* S3_H1 → S3_H1C *(r=.554**, p<0.001)* S3_H1 → S3_H1D *(r=.598**, p<0.001)*

S3_H2: 'Cultural Emotions' trigger 'Cultural Pride'	(S3_H1A) Culturally Engaged → (S3_H2) Cultural Pride (S3_H1B) Cultural Fun(joy) (Emotion) → (S3_H2) Cultural Pride (S3_H1C) Cultural Excitement (Emotion) → (S3_H2) Cultural Pride (S3_H1D) Culturally Relaxed (Emotion) → (S3_H2) Cultural Pride	S3_H1A → S3_H2 *(r*=.430**, *p<0.001)* S3_H1B → S3_H2 *(r*=.516**, *p<0.001)* S3_H1C → S3_H2 *(r*=.397**, *p=0.001)* S3_H1D → S3_H2 *(r*=.671**, *p<0.001)*
S3_H3: 'Cultural Pride' stimulates learning	(S3_H2) Cultural pride → (S3_H3) Stimulates Learning	S3_H2 → S3_H3 *(r*=.361**, *p=0.002)*
S3_H4: 'Cultural Pride' stimulated learning improves Learning experience in SEA	(S3_H3) 'Cultural Pride' stimulated learning → (S3_H4) Improves Learning Experience	S3_H3 → S3_H4 *(r*=.581**, *p<0.001)*
S3_H5: 'Cultural Pride' stimulated learning is vital to improving ICT utilization in SEA	(S3_H3) 'Cultural Pride' stimulated learning → (S3_H5A) Improve ICT utilisation (Useful Interface) (S3_H3) 'Cultural Pride' stimulated learning → (S3_H5B) Improve ICT utilisation (Convenient Interface) (S3_H3) 'Cultural Pride' stimulated learning → (S3_H5C) Improve ICT utilisation (User Friendly Interface) (S3_H3) 'Cultural Pride' stimulated learning → (S3_H5D) Improve ICT utilisation (Prefer this Activity)	S3_H3 → S3_H5A *(r*=.564**, *p<0.001)* S3_H3 → S3_H5B *(r*=.393**, *p=0.001)* S3_H3 → S3_H5C *(r*=.510**, *p<0.001)* S3_H3 → S3_H5D *(r*=.361**, *p=0.002)*

Table 6-8 illustrates the path associated with the proposed constructs, based on bootstrapping with a two-tailed test (*90%* significance level-t value *1.645, 95%* significance level -t value *1.96*, *99%* significance level-t value *2.57*).

Figure 6-18 constructed CFA model showed the path coefficient model, with only significant and valid constructs of 'Cultural Motivation to improve the learning experience' and 'ICT sustainability'. The best path coefficient model was built after 17 runs by removing insignificant values (however, engagement → cultural pride and excitement → cultural pride is kept in the diagram for further discussion). All t-values showed a *95%* significance level except for engagement → cultural pride, and excitement → cultural pride.

Path coefficient model results exhibited that Cultural Motivation triggers Cultural Engagement [Cultural Motivation → Engagement ($R^2 = 0.272, p < 0.005, t = 5.483$)], Cultural Motivation triggers Cultural Excitement [Cultural Motivation → Excitement ($R^2 = 0.303, p < 0.005, t = 7.924$)], Cultural Motivation triggers Cultural Fun [Cultural Motivation → Fun (Joy) ($R^2 = 0.253, p < 0.005, t = 6.491$)], and Cultural Motivation triggers Cultural Relaxation [Cultural Motivation → Relaxation ($R^2 = 0.236, p < 0.005, t = 5.136$)].

However, Cultural Stimulants/Emotions (Engagement and Excitement) do not trigger Cultural Pride as hypothesised earlier [Cultural Engagement → Cultural Pride ($p > 0.005, t = 0.958$), Cultural Excitement → Cultural Pride ($p > 0.005, t = 0.94$)]. Only Cultural Relaxation significantly affected Cultural Pride [Relaxed → Cultural Pride ($p < 0.005, t = 3.916$)]. Cultural Fun had least effect on Cultural Pride [Fun → Cultural Pride ($p < 0.005, t = 2.073$)].

Cultural Pride significantly stimulated learning [Cultural Pride → Stimulate Learning ($p < 0.005, t = 2.872$)]. Stimulated Learning significantly improved learning experience [Stimulated Learning → Improve Learning Experience ($R^2 = 0.343, p < 0.005, t = 6.701$)]. Stimulated Learning improved ICT utilization/sustainability [Stimulated Learning → Convenient Interface ($R^2 = 0.180, p < 0.005, t = 3.624$), Stimulated Learning → Prefer this Activity ($R^2 = 0.104, p < 0.005, t = 3.116$), Stimulated Learning → Useful Interface ($R^2 = 0.303, p < 0.005, t = 5.851$), Stimulate Learning → User Friendly Interface ($R^2 = 0.217, p < 0.005, t = 4.574$)]. Two new factors to be considered in the design of ICT for SEA are Cultural motivation and Cultural Pride.

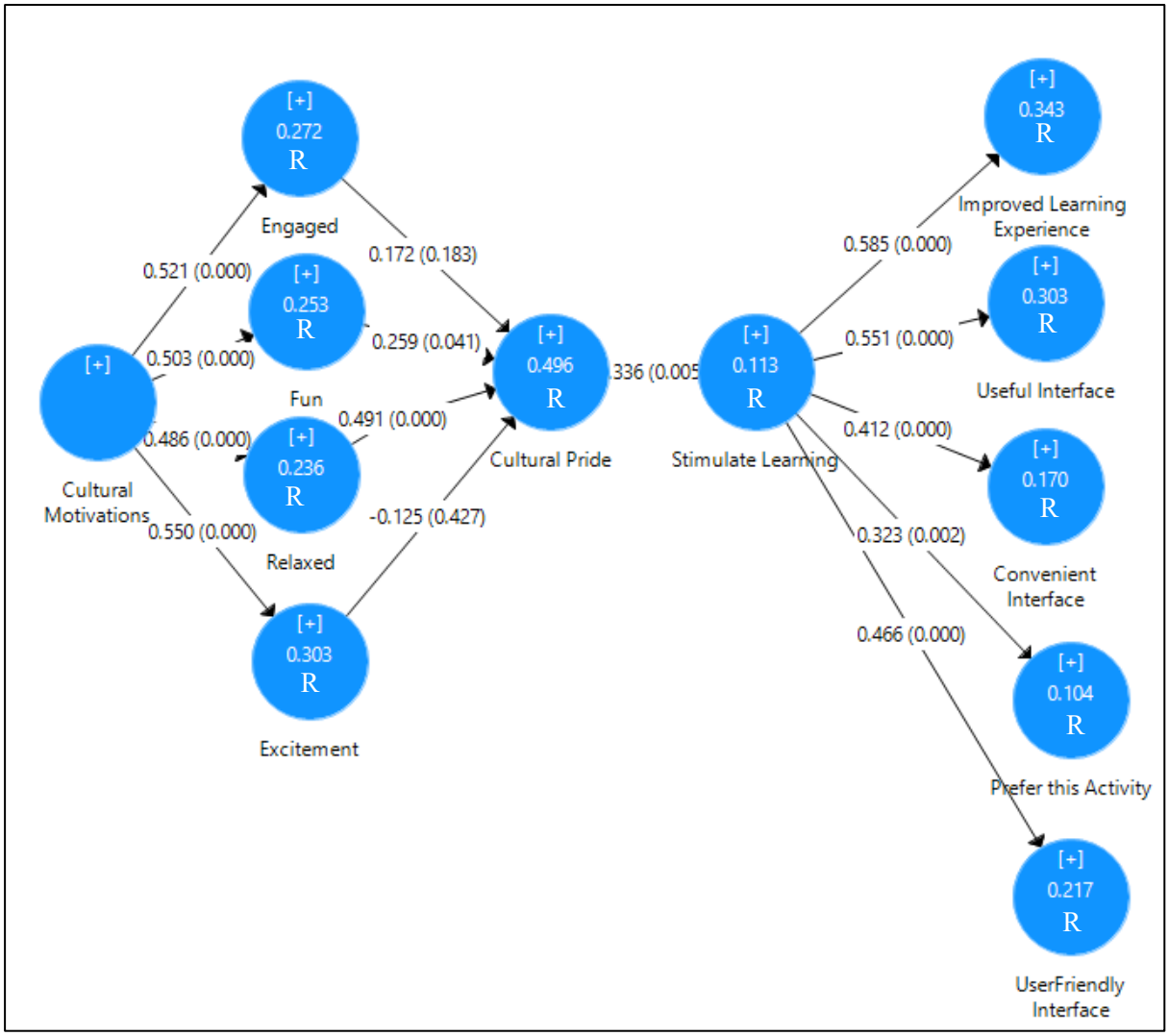

Figure 6-18: CFA Model – Cultural-Based Activity.

Table 6-8: Cultural Activity (Run no. 17).

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Cultural Motivations -> Engaged	0.521	0.524	0.095	5.483	0
Cultural Motivations -> Excitement	0.55	0.542	0.069	7.924	0
Cultural Motivations -> Fun	0.503	0.504	0.077	6.491	0
Cultural Motivations -> Relaxed	0.486	0.496	0.095	5.136	0
Cultural Pride -> Stimulate Learning	0.336	0.345	0.117	2.872	0.005
Engaged -> Cultural Pride	0.172	0.171	0.128	1.34	0.183
Excitement -> Cultural Pride	-0.125	-0.128	0.157	0.798	0.427
Fun -> Cultural Pride	0.259	0.265	0.125	2.073	0.041
Relaxed -> Cultural Pride	0.491	0.496	0.125	3.916	0
Stimulate Learning -> Convenient Interface	0.412	0.402	0.114	3.624	0
Stimulate Learning -> Improved Learning Experience	0.585	0.581	0.087	6.701	0
Stimulate Learning -> Prefer this Activity	0.323	0.325	0.104	3.116	0.002
Stimulate Learning -> Useful Interface	0.551	0.557	0.094	5.851	0
Stimulate Learning -> UserFriendly Interface	0.466	0.469	0.102	4.574	0

Student Learning Achievements

Traditional Experiment

For the two Bruneian schools, the traditional experiment with (*N= 54*) showed a post-test mean score of 8.2 and a pre-test mean score of 5.2; this equates to an achievement of *8.2 - 5.2 = 3.0 (30%).* For the two Indonesian schools, the traditional experiment with (*N=15*) showed a post-test mean score of 9.2 and a pre-test mean score of 8.5; this equates to an achievement of *9.2-8.5 = 0.7 (7%).* The overall achievement for Brunei and Indonesia for the traditional experiment, with a post-test mean score of 8.7 and pre-test mean score of 6.9, is *8.7 - 6.9 = 1.8 (18%).*

Cultural Activity (Non-auspicious and Auspicious) Experiment

For the two Bruneian schools, the cultural experiment with (*N=40*) showed a post-test mean score of 9.6 and a pre-test mean score of 6.3; this equates to an achievement of *9.6 - 6.3 = 3.3 (33%).* For the two Indonesian schools, the cultural experiment with (*N=20*) showed a post-test mean score of 9.0 and a pre-test mean score of 6.5; this equates to achievement of *9.0 - 6.5 = 2.5 (25%).* The overall achievement for Brunei and Indonesia for the cultural experiment, with a post-test mean of 9.3 and pre-test mean of 6.4, is *9.3 - 6.4 = 2.9 (29%).*

Figure 6-19 shows the pre-test scores for the cultural and traditional experiments (sorted in ascending order of student results), and Figure 6-20 shows the achievement based on post-test scores for the cultural and traditional experiments (sorted in ascending order of student results).

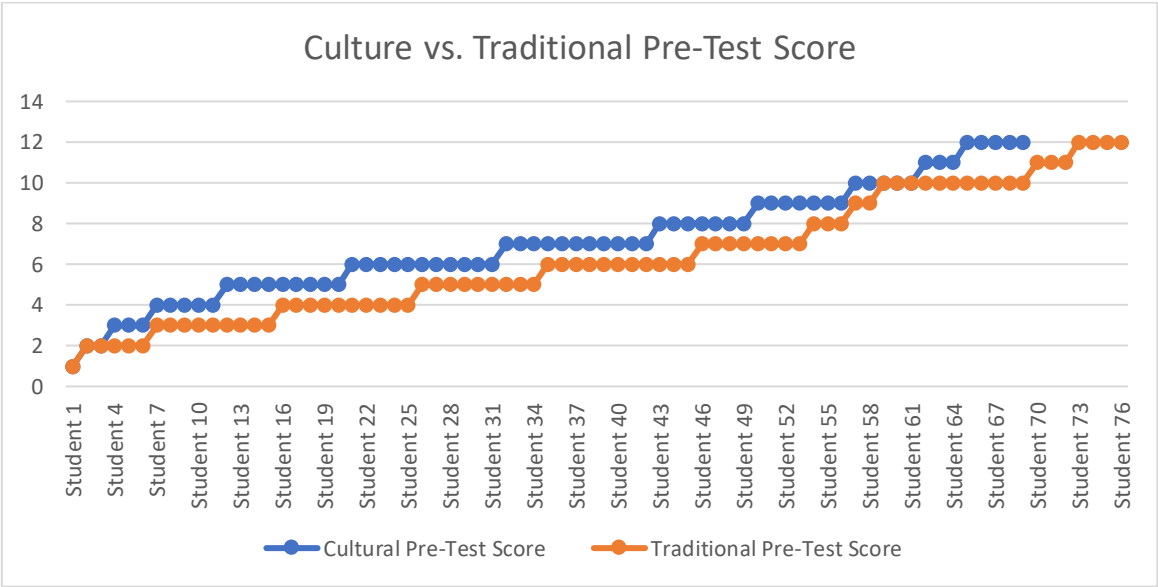

Figure 6-19: Cultural vs traditional pre-test scores (sorted in ascending order).

