# Cultivating Awareness on Email Security Threats among School Children via Game-Based Learning Approach (CEG)

by

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Dissertation report submitted in partial fulfilment of
the requirements for the
Bachelor of Technology (Hons)
(Business Information Systems)

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# CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Business Information Systems Programme
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Approved by,

(Ms Mazeyanti bt Mohd Ariffin)

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

MAY 2011

# CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

Nurul Hazwani bt Sahadek

# ABSTRACT

Internet has brought a huge transformation in many aspects of our life as it is one of the biggest contributors in making the world into global village. The percentage of internet users has increase rapidly across age including children nowadays. Despite giving many benefits to the users, the impressive change of Internet has brought high concern about the threats to safety and security among the users especially for the children nowadays. High concern rises among global expertises on child's online protection as it can harm the children physically and emotionally. Email security threats are one of the cyber threats problem that child should aware to avoid any incidental causes which lead towards negative impact. However, the level of awareness on this issue among Malaysian children is low. Therefore, this paper proposes an alternative method in cultivating early awareness on email security threats among school children in Malaysia. Child Email Game (CEG) has been developed based on game based learning model by using Adobe Flash Professional CS 5 software. Through this interactive and fun approach, CEG is expected to assist them in identifying the emails security threats accordingly.

# ACKNOWLEDGEMENT

In the name of Allah The Most Gracious and The Most Merciful.

First and foremost, praised be to Allah The Almighty as for His blessings, I have successfully completed my Final Year Project (FYP) under the supervision of Ms. Mazeyanti Mohd Ariffin .I also would like to express my deepest gratitude and appreciation to my supervisor as she has been a great source of reference in fulfilling all the FYP requirements.

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# CHAPTER 1

# PROJECT BACKGROUND

## 1.1 BACKGROUND OF STUDY

Internet has brought a huge transformation in many aspects of our life as it is one of the biggest contributors in making the world into global village. Because of its flexibility, the use of internet has grown tremendously since it was introduced. Domestic Trade, Cooperative and Consumerism Deputy, Minister Tan Lian Hoe claimed that the rate of internet users in Malaysia has increased rapidly in nine years which achieved the government target through half percent broadband penetration (Nam News Network, 2010). Figure 1 below shows the percentage share of internet users by age.

| | Percentage Share of Household user base | | | |
|---|---|---|---|---|
| *Age catagory* | *2005* | *2006* | *2008* | *2009* |
| Below 15 | 6.5 | 7.3 | 6.8 | 8.1 |
| 15 - 19 | 18.6 | 18.7 | 17.9 | 19.2 |
| 20 - 24 | 17.2 | 16.3 | 15.7 | 14.2 |
| 25 - 29 | 13.5 | 11.3 | 11.9 | 12.9 |
| 30 - 34 | 12.2 | 12.3 | 11.7 | 11.4 |
| 35 - 39 | 9.9 | 10.4 | 11.2 | 9.5 |
| 40 - 44 | 9.6 | 10.6 | 9.3 | 9.4 |
| 45 - 49 | 5.1 | 6.1 | 6.1 | 5.1 |
| 50 and above | 8.4 | 7.1 | 9.4 | 10.2 |

Figure 1: Percentage Shares of Internet Users by Age (Koay, 2010)

Norton, an Internet company disclosed that on average Malaysian children spend more than fifty hours online every month (Joshua, 2010). Therefore, in this challenging world, internet has become a part of kid's natural environment as it provides children with variety of learning opportunities that emerge to enhance problem solving, critical thinking skills, decision making, creativity, language skills, knowledge, research skills, the ability of integrate information social skills and self esteem (Mayesky, 2009).

However, the impressive change of Internet has brought high concern about the threats to safety and security among the users especially for the children nowadays. According to International Telecommunication Union (2010), there are several issues that have been discussed by global expertise on the bad and negative impacts underlying on internet usage among children such as online gaming and addiction, online fraud, pornography, violence, cyber bullying and racism as well as email security threats (Cocca, 2005).

## 1.2 PROBLEM STATEMENT

Malaysian Communications and Multimedia Commission (2006) defined spam as 'all associated bulk emails' that shares the common aspects such as non-consensual, indiscriminant, repetitious, illegal as well as unsound content or being forged or altered. The spam incidents emerge day by day and this issue has been discussed globally by the expertise. Based on Figure 2, MyCERT (2008) reported that spam mark the highest case compared to other incidents and second highest percentage between Quarter 3 and Quarter 4.

| | Q3 2008 | Q4 2008 | % |
|---|---|---|---|
| Harassment | 12 | 34 | 183.3 |
| Fraud | 260 | 353 | 35.77 |
| Hack Threat | 24 | 34 | 41.67 |
| Malicious Code | 69 | 58 | -15.94 |
| Denial of Service | 2 | 3 | 50 |
| Intrusion | 331 | 295 | -10.88 |
| Spam | 20963 | 32261 | 53.89 |
| **Total** | 21661 | 33036 | 52.51 |

Figure 2: Incidents Reported in Q3 2008 and Q4 2008 (MyCERT, 2008)

According to the survey done by Mohd Arif Ibrahim (2010), the level of awareness among Malaysian children about identity theft, harassment and spam is low. Figure 3 shows the statistical of Malaysian children awareness towards cyber threats.