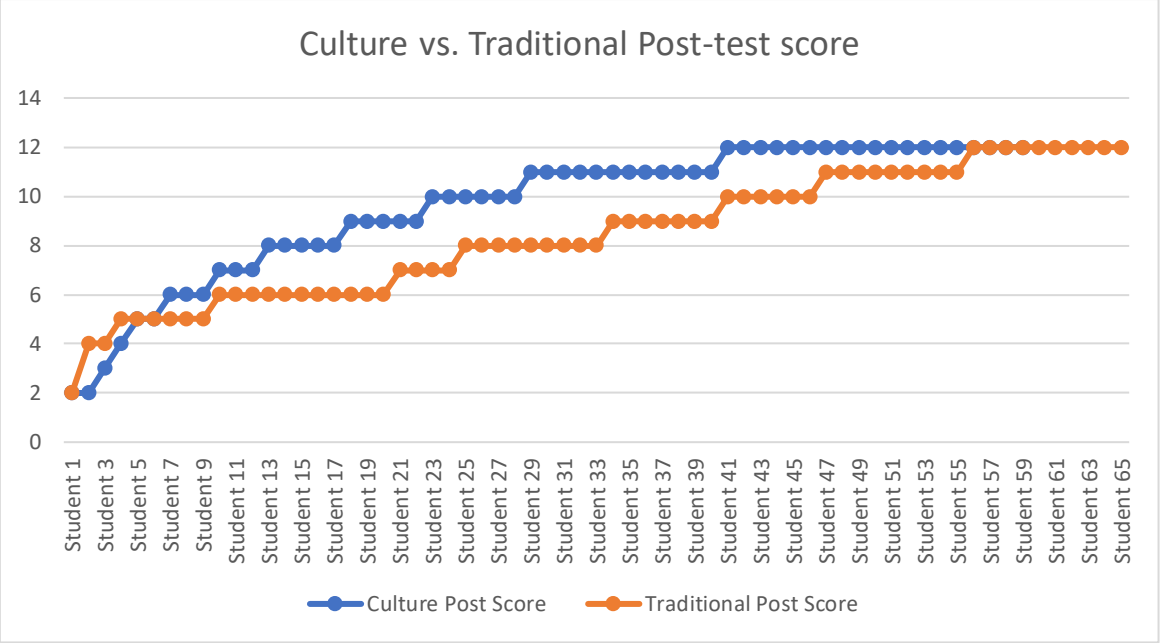

Figure 6-20: Cultural vs traditional post-test scores (sorted in ascending order).

Teachers' Experience using Interactive Cultural Activity (Non-Auspicious and Auspicious)

Teachers evaluated the cultural activities to obtain teachers' perception on the cultural experiences. Thirteen science teachers from Brunei and Indonesia (*N=13*) participated in the evaluation of the cultural activities. Table 6-9 (categorised as Cultural Stimulants/Emotions, Stimulate Teaching, and ICT sustainability) shows seven questions with high mean scores above $m \geq 4.0$ and low *SD* values between *0.65* and *1.15*. Teachers felt engaged (*m=4.6, SD=0.65)*, fun (*m=4.5, SD=0.88)*, happy (*m=4.5, SD=1.10),* and excited (*m=4.5, SD=1.13)* during the cultural activities. These finding suggest that the interactive cultural activity stimulates teaching and learning experiences (*m=4.5, SD=0.88)*. Teachers rated the interface as useful (*m=4.2, SD=1.09)* and convenient for teaching and learning (*m=4.0, SD=1.15).*

Table 6-9: Teachers' evaluation results for cultural and auspicious activity.

Questions	**N**	**Mean (M)**	**Standard Deviation (SD)**
Cultural Stimulants/Emotions			
Do you feel engaged during the activity?	13	4.6	0.65
Rate the level of fun during the activity.	13	4.5	0.88
How will you rate your happiness level during the game?	13	4.5	1.10
How will you rate your excitement level during the game?	13	4.5	1.13
Stimulate Teaching			
How will you rate your teaching/learning experience?	13	4.5	0.88
ICT Sustainability			
Do you agree that the interface is useful?	13	4.2	1.09
Do you agree it is convenient to use the interface?	13	4.0	1.15

6.7.3 Setting 2: Comparing Non-Auspicious Activity vs Auspicious Activity

This evaluation aimed to identify the significant impact of different cultural experiences upon students learning experiences. To evaluate the activities within the cultural conditions, 59 Indonesian students evaluated the non-auspicious activity (activity 1) and auspicious activity (activity 2). Students participated in the activities sequentially and completed questions to assess both activities as part of cultural conditions.

6.7.4 Results for Setting 2

The evaluation result shows the questions for auspicious cultural emotions scored the highest mean score with lower *SD* ($M \geq 4.13$, $SD \leq 0.95$). On the question "Which activity do you prefer", **61%** of students preferred Activity 1, and **39%** preferred Activity 2. However, there was a higher emotional presence during activity 2 with **high scores** for emotional questions (cultural pride, cultural motivation) compared to traditional (see Table 6-10) and cultural activity. The data below shows the evaluation results for Activity 2.

Table 6-10: Evaluation Results of Auspicious activity.

Auspicious Activity Questions	**N**	**Mean (M)**	**Standard Deviation (SD**
How would you rate your level of **engagement** during the 'Activity 2'?	59	3.64	1.17
How would you rate your level of **fun** during the 'Activity 2'?	59	3.74	1.15
How would you rate your teaching/learning **experience** 'Activity 2'?	59	3.89	0.94
How would you rate your level of **happiness** during the 'Activity 2'?	59	3.62	1.28
How would you rate your level of **excitement** during the 'Activity 2'?	59	3.67	1.16
How would you rate your level of **satisfaction** during the 'Activity 2'?	59	3.69	1.08
How would you rate your level of **relaxation** during the 'Activity 2'?	59	3.54	1.23
How would you rate the level of **'cultural pride'** during the 'Activity 2'?	59	3.91	1.02

How would you rate **'cultural motivation'** during 'Activity 2'?	59	3.88	1.11

To compare the three experiments separately, traditional vs. non-auspicious vs. auspicious Activity, I plotted a chart to illustrate the comparison as shown in Figure 6-21 traditional vs non-auspicious vs auspicious. The chart shows improved cultural pride (CP) and motivation (CM) during the auspicious activity compared to traditional and cultural activities.

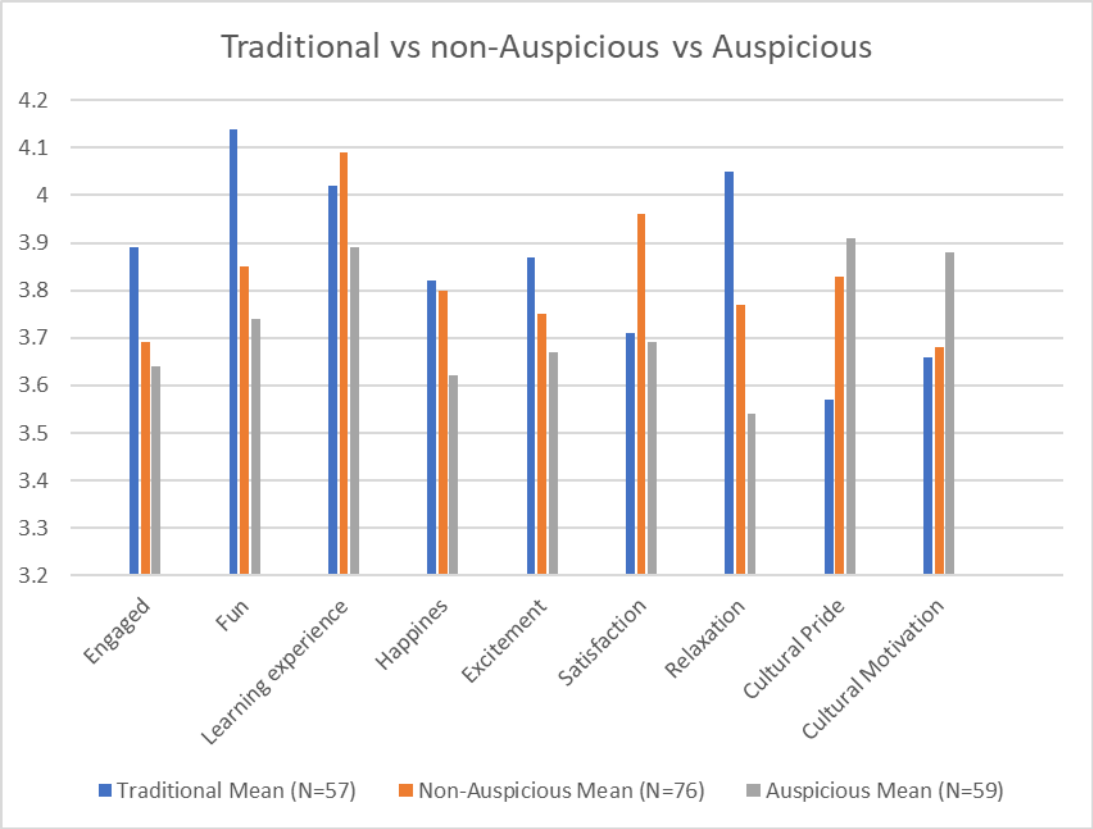

Figure 6-21: Traditional vs non-Auspicious vs Auspicious.

6.7.5 Discussion on Setting 1 and 2

Students reported much better learning experiences participating in the cultural activity than in the traditional activity based on several constructs. The experiment result suggests cultural activity generated higher experiences in terms of cultural motivation (*m=3.68, SD=0.94)* and cultural pride (*m=3.83, SD=0.96)* among students. The cultural music, cultural activities, and cultural icons offered a culturally motivating learning experience. Cultural activity participants were less anxious (*m=3.08, SD=1.09)* compared to their traditional activity counterparts (*m=3.21, SD=0.89)*. They found the interface useful (*m=4.10, SD=0.84)* and convenient (*m=3.92, SD=0.86)*. The cultural identity and

values presented among the SEA teachers and students can be observed in the outcome of the evaluation results for the cultural activity (experiment). The results suggests that students acknowledged the presence of cultural identity within them with empathy and that cultural values do provoke a positive cultural emotion. It reflected their inner nature in embracing their cultural values and respecting cultural practices.

The significant constructs were used to build the CFA model to achieve an appropriate fit for ICT sustainability. The path from cultural motivation factors to the improved learning experiences and ICT sustainability (functional interface, convenient interface, prefer this activity, and user-friendly interface) showed a 95% significance level for t value > 2.07, with some variables showing even higher with $p < 0.005$. The two findings that contradicted the hypothesised results were "Cultural Engagement does not lead to Cultural Pride" and "Cultural Excitement does not lead to Cultural Pride". The R^2 for all constructs in the CFA model showed a low positive correlation between all variables, with "Cultural Pride" achieving a higher $R^2 = 0.496$.

SEA teachers and students have experiences with westernised ICT tools; however, ICT incorporating cultural identity and a closely knitted cultural design significantly stimulated learning and with less effort than westernised ICT. The higher post-test achievement for the cultural activity suggests SEA students are comfortable with culturally designed ICT tools. A close association can be observed when students view learning content through a cultural lens. The high scores achieved by students for the cultural activity *[(N = 60) 9.3 - 6.4 = 2.9 (29%)]* compared to the traditional activity *[(N = 69) 8.7 - 6.9 = 1.8 (18%)]* suggests that the cultural guidelines act as **silent motivators** to promote and stimulate learning among SEA students.

These silent motivators promote submissive acceptance, allowing students to be ready and motivated to work on ICT activities. Students are determined to complete the cultural activity, as it resembled activities close to their hearts that triggered cultural emotions. The students often display keen interest with excitement and fun (joy) while working on creative cultural activities that they are familiar and comfortable with, such as playing with Gasing (top), designing wau (kites), and designing batik prints (silk design). Cultural games have racial and cultural values, a study observing the impact of cultural games on students aged 12 – 13 showed that an artistic games intervention program was highly effective; there was significant improvement in children's motor fitness performance skills, including agility, speed, balance, and reaction time (Gipit et al., 2017).

The auspicious cultural activity also promoted cultural values. Students demonstrated their creativity on an auspicious object, thus fostering empathy during the use of the ICT activities. Students' readiness and enthusiasm for the cultural activity suggests the applicability and orientation of cultural values and identities can simplify learning and which creates a path to absorb knowledge. Students can absorb the information beyond their usual capacity while enjoying a fun cultural game based on a real-world experience. This process reverses a stressful western ICT learning activity that leads to anxiety. Watching the fun movements of cultural icons (animated Gasing) during the activity reduced the anxiety

levels among students and teachers which suppresses their stress level. Nevertheless, some constructs achieved a higher mean score for traditional activity compared to cultural activity, for example, in Engaged, Fun, Happy, which suggest a general experiences during playing a game that promotes fun and exciting emotions. Yet, when the cultural motivation triggered and stimulated their emotions which resulted in increased cultural pride thus, lowering technology anxiety. The cultural learning experiences improved and resulted in higher learning achievement. The evaluation result for cultural-based prototype and the survey responses for teachers suggest the cultural theme preferred teaching mode for ICT design with ($m \geq 4.0, SD \leq 1.15$) for all cultural significant categories.

When comparing within cultural conditions, the evaluation of cultural activity and auspicious activity showed 61% of students' prefer cultural activity compared to 39% of students prefer auspicious activity. However, there was silent emotional acceptance of auspicious interaction among students during the activity. The question on cultural pride showed traditional activity with *(M=3.57, SD=0.95),* cultural activity with *(M=3.83, SD=0.96)* and auspicious activity with *(M=3.91, SD=1.02).* The emotional acceptance in this experiment suggested that cultural emotions are silent motivators that can evoke deep cultural connections.

6.8 Conclusion

SEA teachers and students experienced culturally incompatible ICT tools with minimal user experiences that impacted the learning outcomes and teaching experiences resulting in low ICT use in schools. As this study suggests, experiencing learning content through the cultural lens reduces anxiety and promotes ICT use. These postulates the importance of cultural metaphor integration in ICT design for SEA teachers and students.

The significant constructs must be presented in ICT design to promote ICT sustainability and to increase the frequency of ICT use in classrooms. The most considerable constructs are Cultural Motivations and Cultural Pride, with a significant correlation *r=.635***. These findings further suggest the need to integrate cultural friendly metaphors in ICT tools to SEA secondary schools.

Cultural activities and culturally designed ICT tools can be **silent motivators** for SEA students. Students accepts social and cultural elements to evoke fun, happy, and exciting moods; however, the western influenced ICT topped these emotional categories. Some constructs in the traditional and cultural activities produced similar results in the students' learning experiences, which suggests that students generally perceived ICT tools as technology that imparts knowledge; however, the post-test outcomes for the cultural activity resulted in higher achievements. Students' achievement level for the cultural activity was 29%, compared to 18% for the traditional activity. The cultural activity provoked silent emotions among students, resulting in high learning achievements. The significant achievement (post-test – pre-test) with the cultural activity suggested the need for culturally friendly ICT tools for SEA teachers and students. Furthermore, evaluating cultural conditions showed a higher mean score for

auspicious activity with cultural emotional questions. SEA classrooms can make significant progress through sustainable ICT use with sophisticated technology-oriented learning blended with culturally comfortable and culturally familiar design as silent motivators.

6.9 Proposal for Next Section (Chapter Seven)

Infusing cultural learning activities with cultural values optimised and boosted the student's confidence in using ICT. Educational tools and ICT must include elements that invoke deep cultural emotions with a cultural theme, cultural activities and cultural emotional metaphors. I proposed using CMEs' ICT guidelines and practices to accelerate ICT use in SEA. The CMEs ICT guidelines and practices are further described and discussed in the next section.

Note on publication: Vadivel, et al., 2022. Cultural Activities as New Cultural Metaphors. [Unpublished manuscript].

Chapter 7 Outline

7. CMEs ICT Guidelines and Practices for Southeast Asia

7.1 Introduction

7.2 Summary of Studies led to the Proposed Guidelines

7.3 Proposed Summary of Practices for CMEs ICT Guidelines

7.3.1 The Missing Element in HCI Design

7.4 Cultural Motivational Elements

7 CMEs ICT Guidelines and Practices for Southeast Asia

7.1 Introduction

In this chapter, I summarise the findings from the literature review, Comprehensive survey, focus groups, Study 1: Study on the Impact of cultural themes and Study Two: Study and evaluating the impact of cultural activity, which were used as the foundation for the proposal of CMEs ICT guidelines and practices that will mitigate the slow ICT adoption in SEA. To recap the results of the comprehensive survey, study 1 and study 2. Table 7-2 shows the complete survey findings, and Table 7-3 shows the findings of study one and two that contributed to the four CMEs ICT guidelines. Table 7-1 summarises the aim of this chapter. It states the research question, aims, and hypothesis of this chapter is designed to address.

Table 7-1: Summary of what this chapter aims to achieve.

Summary of what this Chapter aims to achieve:
Research Question 4 - Cultural related activities and design improve teaching/learning experience and learning outcome?
Aims 4 – Develop new ICT guidelines and framework for Secondary schools that will accelerate the adoption of ICT solutions in Southeast Asia
Hypothesis 3 - Southeast Asian Cultural values and activities can improve the teaching and learning experience

7.2 Summary of Studies led to the Proposed Guidelines

In reviewing the literature, we identified that Southeast Asian schools had been affected by the slow adoption of ICT in teaching and learning domains. Several factors were identified that caused the slow adoption of ICT, mainly cultural differences between Asian and Western students and factors that hinders technology use among teachers in Southeast Asian secondary schools (Vadivel et al., 2017).

A comprehensive survey was proposed to investigate the slow ICT adoption in Southeast Asia. The comprehensive survey collected teachers' and students' data from secondary schools in SEA, namely Brunei, Indonesia, Malaysia, and the Philippines. Three hundred forty-two teachers and 978 students participated in a study to identify factors affecting slow ICT adoption in Southeast Asia schools. Quantitative and qualitative techniques were carried out for data collection. Teachers and students were recruited after the respective countries' approval from the Ministry of Education. Results from the comprehensive study showed that there was resistance among teachers and students to use ICT in SEA secondary schools. Cultural barriers were identified as the resistance factor and that the current ICT is incompatible with teachers and students in Southeast Asia. These factors were identified as causing the slow ICT adoption in Southeast Asia (Vadivel et al., 2021).

After holding several focus groups, we proposed that the cultural theme ICT to be evaluated in Southeast Asian secondary schools. Study one assessed the impact of Cultural themes or Festive-themed ICT which was designed to test whether cultural artefacts expressed as game themes (festive cultural themes) can improve students' learning outcomes and students' learning experiences in Indonesia. Seventeen teachers and 84 students from three schools in Indonesia participated in the evaluation. Evaluation results showed cultural theme prototype improved learning experiences and learning outcomes (Vadivel et al., 2020).

In Study two, I evaluated and tested the impact of Cultural Activities ICT. Cultural activities (non-auspicious and auspicious) were designed as cultural activity metaphors to assess students' learning outcomes, teaching and learning experiences. The prototypes with cultural activities as a new cultural metaphor for non-auspicious and auspicious activities were designed and evaluated in schools in Brunei and Indonesia. The evaluation is based on a case study that evaluated three prototypes: traditional activity, auspicious cultural activity, and cultural non-auspicious activity in Brunei and Indonesian high schools. The cultural activity prototypes were integrated with elements symbolising actual and familiar propositions as metaphors. Twenty science teachers and 150 students were recruited to participate in this study. The evaluation results suggests that ICT-designed cultural activities (both auspicious and non-auspicious) promote silent emotions among students, resulting in higher learning achievements and better learning experiences.

Summary of findings of Literature Review, Comprehensive Survey, focus groups, Study 1, and Study 2 and Proposed CMEs ICT Guidelines (see Appendix for more details):

Table 7-2: Summary of findings.

Findings	Summary of Findings
Finding 1.1	Southeast Asian (SEA) teachers use less educational technology in teaching than previously known, contradicting the findings of UNESCO's report in 2021. This demonstrates a clear need for new ICT solutions for education for SEA.
Finding 1.2	The current educational technology is not culturally compatible with SEA teachers. It causes anxiety for SEA teachers. Teachers feel uncomfortable using ICT for teaching, limiting students' opportunities with technology.
Finding 2.1	Students prefer teacher-centred learning over mobile-based learning, which identifies cultural orientation among Southeast Asian students.

Finding 2.2	SEA students are less anxious when ICT (e.g., mobile learning, LMS, online videos) is used during technology-assisted learning and when teachers guide technology-assisted learning.
Finding 2.3	SEA students are less anxious about using ICT for learning than teachers in using ICT for teaching, which identifies cultural orientation among Southeast Asian students.
Finding 3.1	A variety of cultural emotional states, such as anxiety (using technology), excitement (technology interaction), relaxation (guided by the teacher), and engagement (interacting with classmates), are present among SEA students when using ICT.
Finding 3.2	SEA Students are engaged and satisfied (classmate interaction). When students interact with their classmates with ICT, SEA students feel engaged and satisfied instead of anxious. They report better collaboration with classmates, better teamwork, a better understanding of the topic, and better learning with different technology, identifying cultural orientation among Southeast Asian students.
Finding 3.3	SEA Students are more relaxed and excited with the teacher present. SEA students are more comfortable and excited in the classroom when teachers are present and guide them during technology-assisted learning.
Finding 4.1	SEA teachers' ICT experience has minimal impact on students' intention to use ICT for learning. SEA teachers are more anxious about using educational technology for personal use and teaching than students are using educational technology for learning. This result had minimal impact on students' intention to use ICT; students reported looking forward to using ICT in the classroom.
Finding 5	Cultural barriers Current ICT tools are incompatible with SEA teachers and students as per the literature review and focus group findings.

Finding 5.1	SEA values, including a strong focus on race, religion, customs, and practices, are incompatible with Western values and approaches, thus hindering adaptation to western-influenced technology.
Finding 5.2	Customs, such as traditional rites, music, arts (e,g., silk painting, batik, handicraft, kite flying) and festivals are incompatible with western customs, styles, artefacts, and presentation.
Finding 5.3	SEA practices, such as showing respect to their traditions, auspicious practices, emphasising the importance of family, artistic practices, using hands and chopsticks for eating, gift offerings, respect for the elders and God, humble greetings and gestures, and focus on auspicious events conflict with westernised practices, such as emphasising individualism, placing less importance on the advice of elders, and less focus on auspicious occasions.
Finding 5.4	Discovered cultural emotions during ICT use from data analysed from teachers' and students' perspectives.
Finding 6.1	SEA students' learning outcomes improved significantly in the classroom and mobile learning when "festive theme" activities were used.
Finding 6.2	Cultural themes have a "silent positive impact" on SEA students' learning outcomes.
Finding 7	Students reported an improved learning experience with mobile learning with minimal negative interactions. SEA Students rated both "standard theme" activities and "festive theme" activities similarly, as both have minimal negative interactions.
Finding 8	SEA teachers' cultural and emotional states were higher when "festive theme" ICT with a local setting was used for teaching and learning.

Finding 9	Cultural activities (Auspicious and Non-auspicious) improve students' learning outcomes.
Finding 10	Cultural activities (Auspicious and Non-auspicious) improve teachers' and students' teaching and learning experience, respectively.

I propose Cultural Motivational Elements (CME) ICT guidelines as the summary of the results and findings. **The following are the four CMEs ICT guidelines for SEA** proposed based on the findings:

Guideline 1: Interactive cultural activity metaphor as learning activities – Learning activities, including ICT activities, adapted for culture, lower cultural barriers by integrating customs and cultural practices, as shown in Findings 3.1, 3.2, 4.1, 5.1, 5.2, 5.3, and 5.4 respectively. The use of ICT with cultural activities as delivery modes in learning increases students' comfort levels and stimulates discussions in class, thus resulting in improved learning outcomes and learning experiences.

Guideline 2: Auspicious activities metaphor as a learning activity - Interaction between students and ICT based on designing an auspicious object lowers cultural barriers, as shown in Findings 3.1, 3.2, 3.3, and 5.3. ICT that incorporates building auspicious objects stimulates discussions in class, thus resulting in improved learning outcomes and learning experiences.

Guideline 3: Cultural offering (gift) metaphors - Teaching and learning activities, integrated with cultural gifts that symbolise actual and familiar objects used in cultural and traditional events as a form of wishing good luck and good fortune as metaphors, lower cultural barriers as shown in Findings 5.1, 5.2, 5.3, and 5.4.

Guideline 4: **Use cultural themes as cultural theme metaphors -** Learning activities, including ICT activities, based on cultural themes stimulate empathy and lower cultural barriers, as shown in Findings 6.1, 6.2, 7, and 8. These result in improved learning outcomes.

7.3 Proposed Summary of Practices for CMEs ICT Guidelines

Table 7-3 presents the brief practices for the four proposed CMEs ICT guidelines:

Table 7-3 CMEs ICT Guidelines and Brief Practices

CMEs ICT Guideline	Brief Practices
i. Interactive cultural activities metaphor as a learning activity	The use of a gasing activity (an Asian top) or batik printing or silk painting activity further amplifies the effect of connecting the user to the cultural experiences (mood).
ii. Auspicious activities metaphor as a learning activity	Using auspicious objects in activities such as designing or building auspicious objects such as lanterns, oranges, dragons and lamps evokes emotion and cultural experiences that stimulates cultural pride and motivation.
iii. Cultural Gift as cultural gift metaphor	Cultural gift metaphors are cultural offerings that symbolises actual intentions in cultural activities and traditional events to wish luck and good fortune, e.g., cultural gifts such as 'Ang Pow' (red packet) and ketupat (rice dumplings), are used as metaphors. Cultural gifts and symbols symbolise cultural beliefs and ideologies that can be used as cultural emotional metaphors that stimulate cultural pride and cultural motivation. Cultural gift metaphors can be used as hints/advice, such as giving rice dumplings, 'Ang Pow' packets, and lighting lamps as positive advice, or hints during learning activities that provide emotional and cultural familiarity to promote learning with emotional experiences (mood).
iv. Cultural themes as new cultural theme metaphor	The use of festive cultural themes or other Asian festival themes is not just using cultural artefacts for familiarity, but also the festive theme makes the user interaction more meaningful and connected which evokes festive mood.

7.3.1 The Missing Element in HCI Design

In the HCI context, the cultural artefacts used as metaphors do not necessarily amplify cultural emotions. The cultural artefacts are used simply to promote user experiences. The cultural emotions metaphor is used to stimulate and provoke users' emotions when users are involved and participate in cultural activities. The cultural activity (auspicious and non-auspicious) metaphors are typical settings for cultural motivations that can promote deep cultural essence that triggers deep cultural emotions and excitement.

7.4 Cultural Motivational Elements

At this stage, from the list of proposed guidelines, I presented CME as an extension to the existing HCI model and a broad category of cultural elements for simplicity of design execution. The CME incorporated three items and I classified them as:

i) New Cultural Emotional Metaphors
   a. As Cultural Themes metaphor;

ii) Cultural Gift Metaphors
   a. Cultural gifts used during festivals that can present actual intentions in festivals and cultural occasions that symbolise real meanings in cultural activities and traditional events as a form of wishing luck and good fortune;

iii) Cultural Activity Metaphors as new deep cultural emotional metaphors
   a. Interactive Non-Auspicious Activities;
   b. Interactive Auspicious Activities.

Deep cultural emotional metaphors are interactive cultural activity metaphors that go beyond simple cultural artefacts (metaphors). These approaches emphasise by creating or building auspicious objects or playing cultural activities that exemplify cultural, emotional moods of excitement and joy of participating in cultural activities with cultural pride and cultural motivation. A further extension to the current HCI model is required to support this addition of new metaphors. Thus, the HCI model on user experiences and interaction design is extended with an additional element of CME.

The CME is composed of (i) Cultural Theme Metaphors (e.g., festive themes) in which emotional attachments toward cultural identity are evoked with the presence of culture. Cultural Theme Metaphors such as festive themes and traditional wedding themes; (ii) Cultural Gift Metaphors that evoked emotional attachment, e.g., gifts that symbolise actual propositions of luck and good fortune in cultural or traditional events; and (iii) Deep Emotional Metaphors as Cultural Activities metaphor, which are activities of non-auspicious in which users are encouraged to play a traditional cultural game

activity and auspicious activities in which users are encourage to design or build an auspicious object. In both, users take great pride in completing the ICT activities.

I propose the following metaphor model as an overall contribution towards the HCI domain as illustrated in Figure 7-1 and as an updated HCI model for designers and practitioners.

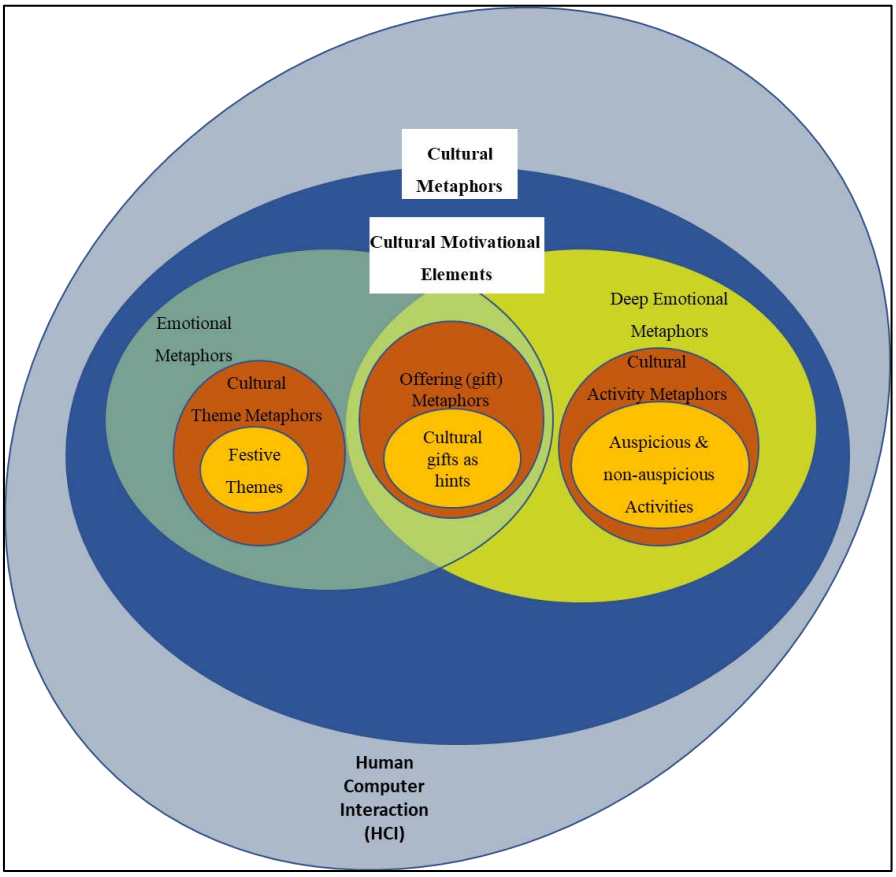

Figure 7-1: CME as part of the HCI model.

Note on publication: This Chapter is accepted for the HCII conference and will be published by Springer in the LNCS series.

Chapter 8 Outline

8. Conclusion

8.1 Successes and Limitations of Study One and Study Two

8.1.1 Successes

8.1.2 Limitations

8.2 Recommendations for Future Research

8 Conclusion

> Like all open systems, organisations must cope with two significant universal challenges: adapting to the external environment and integrating their internal system (von Bertalanffy, 1968; Schein, 1983).

In this thesis, I discovered the barriers to slow ICT adoption in Southeast Asia secondary schools. I proposed four Cultural motivational elements (CMEs) of ICT Guidelines and practices. I evaluated prototypes integrated with the four CMEs ICT guidelines in two countries in Southeast Asia, which yielded significant results in students learning outcomes and learning experiences. More specifically, this research aimed to identify how cultural motivational elements can be integrated into the design of educational tools to enhance teaching and learning experiences and improve students' learning outcomes in Southeast Asia schools using the four CMEs ICT guidelines and framework. Cultural elements and values (cultural activity, cultural icons and tasks, cultural interactions) are classified as cultural motivations that can stimulate teaching and learning. Thus, this field of research on cultural integration in ICT for Southeast Asia schools elaborated on the real-world concept of cultural benefits derived from Southeast Asia teachers' and students' perspectives.

In chapter one, several hypotheses were raised, and gaps were identified, such as poor governmental support and policies are the cause of insufficient use of advanced and mobile technology in secondary schools; Insufficient technical training and professional development for secondary school teachers have led to incompetent technology use; Incompetent software and technology evaluation for classroom management has led to a lack of technology use in teaching and learning environment; Mobile technologies can reduce the overall teaching and learning cost, improved learning outcomes and students' learning experiences; Culturally motivated technology is required to stimulate teaching and learning; The gaps identified were: Southeast Asia's Educational technology with western learning culture; Lack of active learning; Incompatible western education technology design; Adapting to western teaching approach; Absence of Asian cultural values and activities. The findings of the two primary studies presented in this thesis addressed some of these questions and gaps.

The comprehensive survey was to investigate factors affecting teachers and students ICT use from four countries in Southeast Asia: namely Malaysia, Indonesia, Philippines, and Brunei. The study identifies the critical deficiencies and effects of cultural attributes in using digital tools in classroom learning among teachers and students in Malaysia, Indonesia, Brunei, and the Philippines secondary schools.

Several focus groups were conducted with Southeast Asian students to discover culture-based ICT design preferences. The Southeast Asian students' preferences and outcomes of the focus groups were applied in the proposed ICT design in study one. In study one, I designed and evaluated the Festive-Theme ICT design to observe teaching experiences and learning outcomes. Result showed that

students learn better with Festive-Theme design. Study two was to test Cultural activity ICT designed with the proposed four CMEs ICT guidelines and framework. The evaluation results showed that students learn better with cultural activity and with improved teaching and learning experiences.

Southeast Asia's rich cultural values and practices are an asset to the region. Their cultural values and practices are essential in transiting from the conventional practices to digital practices if they are well positioned and integrated. The western influences on digital tools and technology portrays an exemplary design and sophisticated way to use. However, the western design prohibits extensive exploration among most Southeast Asian traditional mindset individuals. These are the main concerns for Southeast Asia's education industry for the rural schools which impacts the use of ICT. Schools in the capital cities have encountered the same issues of placing less importance on ICT activities to enhance student learning. Back to the manual classroom-based teaching and education seems more attractive for Southeast Asian schools. Placing importance on cultural values in the design of educational tools will enhance the teaching and learning experiences. Cultural values and practices have long-lasting impressions on the local people despite the exposure to the western approach in the entertainment and media industry. These deep-rooted cultural practices and values can be triggered by cultural elements in the design and daily activities with a sense of familiarity and belonging. The silent motivators can be observed in the Festive-theme activities and Culture-based activities. The cultural values are the silent motivators and the key to rich teaching and learning experiences for Southeast Asian schools. Culturally accustomed digital tools for teachers and students are the basis for ICT sustainability in Southeast Asia secondary schools. These new cultural practices for ICT design will bridge the gap and mitigates problem of slow ICT adoption in Southeast Asia secondary schools. The proposed CMEs ICT guidelines can ramp up ICT and digitalisation in Southeast Asia classrooms and which can be on par with their western counterparts.

8.1 Successes and Limitations of Study One and Study Two

8.1.1 Successes

- Approval for data gathering from the Ministry of Education of Indonesia, Brunei, Philippines, and Malaysia for Study 1;
- Approval to evaluate the Festive-themed prototype via Zoom from the Ministry of Education of Indonesia and Brunei;
- Results achieved for Study one and two – Evaluating the prototype with Brunei and Indonesia secondary schools (study two) despite travelling restrictions amid the pandemic.

8.1.2 Limitations

- Primarily teachers in the respective schools undertook the sampling procedures for the comprehensive survey. While survey procedures were strictly followed, staff rarely recorded additional and potential observations during data collection;
- The evaluation sampling from study one was limited to Indonesian schools. Respondents were mainly students and teachers from Jakarta secondary schools. This reflects selectivity bias;
- The sampling from study two, which is the evaluation of prototype was limited to Indonesia and Brunei schools. Respondents were mainly students from Jakarta and Bandar Seri Begawan secondary schools. This reflects selectivity bias;
- The focus groups were conducted with Southeast Asian students residing in Singapore. Some of these students are educated in private schools in their homeland. Hence, these respondents' perceptions not necessarily indicated Southeast Asian cultural practices and values. This reflects cultural bias;
- Teachers in Brunei and Indonesia essentially undertook the sampling procedure in study two (prototype evaluation). As the setting was a classroom computer lab, hence not all students' emotional expressions could be observed during the activity;
- The sampling procedure in study two (prototype evaluation) in Indonesia and Brunei was carried out via Zoom. The intermittent Internet connection errors affected students' online activity. Hence, this limitation would have affected students' emotional levels and their learning outcomes;
- The sampling size in study two (prototype evaluation) can be based on a larger scale to yield a better T-test score;
- Google forms were used for pre-test, post-test, and survey to collect respondents' data. Teachers in Brunei requested the removal of mandatory login to Google for convenience. Hence, there were double entries for students' post-test attempts. The discrepancies had to be manually checked, and redundant records were removed;
- Language barrier affected the communication with students. Study two in Indonesia was carried out via Zoom activity; hence the activity was briefed in English, and the teacher assisted in interpreting the activity to students in Bahasa Indonesia.

8.2 Recommendations for Future Research

The findings reported in this thesis on the cultural and emotional integration in ICT design suggested several other potential research areas. In general, there is a need to diverse data collection and well-planned analysis from other countries in Southeast Asia (Eg. Vietnam, Myanmar, Thailand, Cambodia) to optimise and evaluate the cultural emotions and integration in ICT. This approach would have

demonstrated higher level acceptance among teachers and students in Southeast Asian regions and would have justified and fully benefited the research study. Another potential improvement if all countries in Southeast Asia participated in the survey, which could have enabled me to identify and highlight future progress and enhancements to the study. Furthermore, other significant cultural activities and elements could have been suggested in the cultural guidelines and framework with a revision and update.

The second recommendation is to simulate the propose cultural guidelines and practices to suit rural areas of other Asian regions (Eg. India, Bangladesh, Pakistan, Nepal). Coupled with Asian countries' cultural expectations and values would contribute significantly to applying cultural guidelines and practice. Furthermore, this enables me to cover a broader range of cultural beliefs in ICT design to enhance teaching and learning. Regularly revising policies and procedures according to new standards and requirements is essential (Havas et al., 2014).

Integrating AI into culture-based ICT design aspects would be the third recommendation. Some promising features of AI to culture-based learning which includes detecting technology anxiety and cultural emotions to lower technology anxiety. Hence, once technology anxiety is detected, a smooth transition to a localised cultural appearance of icons, design, music, and cultural interactions is recommended. There is a lack of studies on machine learning and AI integration in educational tools (Dixon-Román et al., 2020), mainly in the design and presentation of culture-based educational tools.

The fourth and final recommendation is to simulate and evaluate the cultural guideline and practices with external regions of Asia covering Europe, North America, and the African regions and making the marks of exploring the rural areas of these regions. Integrating the cultural values, practices, and beliefs in these regions in the design of ICT educational tools to observe the teaching and learning outcomes. The approach is to concentrate on the poorest countries in these regions that has poor ICT exposure to stimulate teaching and learning with ICT integrated with cultural motivational elements to simplify adaptation and to reduce technology anxiety. Complete replication of the Southeast Asia study in the Europe regions will be impossible; however, diligence and careful cultural consideration and assimilation of localised practices, values and beliefs will provide an inside and clarity to integrate the most impactful ICT cultural themes and activities in the teaching and learning domain.

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Appendix A – Summary of Cultural Activities and Games

Traditional/Cultural Games	Descriptions
Top Spinning (Gasing)  *Gasing (Top)*	A rope is tightly tied around the gasing (top) and spun. Once the gasing starts to turn, the player carefully scoops off the gasing using a wooden bat and places it on a wooden surface. The gasing that spins the longest wins. It is widely played in the villages in Southeast Asia (Jaelani et al., 2013).
Five Stones  *Five Stones*	Five stones are thrown to the ground, and one stone is selected before being tossed in the air. With the same hand, a second stone is picked up from the ground, and the player quickly catches the first stone before it touches the ground. Now with two stones in the same hand, one of the stones is tossed into the air, and a third stone is picked up from the ground. The game goes on until all stones are collected in the same way. A player wins if none of the tossed stones has touched the ground (Nagpal et al., 2019).
Capteh  *Chapteh (feathered shuttlecock)*	Capteh is a feathered shuttlecock. Capteh is played by kicking the capteh into the air with one foot and keeping it in the air with continuous kicks. A point is awarded for every lift. The winner is the person who can keep it going. In Vietnam, it is known as “Da cau” (Ng et al., 2009).
Sepak Takraw (rattan ball)	The game is played by two teams using a woven rattan ball. Each team has three players and two substitutes. Players can only touch the ball with their feet, head, knees, and chest. Each team can handle the ball three times while passing it to the other side; the goal is not to let it touch the ground. The first team to score 15 to 21 points wins the set (depending on the rules). This

 *Sepak Takraw*	game is played in almost all countries in Southeast Asia (Zarei et al., 2018).
Congkak  *Congkak*	Congkak is a popular board game played in Asia. It is known as Mancala in other regions. The Congkak board has two rows of seven holes containing seven seeds and a storehouse (bigger hole). Two players are seated at opposite sides and take turns playing by collecting all of the marbles from one of the holes on their side and dropping one marble at a time in each hole clockwise until the player has emptied all the seeds in their hand. If the last seed falls into a house part of a player's village, he can pick up all the seeds from his opponent's house that lies opposite it and deposit them in his storehouse. The player who collects the most seeds in the storehouse wins the game (Chan, 2010).
Cultural Artwork Activity	**Descriptions**
Batik Art Design (Silk painting)  *Batik (silk painting)*	Batik painting (silk painting) is well known in Asia as an art. It is a unique tradition in Southeast Asia. It is called Batik in Malaysia, Indonesia, Vietnam and Myanmar, and it is called Barung Batik in the Philippines. Batik designs are expressions of love and happiness (Rante et al., 2016).
Wau Bulan (Moon Kite Flying)	These are huge, decorated kites used in kite flying competitions in Malaysia, Indonesia, the Philippines (during Cebu's Sinulog Festival), Brunei and Vietnam. They are also used during the Bali Kite Festival: worshipers send signals to the gods asking for a plentiful harvest during this colourful festival. There is an enormous annual traditional kite flying competition in Thailand

 *Wau Bulan (Moon Kite)*	between Chula and Pakpao. In Malaysia, the kite is named Wau Bulan (moon kite), an intricately designed moon kite traditionally flown in Kelantan; it has been adopted as one of Malaysia's national symbols (Noor and Manan, 2012).

Appendix B – Main Contribution – CMEs ICT Framework, Guidelines and Practices for Southeast Asian Education

Teaching and learning with CMEs ICT Framework, Guidelines and Practices for Southeast Asian Schools

This document outlines:

- The learning goals of Southeast Asian secondary schools.
- The use of Information and Communication Technology (ICT) for secondary education with cultural elements.
- The Culture-centred ICT framework and five guiding principles are illustrated with examples of teaching practices.

Contents

Executive Summary

The CMEs ICT guidelines and practices support teachers in planning, implementing, and reviewing ICT learning activities that use cultural values and motivational elements to enhance teaching and learning. The CMEs ICT guidelines and practices are written for teachers of children ages 13 to 18. The CMEs ICT guidelines enhance and motivate teaching and learning experiences with cultural themes and cultural activities. These trigger cultural emotions with empathy towards using ICT.

Introduction

Culture-centred ICT Design with CME for Southeast Asia

A prosperous society in art and culture requires a varied educational design that aligns with its niche and diversified values. Southeast Asia, which is comprised of 11 countries, is a region with unique and rich cultural diversity and religion. The primary beliefs are Islam, Christianity, Buddhism, and Hinduism. Despite the prevalence of multiple religions, races, and identities, Southeast Asia's cultural activities and festivals appear to unify the different faiths and races (Tong, 2010). The region's rich cultural diversity and values can be used to bridge the gaps that appear in technology-oriented learning. Encouraging students' excitement, fun, and motivation through traditional cultural activities and games can create an enriching and positive learning experience fomented by technology.

Cultural festivals and activities are treated auspiciously and celebrated with affection and pride (Andaya, 2006; McLeod, Dieu, and Nguyen, 2001). Indeed, they are attractions that tourists cannot miss. The Ramadhan, Lunar New Year, Christmas, Songkran, Vesak, and Diwali, to only name a few of the festivals, identify the importance placed on auspicious festivals in Southeast Asia, and the celebrations are often observed as essential events in their respective countries. Cultural activities such as wau bulan design (moon kite design), Congkak, and Gasing (top) are given equal importance and frequently celebrated with cultural pride. This demonstrates the conjunction of cultural events and activities in Southeast Asia.

Southeast Asia's cultural identity is rich and deeply rooted among Southeast Asians; consequently, this identity has excellent potential to be used as a motivator, triggering excitement and promoting active learning, along with ICT integration.

A cultural framework with five guiding principles and practices is proposed to exemplify the culture-based ICT framework and guidelines for 'ICT sustainability in Southeast Asia schools to shape individuals with culture-based ICT'.

Definition of ICT

‘ICT encompasses any technology teachers, and children use in the education setting that handles information and has an interactive capacity.

Definition of Culture-Centred ICT

‘Culture-Centred ICT with CME’ encompasses any technology integrated with cultural motivational elements (CME) used by teachers and students in the education setting and handles information that enhances and motivates teaching, aligning the learning experience with interactive cultural capacity and cultural values.’

Cultural Motivational Elements (CME)

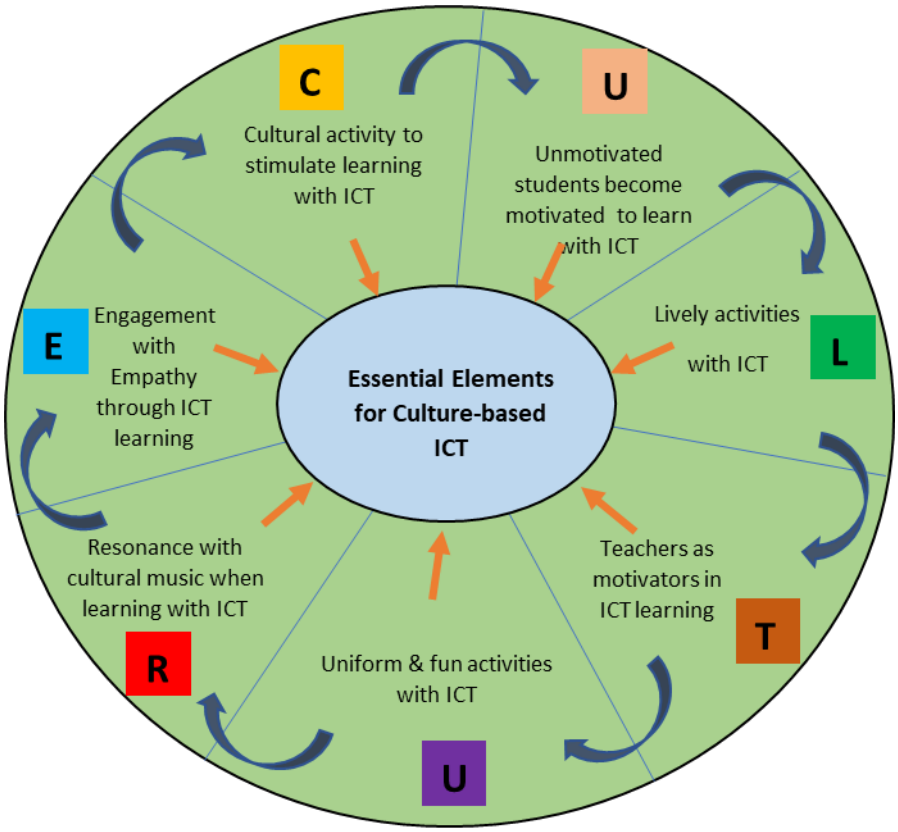


Figure 0-1: Cultural Motivational Elements (CME) Framework

Figure 1 shows the CME framework, which identifies essential elements Southeast Asian students can learn with ICT. The framework identifies the vital ingredients of culture-based ICT in Southeast Asian secondary schools to **enhance** teaching and learning experiences. An abbreviation 'CME' states the importance of cultural integration into ICT learning for Southeast Asian schools. The seven elements of 'C U L T U R E' were used for ease of planning and implementation (**C**ultural activity to stimulate learning with ICT, **U**nmotivated students become motivated to learn with ICT, **L**ively activities with ICT, **T**eachers as motivators in ICT learning, **U**niform and fun Activities with ICT, **R**esonance with cultural music when learning with ICT, and **E**ngagement with empathy through auspicious ICT).

Framework - Essential Elements for ICT

The framework identifies elements of 'C U L T U R E' to be integrated into culture-based ICT teaching and learning processes. The seven aspects of 'C U L T U R E' identified in the model are essential (as shown in straight amber arrows) to promote ICT learning holistically, enhancing classroom-based learning. The curved arrow in blue illustrates the connectivity between 'C → U → L → T → U → R → E' and how they are interrelated to create a holistic teaching and learning environment with culture-based ICT in Southeast Asia. The summary of 'C U L T U R E' is stated below:

C - Cultural Activity to Stimulate Learning with ICT

Culture-based ICT drives students to be competent and conscientious in using ICT. A talented and conscientious student will acquire ICT skills with an awareness of a moral sense of righteous conduct. Conscientiousness and competency are two essential ingredients for the safe and secure use of ICT among students in Southeast Asia.

U - Unmotivated Students Become Motivated to Learn with ICT

Culture-based ICT can transform unmotivated students into motivated students with less effort and more auspicious, positive interactions. Students feel motivated to interact positively with ICT because it promotes positive interactions, positive active learning, and a positive mindset. Hence, students are involved in quality interactions, thus becoming competent ICT learners.

L - Lively Activities with ICT

Culture-based ICT promotes students to be enthusiastically involved in learning with cultural icons and tasks. Thus, by encouraging students to explore and acquire knowledge using ICT with cultural icons and schemes with which students are already acquainted, students will become better learners.

T - Teachers as Motivators in ICT Learning

Culture-based ICT promotes teachers as guardian angels. Teachers are encouraged to involve students in teamwork to fulfil their tasks with more motivation and encouragement. Teachers facilitate their teaching tasks with students' ability to interact with ICT. Teachers as guardian angels promote positive and interactive discussions among students. Students become more creative and thoughtful, resulting in an enhanced learning experience.

U - Uniform and Fun Activities with ICT

Culture-based ICT encourages uniformity in teaching and learning with fun and engaging activities. Teachers must exercise a uniform approach to ensure consistent use of culture-based learning throughout the learning activities. Uniformity with fun, engaging, and culture-based ICT activities will strengthen deep-rooted bonds among students.

R - Resonance with Cultural Music when Learning with ICT

For culture-based ICT, cultural music resonates with students' emotions. Cultural music motivates students to be more thoughtful, an essential element that inspires a student to use ICT.

E - Engagement with Empathy through Auspicious activity

Culture-based ICT with a cultural theme promotes empathy and respect. Southeast Asian students must interact and learn with ICT to empathise with cultural values.

(Core) of Framework - Aims

The framework aims to identify the essential cultural elements for ICT's sustainability with culture-based learning.

Guidelines for CMEs ICT Design (Educational Tools)

This document outlines teaching and learning guidelines on the design of educational tools (ICT) for Southeast Asian secondary schools. Five guiding principles for designing culture-based ICT solutions and educational tools for students ages 13 to 18 in Southeast Asian schools are presented. The five guiding principles are illustrated with examples of design and teaching practices.

The four guiding principles for designing ICT solutions and educational tools in Southeast Asia cater to the requirements and preferences of educators, administrators, and students within the local context. Classroom teaching can be supplemented with ICT cultural activities. The five guiding principles highlight specific cultural elements that can be present in ICT solutions and educational tools to stimulate cultural emotions to reduce cultural barriers. The sustainable use of ICT in the classroom will improve teaching and learning experiences. The guidelines can be incorporated individually or jointly, depending on the design of the ICT activity.

The objectives of the five guiding principles are:

- Interactive learning and active engagement with ICT that adheres to cultural values,
- Encouragement of cultural emotions with cultural activities that align with cultural values,
- Placement of ICT as a respected and auspicious object that can be used to acquire knowledge that aligns with cultural practices, and
- Development of confidence in using ICT that aligns with cultural values.

Guiding Principles

Guiding Principle 1: Interactive Cultural Activities as Cultural Activity Metaphor

Learning activities based on cultural activities will lower cultural barriers by integrating customs and cultural practices. Cultural activities commonly practised in Southeast Asia can be identified as learning tools. The use of ICT with cultural activities and delivery modes stimulates cultural pride. Students will be keen to engage with others and be spurred to complete the activity with excitement. The learning process will promote discussions, resulting in improved learning outcomes and learning experiences. Integrating interactive cultural activity in ICT learning boosts ICT use in the classroom.

Practices:

Interactive cultural activities, such as designing a wau (kite), designing a batik (silk painting), and playing gasing (top), are common for Southeast Asians and are frequently seen in cultural events and sports. These are common activities that teachers and students understand how to play. Such activities can be integrated as metaphors and teaching activities to increase the comfort level between teachers and students. Furthermore, these activities relax teachers and students, helping them actively enjoy the teaching and learning.

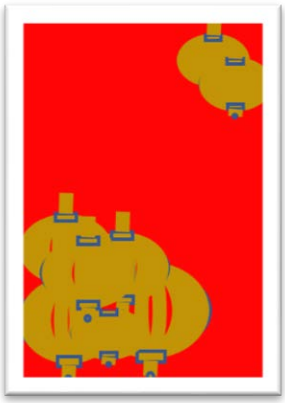
An interactive cultural activity can lower the anxiety level among teachers and students while using ICT for teaching and learning. The activity will be perceived as a game rather than a purely academic activity, promoting cultural emotions and happiness among the students. Students learn the topic via a cultural activity through stimulating discussions with their peers and teachers. With a teacher's guidance, a smooth transition from teacher-centred learning to a more independent, ICT-based education can result in the students becoming more resilient ICT users.

Examples of interactive cultural activities in Southeast Asia include gasing (a spinning top), wau bulan (moon kite), congkak, and batik design (silk painting).

Content has been removed due to copyright restrictions *Gasing (Top)*	 *Congkak*
 *Sepak Takraw*	 *Batik Design (Silk Painting)*

Teachers can briefly illustrate the cultural activity before introducing the ICT activity. For example, teachers can post questions to students on the common cultural activities in which students have participated. Students can relate their knowledge of cultural events and activities, share their experiences with classmates and create a comfortable interaction among teachers and students. Teachers can also draw or display cultural activity images to promote students' enthusiasm.

An interactive cultural activity encourages students to interact with the system by involving them in the activity as 'doing.' The cultural activity can be presented as an animated object in an ICT activity that players can spin (gasing), kick (sepak takraw), collect (congkak), draw (batik/silk painting), or design (lantern). Students will enjoy the different animation aspects of a cultural activity while simultaneously completing the activity to achieve the desired learning outcome.



Guiding Principle 2: Cultural Gift Metaphor

Teaching and learning activities are integrated with cultural offerings (gifts) as metaphors that symbolise actual and familiar objects used in cultural and traditional events as a form of wishing good fortune and lower cultural barriers. These friendly gestures of receiving gifts evoke joy and happiness, lowering cultural barriers. Elements symbolise true and familiar propositions as emotional metaphors improve teaching and learning experiences. The emotional metaphors amplify emotional experiences, which promotes teaching and learning.

Practices:

Southeast Asian cultural icons can be used as deep emotional metaphors to present an idea cognitively and emotionally. Cultural gifts such as oranges, lamps, ketupat (rice dumplings), and ang pow (red packets) are often used during festive seasons as **offerings**. Cultural elements symbolising true propositions in cultural events or festivals can help students feel more engaged. There is a close association with Southeast Asians, triggering cultural emotions of joy and happiness. The familiarity of cultural icons makes teaching and learning easier to assimilate and comprehend.

Using cultural gifts as emotional metaphors strengthens cultural emotions and cultural pride among Southeast Asians. Students recognise the application of cultural icons more accurately. For example, ketupat (rice dumplings) or ang pow (red packet) is perceived as a gift with good wishes during auspicious occasions. The icons can be used as hints or treats in learning activities. Positive advice with deep emotional metaphors encourages excitement and zeal towards the activity, and students can revel in triumph. The positive vibes will increase the players' self-esteem and confidence, sustaining their interest in completing the activity. Players feel there is another chance to demonstrate their knowledge with guidance from the emotional metaphors. The positive and encouraging advice builds resiliency within students. Students feel inspired and motivated to complete the activity because the system presents positive and auspicious advice.

Positive advice can be integrated by using hints when incorrect choices are selected (e.g., providing keywords related to the correct answer, providing images to the right answer, and offering more positive

advice and interactions). Examples of emotional metaphors include ang pow (red packets) – clicked to obtain hints; lanterns and lamps - lighted to receive suggestions; ketupat (rice dumplings) - clicked to accept clues; gesture as a form of greetings or blessings during festivals – gestured at to obtain indications; and Rangoli (patterns with colourful rice flour) - drawn to get hints.

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Hint using Ketupat (Rice Dumpling)</td>
<td> 

Hint using Ang Pow (Red Packet)</td>
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<td> 

Hint/advice using Lantern</td>
<td> 

Hint/Advice on using Malay Wedding gifts</td>
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Hints using Ketupat

Hints using oranges

Teachers can illustrate the cultural gifts before introducing the ICT cultural activity. Teachers can display images of cultural offerings to stimulate discussion among students about when they have received ang pow from their grandparents or have made ketupat (rice dumplings). Students can share their experiences with classmates.

Cultural gifts can be incorporated as metaphors in ICT solutions. The cultural gifts can be presented as hints (ang pow packets) or treat (ketupat) when a task is achieved. Cultural icons such as lanterns, dragons, and a wau bulan (moon kite) can also be used in decorating and designing activities. Additionally, these cultural gifts can be presented as deep emotional metaphors (animated objects) in activities.

Guiding Principle 3: Auspicious Learning Activity as Cultural Activity Metaphor

Auspicious activities will lower cultural barriers and stimulate teaching and learning. Using ICT with auspicious objects and CME in class will improve students' learning outcomes and learning experiences. Auspicious activities requiring students to design an auspicious object with learned knowledge stimulate teaching and learning, thus reducing cultural barriers.

Practices:

Students can design or build an auspicious object such as a lantern, red packet (ang pow), or lamp with things or information learned. Auspicious activities promote the art of designing or building an auspicious object using ICT. The auspicious activity promotes emotional attachment as the students complete the task with ICT. Auspicious activities instil respect for tradition and culture, which promotes good habits.

Auspicious activities, which include designing an auspicious object or building an auspicious object with knowledge gained, can be integrated into ICT activities as tasks. Teachers can encourage students to create or develop lanterns, lamps, a wau (kite), or dragons with knowledge acquired during lessons. This enables students to engage with what was taught during the class actively.

Guiding Principle 4: Cultural Theme for Educational Technology

Learning activities based on cultural themes with cultural motivational elements (CME) stimulate cultural pride and emotions that lower cultural barriers. ICT with cultural themes such as festive and traditional wedding themes can result in improved learning experiences and outcomes. Empathy towards cultural practices stimulates cultural emotions, thus fostering students' interest in fulfilling the ICT activities and achieving the desired effect or result.

Practices:

ICT activities can be presented as cultural themes to stimulate empathy and respect for cultural values and traditions. Presumably, teachers and students are familiar with the cultural music, creating a close and comfortable bond with the ICT activity. Examples of cultural themes are ICT activities using festive themes (e.g., Christmas, Lunar New Year, Ramadhan, and Diwali) or traditional wedding themes (e.g., Chinese and Malay wedding themes).

Lunar New Year Theme

Ramadhan Theme

Chinese Wedding Theme

Indian Wedding Theme

Students learn better with empathy when the topic is presented in an ICT activity with a cultural theme. In this case, students feel more compassionate towards learning with ICT. Learning with empathy allows students to feel and share other students' emotions. Hence, a cultural theme will enable students to learn with the presence of cultural values and practices, which instils humility, the critical enabler of empathy.

Empathy can be achieved with a cultural theme design (e.g., Ramadhan, Lunar New Year, Diwali, and traditional wedding themes). Indeed, empathy can achieve solace among students because they feel more connected with cultural values and traditions; as a result, learning becomes more meaningful. The smooth execution of ICT activities with cultural themes is possible as students feel more culturally integrated and connected. A cultural theme can be integrated into ICT solutions as a cultural wedding theme, festive theme, New Year theme, water festival theme, or hungry ghost festival theme. Teachers can discuss with students the different types of cultural festivals in Southeast Asia. Teachers can share pictures of celebrations with students and discuss the significance of the festivals celebrated throughout Southeast Asia. Teachers can encourage students to share their festival experiences with their peers. Festive themes can be integrated into ICT solutions as students share and become emotionally attached, creating a feeling of empathy while participating in the ICT activity. For example, the Lunar New Year festive theme can provide the lively theme design with a cultural activity on designing dragons with

images learned in a science lesson. Examples of the Christmas festive theme for the topic of photosynthesis are shown below.

Christmas Theme Leaf

Christmas Theme Stomata

Christmas Theme Diffusion

Christmas Theme Chlorophyll

Examples of the use of Guiding Principles in ICT

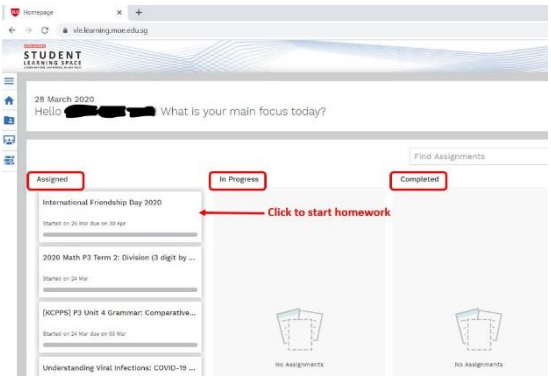
Standard principles for using ICT provide an elementary guide for teachers and students on how to use ICT tools ethically. Some examples of the traditional education portals and ICT activity screens used in Southeast Asia are stated below.

Standard Education Activity Portals

Resource Portal – OPAL

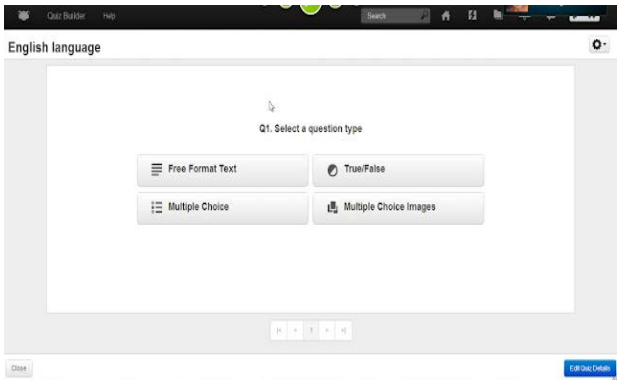
Resource Portal (OPAL)

Student Learning Space



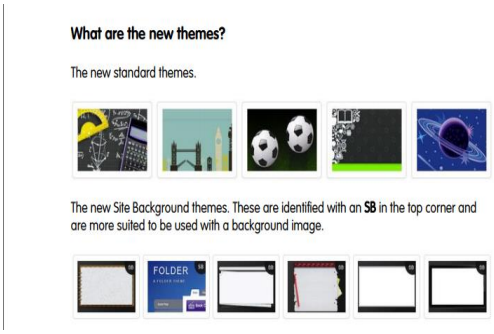
Student Learning Space

VLE Frog (Activity Creation)



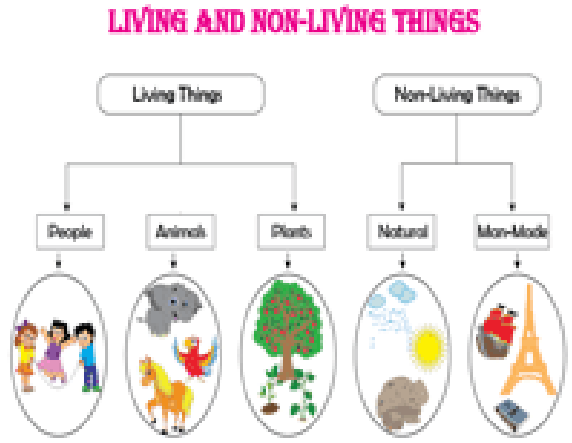
VLE Frog

VLE Frog Theme



VLE Frog Theme

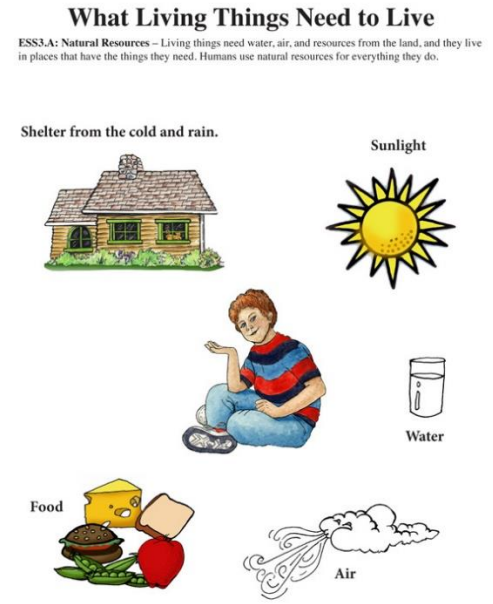
Standard Student Activities



Science Activity 1

Science Activity 2

Science Activity 3

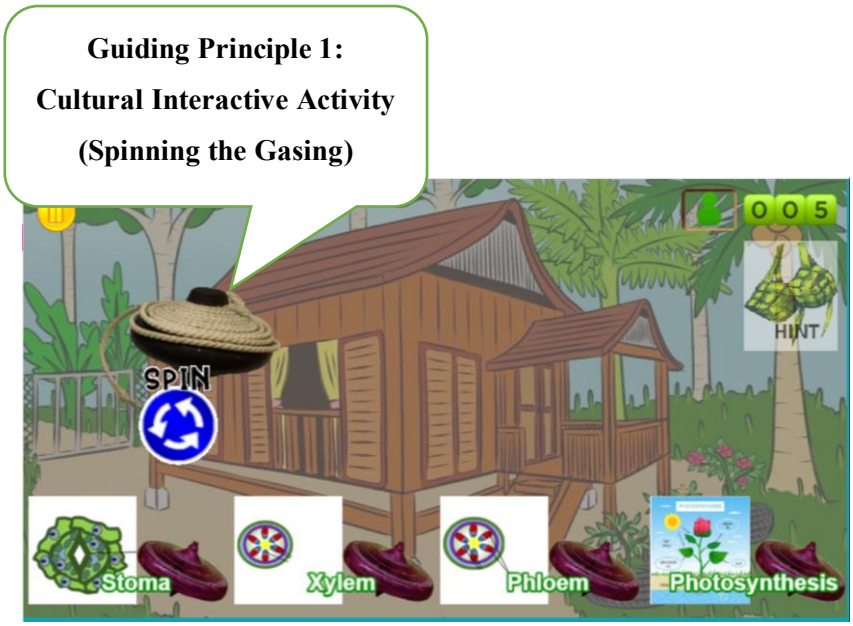


Science Activity 4

Updated Activities with Cultural Guiding Principles

The updated activities with cultural ICT guiding principles are illustrated below with examples:

Updated ICT Guiding Principle with Cultural ICT Guiding Principle 1



Guiding Principles 1.

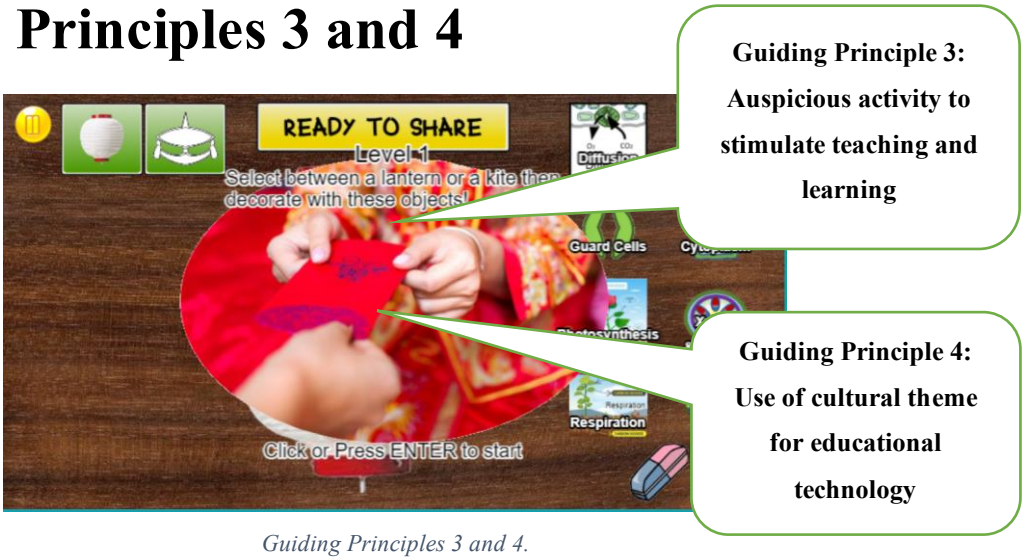
Updated ICT Guiding Principle with Cultural Guiding Principle 2

Guiding Principle 2.

Guiding Principle 2: Use of emotional metaphors (promote CP and CM) with traditional cultural icons

Guiding Principle 2: More Positive Hints/Advice Hints When Incorrect Answer is Selected with gift metaphor

Updated ICT Guiding Principle with Cultural Guiding Principles 3 and 4



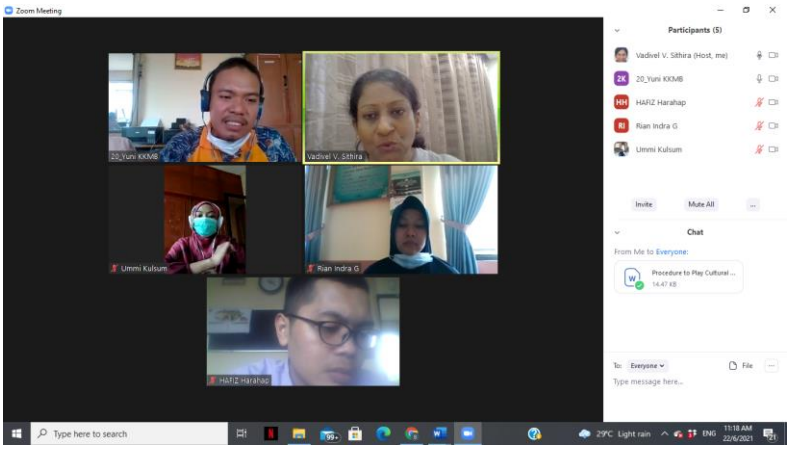
Guiding Principles 3 and 4.

Using the Guiding Principles to Plan Quality Learning Experiences

The Process (Teachers briefing)

Teachers can stimulate and motivate students with cultural questions in discussions before ICT activities. Examples of questions to encourage and inspire conversations include:

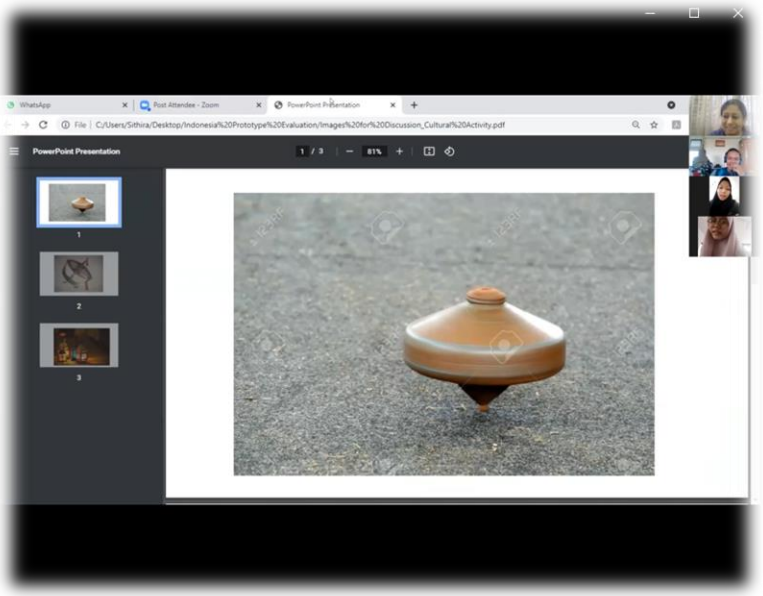
- How many of you have played these games? (*Displaying images of Gasing, wau, and lanterns*)
- When did you last play them?
- Did you enjoy playing these games?
- How fun was the game?
- What is encouraging about these games to you?
- To be kind, would you share your knowledge with others?
- What are some auspicious activities in which you have participated?



Teachers Briefed on Culture-Based Teaching.

The Process (Students' Learning Process)

Students complete activities as part of the learning process in class.



Students Participate in Cultural Discussions.

Students Participate in a Culture-Based Activity.

Students Participate in a Culture-Based Activity Discussion.

Appendix C - Technology used in the classroom (Teacher)

1. How many years have you taught at your current school?
   □ < 1 year □ 1-2 years □ 3-5 years □ 6-10 years □ > 10 years

2. How many years have you taught throughout your career?
   □ < 1 year □ 1-2 years □ 3-5 years □ 6-10 years □ > 10 years

3. What is your gender?
   □ Male □ Female

4. Please select the appropriate range for your age.
   □ 20-30 □ 31-40 □ 41-50 □ >51

5. What subjects do you currently teach? Please mark ALL that apply.
   □ Language (Language taught: _____)
   □ Mathematics
   □ Geography
   □ Science
   □ History
   □ Music/Arts
   □ Others (Please specify: _____)

6. What level(s) do you currently teach? Please mark ALL that apply.
   □ Lower secondary (1-2) □ Upper secondary (3-5)

7. Select the type of students you manage during lessons? Please mark ALL that apply.
   □ Active
   □ Quiet/passive
   □ Weak
   □ Shy
   □ Others (Please specify: _____)

Section A: Types of technology used in the classroom

Technology Description	Never	Monthly	Weekly	Daily	N/A
Internet for research/solving problems.	□	□	□	□	□
Internet for developing lessons.	□	□	□	□	□
Mobile Device (Eg. Smartphone).	□	□	□	□	□
Tablets (Eg. Ipad).	□	□	□	□	□
Learning Management Systems (Eg. Online Blackboard).	□	□	□	□	□

Online Videos (Eg. YouTube).	□	□	□	□	□
Collaboration Tools (Eg. Google Drive).	□	□	□	□	□
Electronic Mail.	□	□	□	□	□
Social Media (Eg. Facebook, Twitter).	□	□	□	□	□

Section B: Technology Competency

Technology Description	**Competent**	**Adequate**	**Weak**	**Very Weak**	**Never Used**
Using the Internet for research/solving problems.	□	□	□	□	□
Using the Internet for developing lessons.	□	□	□	□	□
Using Mobile Device assisted teaching (Eg. Smartphone).	□	□	□	□	□
Using Tablets assisted teaching (Eg. Ipad).	□	□	□	□	□
Managing Lesson Materials Online (Eg. Blackboard).	□	□	□	□	□
Online Videos assisted teaching (Eg. YouTube).	□	□	□	□	□
Using collaboration tools assisted teaching (Eg. Google Drive).	□	□	□	□	□
Using Electronic Mail assisted teaching.	□	□	□	□	□
Using social media-assisted teaching (Eg. Facebook group chat).	□	□	□	□	□

Section C: Opinions and attitudes on technology use in the classroom

When using the technology (Internet, mobile devices, social media, collaboration tools, email) during lessons….	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Is there sufficient professional development for teachers for technology-assisted teaching?	□	□	□	□	□
Students demonstrate a higher level of learning.	□	□	□	□	□
Students are more motivated.	□	□	□	□	□
There is more student collaboration.	□	□	□	□	□
There is more teamwork among students.	□	□	□	□	□
It is easier to make students understand the topic.	□	□	□	□	□
It is easier to get quiet students to participate.	□	□	□	□	□
Students get distracted easily.	□	□	□	□	□
Students go to inappropriate sites.	□	□	□	□	□

Section D: Managing cultural issues with technology during lessons

When using specific technology in the classroom (The Internet, mobile device, collaboration tools, emails, YouTube, LMS, social media)	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Are Male students more proactive in using the Internet to solve problems?	□	□	□	□	□
Do students wait for instructions before exploring mobile-assisted learning (Eg, LMS)?	□	□	□	□	□
Students practice mannerisms and respect for teachers and parents when posting comments on social media (Eg. Facebook-Group Chat, WhatsApp, Twitter)?	□	□	□	□	□
Do students use the collaboration tools to share and post questions to teachers without being instructed?	□	□	□	□	□
Individual students email teachers more often to clarify doubts than in groups.	□	□	□	□	□
Do you agree that students discuss actively in groups during mobile device activities? (Eg. Feedback on experiments or outdoor activities)	□	□	□	□	□
Do students get bored using the same technology for learning a topic? (Eg. Tablet for research work or outdoor activities)	□	□	□	□	□
When using technology in the classroom….	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Students are constantly motivated during technology-assisted learning.	□	□	□	□	□
Using different technology for different activities help students to understand the topic better (Eg. YouTube for a Science activity).	□	□	□	□	□
Can I instantly change technology for different activities to suit students' learning behaviour?	□	□	□	□	□
It eases managing different types of learners (Eg. Active, passive, weak, shy)	□	□	□	□	□
Do students wait for teachers' instructions before proceeding with the technology-assisted classroom activities?	□	□	□	□	□
Are students very dependent on teachers during technology-assisted classroom activities?	□	□	□	□	□
Technology-assisted activities have more value when students work in groups than as individuals?	□	□	□	□	□

Male students learn faster during technology-assisted classroom activities than female students.	□	□	□	□	□
Do male students dominate technology-assisted learning activities?	□	□	□	□	□
Is there power distance during technology-assisted learning? (Eg. Students from the poor community are more passive than students from the affluent community?)	□	□	□	□	□
Do students prefer traditional classroom learning to technology-assisted learning?	□	□	□	□	□
Do you agree that students require different technology/approaches in learning various topics?	□	□	□	□	□

Appendix D - Technology used in the classroom (Student)

1. What is your gender?
   □ Male □ Female

2. Please select the secondary level you are studying.
   □ Lower secondary (1-2) □ Upper secondary (3-5) Others: _____

3. Do you own the following mobile/computer devices? Please mark ALL that apply.
   □ Laptop □ Smart phone □ Tablet PCs □ Handheld PDAs

Section A: Types of technology used in the classroom

Technology Description	Never	Monthly	Weekly	Daily	N/A
Internet	□	□	□	□	□
Mobile Device (Eg. Smartphone)	□	□	□	□	□
Tablets (Eg. Ipad)	□	□	□	□	□
Learning Management Systems (Eg. Blackboard)	□	□	□	□	□
Online Videos (Eg. YouTube)	□	□	□	□	□
Collaboration Tools (Eg. Google Drive)	□	□	□	□	□
Electronic Mail	□	□	□	□	□

Section B: Technology Competency

Technology Description	Competent	Adequate	Weak	Very Weak	Never Used
Using the Internet for research/solving problems	□	□	□	□	□
Using Mobile Device assisted learning (Eg. Smartphone)	□	□	□	□	□
Using Tablets assisted learning (Eg. Ipad)	□	□	□	□	□
Managing assignments/exercises Online using Learning Management Systems (Eg. Blackboard)	□	□	□	□	□
Online Videos assisted learning (Eg. YouTube)	□	□	□	□	□
Using collaboration tools assisted learning (Eg. Google Drive)	□	□	□	□	□
Using Electronic Mail assisted learning.	□	□	□	□	□
Using social media-assisted learning (Eg. Facebook	□	□	□	□	□

Section C: Opinions and attitudes on technology use in the classroom

When using the technology (Eg. The Internet, mobile devices, collaboration tools, email, social media) …….	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I look forward to using the Internet during lessons.	□	□	□	□	□
I feel motivated when a mobile device (Eg. Smartphone) is used in the learning process.	□	□	□	□	□
I can collaborate with my classmates better.	□	□	□	□	□
There is more teamwork in my group.	□	□	□	□	□
I understand the topic better.	□	□	□	□	□
I get distracted easily.	□	□	□	□	□

Section D: Managing cultural issues with technology during lessons

When using technology (The Internet, mobile device, collaboration tools, emails, YouTube, LMS, social media) in the classroom….	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I am constantly motivated during technology-assisted learning.	□	□	□	□	□
Using different technology for different activities helped me understand the topic better.	□	□	□	□	□
I prefer to work in groups than as an individual during Technology-assisted activities as it has more value and we can clarify doubts about technology use.	□	□	□	□	□
I feel bored when teachers use the same technology when teaching a topic.	□	□	□	□	□
I learn better when teachers use different technology during lessons (Eg. mobile device, internet, email discussion, YouTube)	□	□	□	□	□
I prefer traditional classroom learning to technology-assisted learning.	□	□	□	□	□

Appendix E - Interview Questions (Teacher)

- How do you use technology to motivate students?
- Do you think using technology stimulates learning, and why?
- What are the challenges you face when using technology in the classroom?
- How do you manage students' behaviour (e.g., active, passive/quiet, shy) when using technology in the classroom?
- What type of technology-related professional development have you attended?
- Do you think students learn and respond better during technology-assisted learning, and why?
- Is the current professional development sufficient? If not, what is required to assist a teacher in technology-assisted teaching?
- How can the school assist you in using the technology competently during lessons?
- Do you think cultural barriers (among students) exist when using technology in the classroom? If yes, can you further explain these barriers?
- In which ways do you think a teacher can improve technology-assisted learning in the classroom to motivate students?
- In your opinion, how does Asian students' culture affect their learning ability in using technological tools in the classroom and during activities?
- Do you believe that Asian culture has a barrier to using extensive technology-based learning?

Appendix F – Focus group Questionnaire (Technology Interface): Students

1. Is easy-to-use UI motivate learning?
2. Is colourful UI stimulating the learning experience?
3. Do simple UI enhance the learning experience?
4. Is easy-to-use UI practical and fun?
5. Do quick downloading and uploading of materials enhance the learning experience?

Appendix G – Focus group Questionnaire (Technology Interface): Teachers

1. Do you agree that using technology motivates learning?
2. Do you agree that an easy-to-use user interface (UI) for Learning Management Systems (LMS) will cut down on setup time?
3. Do you agree that a colourful user interface (UI) in an educational tool/technology will encourage and attract teachers to use the tools?
4. Do you agree that a colourful user interface (UI) in an educational tool/technology will improve teachers' teaching experience?
5. Do you agree that a simple user interface (UI) design for an educational tool/technology will enhance teaching?
6. Do you agree that an easy-to-use user interface (UI) for educational tools/technology is essential to facilitate teaching?

Appendix H - Interview on Technology Tools for Education in Southeast Asia

Questions for Pre-Design interview

- What are the challenges faced by Southeast Asian teachers in using technology in the classroom?
- What are the challenges faced by Southeast Asian students in using technology in the classroom?
- What are your challenges using technology?
- How do you perceive the current User interface (UI) in meeting the challenges of Southeast Asian teachers and students?
- How can educational technology use be improved?

Appendix I – Summary of Main Discoveries from Surveys

Findings	Description	Data
Finding 1.1	Southeast Asian (SEA) teachers use less educational technology in teaching than previously known, contradicting the findings of the UNESCO report in 2012. This shows a clear need for new ICT solutions for education for SEA.	United Nations Educational, Scientific and Cultural Organisation's (UNESCO) 2012 statistics state that "Malaysia is at 91% in terms of information and communications technology (ICT) infrastructure in schools with Internet access." My study suggests low use of technology and digital tools in classroom activities by teachers (using the Internet to develop lessons, Mobile device use, Online video, collaboration tools, email and social media < 2.7) for Malaysia, Indonesia, Philippines and Brunei (4=daily, 3=weekly, 2=monthly, 1=never, 0=NA)
Finding 1.2	The current education technology is not culturally compatible for SEA teachers. It causes *anxiety* for Southeast Asian Teachers. This, in turn, makes teachers uncomfortable using ICT for teaching,	My study suggests the two ICT educational tools scored the lowest use among teachers, with a mean of <1.4 for "Learning Management Systems" (the Philippines and Brunei) and a mean of

	which affects students' learning with technology.	<1.95 for "Online Video" (Indonesia and Brunei) (4 = daily, 3 = weekly, 2 = monthly, 1 = never, 0 = NA)
Finding 2.1	Students prefer teacher-centred learning over mobile-based learning.	This is partly due to teachers' lack of ICT exploration in classrooms (Finding 1.1). A mean score of between 2.64 - 2.75 for 49% of students and between 3.19 - 3.62 for 51% of students (1 = strongly disagree, 5 = strongly agree) for the construct of "students prefer traditional classroom learning to technology-assisted learning". This result shows students are more content in traditional classrooms with the teacher's presence.
Finding 2.2	SEA students are less anxious when ICT (Eg. mobile learning, LMS, online video) is used during technology-assisted learning and when teachers guide technology-assisted learning.	Students data for the construct of "intention to use" for the learning technology shows mean > 2.92 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree).
Finding 2.3	SEA students are less anxious about using ICT for learning compared to teachers' emotional state of being nervous when using ICT for teaching.	Teachers' data for the construct using ICT for teaching "Use of the Internet for developing lessons", "Mobile Devices Use", and "Online video use" shows a mean < 2.85. Students' data for the construct of using educational technology for learning "Internet for Research", Mobile Device Learning", "Online Video Learning", and "Learning Management Systems" shows a mean > 2.92 *(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)*.
Finding 3.1	The significant presence of cultural emotion states, such as anxiety (using	Students' data for the construct of "better collaboration with class mates"; "better

	technology), happiness (technology interaction), relaxation (guided by the teacher), calmness and satisfaction (interacting with classmates) are present among SEA students when using ICT.	teamwork among students",; "Better understanding of the topic", and "Learn better when using different technology" shows a mean > 3.70
Finding 3.2	SEA Students are Satisfied and Calm (Classmate interaction). When students interact *with their classmates with ICT*, SEA students feel satisfied and calm instead of anxious. (Eg. Better collaboration with classmates, better teamwork, understanding the topic better and learning better with different technology)	
Finding 3.3	SEA Students are more 'Relaxed and Happy with teacher presence'. SEA students are more relaxed and happier in the classroom when teachers guide students and with teachers' presence during technology-assisted learning (Eg. Internet lessons; understanding lessons better when using different technologies; motivated when mobile devices are used; constantly inspired during technology-assisted learning)	Students' data for the construct of "Anticipate Internet Lessons"; "Deep understanding of different technologies for different activities" shows a mean > 3.65. Students' data for the construct of "more motivated when using mobile devices"; "students are constantly motivated during technology-assisted learning" shows a mean > 3.71
Finding 4.1	SEA teachers' ICT experience has minimal impact on students' intention to use ICT for learning. SEA teachers are more anxious when using educational technology for personal use and teaching compared to students using educational technology for learning. This result had minimal impact on students' intention to use ICT, and students look forward to using ICT in the classroom.	a. Result shows teacher data on the use of ICT with a low mean < 2.8 for "using the Internet to develop lessons"; "Mobile devices use"; "Learning Management use"; "Online Video use" with Brunei showing the lowest mean value *m=0.91* for Learning Management (LMS) which shows the use between never to not applicable) - (4 = *daily*, 3 = *weekly*, 2 = *monthly*, 1 = *never*, 0 = *NA)* b. Result show students data for "intention to use" for ICT (Internet,

		Mobile device, Learning management, Online Video) shows mean > 2.92 and with Brunei students data showing mean> 4.0 for "Internet for Research" and M>2.9 for "Learning Management System" - (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree).*
Finding 5	**Cultural barriers** (Current ICT tools as incompatible with Southeast Asian teachers and students):	a. Refer to results Focus Group
Finding 5.1	Southeast Asian values, such as placing significant importance on race, religion, custom and practices, hinder Western values and approaches Eg. adaptation to westernise influences technology.	
Finding 5.2	Customs, such as placing importance on traditional rites, music, arts (Eg. silk painting - batik, handicraft, kite flying), and festivals hinder Western customs, Eg. westernise styles, artefacts, and western presentation.	
Finding 5.3	Practices, such as showing respect for their traditions and auspicious practices Eg. importance to family, artistic practices - using hands and chopsticks for eating, respect for the elders, humble greetings and gestures, and importance to auspicious events hinder westernise practices, Eg. showing importance to individualistic, less importance to elderly advice, less importance to auspicious occasions.	
Proposed Guidelines for CME		

Guideline 1: Cultural interactive activities as learning activities – Learning activities based on interactive cultural activities will lower cultural barriers by integrating customs and cultural practices, as shown in Finding 5.2 and 5.3. Using ICT with interactive cultural activities and delivery modes in learning lowers cultural barriers and stimulates discussions in class, resulting in improved learning outcomes and learning experiences.

Guideline 2: Auspicious learning activity – Auspicious Interaction of designing an auspicious object with what they have learned will lower cultural barriers, as shown in findings 3.1 and 5.3. Students can also share knowledge learned with others through such an activity. Using ICT with auspicious sharing and giving lowers cultural barriers and stimulates class discussions, resulting in improved learning outcomes and learning experiences.

Note: All ICT activities guided by teachers

Findings	**Description**	**Data**
Finding 6.1	SEA Students learning outcomes improved significantly in the classroom and when "Festive Theme" mobile learning was used.	SEA Students achieved higher learning outcomes in classroom activity and mobile learning with a 'festive theme' activity compared to a "standard theme" activity. Students completed seven pre-test questions on Photosynthesis before the activity and attempted the same post-test questions after the activity. Achievement results showed: a) Classroom activity with 14.16% achievement; b)"Festive theme" activity with 14.12% achievement; c)"Standard theme" activity with: 6.54% achievement.
Finding 6.2	Cultural themes have a "silent positive impact" on SEA students' learning outcomes.	Results show SEA students learn better with higher learning outcomes during the "Festive theme" activity, as shown in Finding 6.1.

Finding 7	The improved learning experience with mobile learning with minimal negative interactions. SEA Students rated both the "Standard theme" and "Festive theme" activity with a similar learning experience as both have minimal negative interactions.	a) Motivation during activity: Classroom: *M=4.25*; Standard theme: *M=4.27*; Festive theme: *M=4.31*;
		
		b) Fun during activity: Classroom: M=3.96; Standard theme: M=4.19, Festive theme: M=4.12;
		
		c) Happiness during activity: Classroom: M=4.3; Standard theme: M=4.3; Festive theme: M=4.1;
		
		d) Excitement during activity: Classroom: M=4.1; Standard theme: M=4.2; Festive theme: M=4.0

Finding 8	SEA Teachers' cultural emotion states were higher compared to students when "Festive theme" ICT was used for teaching and learning.	Results show SEA teachers score higher mean >=4.4 when using the cultural "Festive theme" ICT was used to evaluate the 'Teaching and Learning' experience for the construct of Motivation, Excitement, Happiness, Enjoyment, and Fun. **(1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree).***

Proposed Guidelines

Guideline 3: Use of cultural theme for educational technology - Learning activity based on cultural themes stimulates empathy and lowers cultural barriers, as shown in finding 6.1 and 6.2. ICT with cultural themes can foster empathy and lower cultural barriers resulting in improved learning outcomes.

Guideline 4: More positive auspicious hints/advice with cultural gift metaphors - Learning activities based on cultural themes lower cultural barriers by integrating positive advice and positive interactions, as shown in finding 7 and 5.3. ICT with auspicious positive advice and positive interactions lower cultural barriers and improves the learning experience.