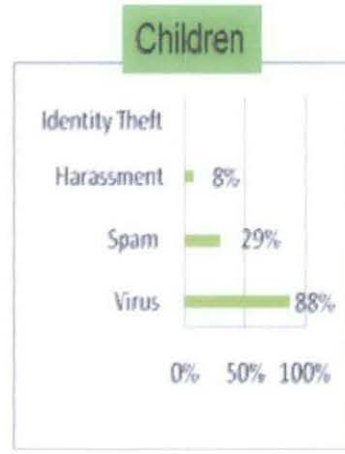


Figure 3: Statistical of Malaysian Children Awareness towards Cyber Threats

(Mohd Arif Ibrahim, 2010)

Based on Cocca (2005), there are three main categories of threats to email security which are viruses, spam and phishing. MyCERT (2008) stated that spam emails were recorded higher with phishing emails as the top categories and Trojan emails go after. Lack of awareness on this crucial issue may harm children who are the next generation in the future. Figure 4 illustrates Malaysian parents' actions towards their children on the issue of the internet. This problem become more crucial as no measures taken by the parents indicate the higher percentage compared to others.

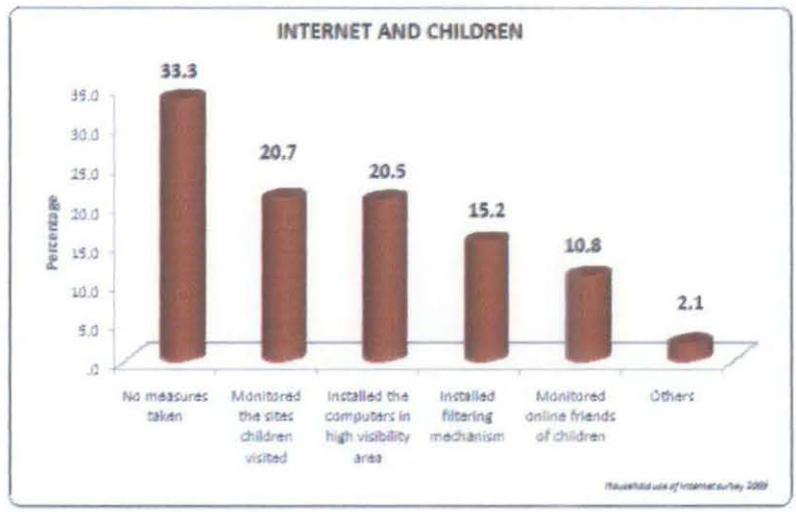


Figure 4: Parents Actions towards Internet Activity within Their Children (Koay, 2010)

Therefore, there is a need to nurture early awareness on emails security threats among school children nowadays as they are part of the email users' portion. Thus, Child Email Game (CEG) is proposed to assist them in identifying the emails threats through game-based learning approach.

## 1.3 OBJECTIVES

1. To identify email security threats issues.
2. To develop a computer game that cultivates early awareness among children on email security threats issues.

## 1.4 SCOPE OF STUDY

This research project target is to get the understanding on email security threats elements and cultivating early awareness about safer internet environment among children. In parallel with this project, one game-based learning application has been proposed to measure the improvements on children awareness. The main target audiences are the children aged 11 to 13.

According to Baumgarten (2003), during this age, the youngsters become immersed in internet activities from which they can learn to have fun and gain self-esteem. The growing ability to reason logically provides them the opportunity to engage in strategy –based activities and contests, mathematical understanding allows for more complicated number-based play and more advanced form of scoring. Youngster in this age group has a desire in internet activities.

CEG is designed to meet current situation where the focus point is not on the spam problem only. Blending together with the virus and phishing email issues, the game is expected to give broad overview about email security threats to the children. Children

need to identify the characteristics of emails security threats before they can classify them accordingly in order to get higher point.

Game-based learning has been discovered many years before and this medium is believed to provide fun and interesting learning process for the children nowadays. There are many tools available in the market used to develop a game such as RPG Maker, A Gen 2D Game Engine, Flash, Game Maker and Game Editor. In completion with this project, CEG has been developed by using Adobe Flash Professional CS5 software.

## 1.5 THE RELEVANCY OF THE PROJECT

The project undertaken is in line with today's issues which is the emerging of email security threats problems. CEG is expected to nurture early awareness about this issue among kids nowadays and give them an overview on the precaution measures that should be practice in the future.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 PLAY & CHILD DEVELOPMENT

According to Sully (2007), play is defined as 'freely chosen; personally directed, intrinsically motivated behavior that actively engages the child. Play can be fun or serious.'. Play is actually an essential routine in children's daily life. According to Ginsburg, et al. (2007), play is a right of every child as it drives towards child development optimization.

Play and children cannot be apart as they are by nature playful. There are some of play theorists throw in their thought in play definition and key concept(s) that indicate play has a crucial role in children's learning. Table 1 below gives general overview on each theorist's definition of play (Mayesky, 2009):

Table 1: Theories of play

| Theorist | Definition of Play | Key Concept(S) |
|---|---|---|
| Parten (1932) | Play is a measure of child's increasing social maturity | Developmental stages of play: onlooker, solitary, parallel, associative, cooperative |
| Piaget (1962) | Play is assimilation – child makes world adapt to him | 3 stages of play: sensorimotor, symbolic and game with rule |
| Smilansky (1968) | Play aids child's social development | Six criteria of dramatic play: imitative role-play, make believe, verbal make believe, persistence in role play, interaction and verbal communication |
| Vygotsky (1977) | Play directly supports the development of child's cognitive powers | Symbolic play promotes abstract thinking |

There are many benefits gain by children while playing. According to Mayesky (2009), play can contribute towards physical growth, mental growth, emotional growth and social growth. Based on Ginsburg, et al. (2007) play let the children stimulate their creativity and at the same time develop their imagination, dexterity and physical as well as cognitive and emotional strength. Apart from that, play is essential to healthy brains development as they engage and interact in the world around them. As a result, they able to cultivate new competencies that lead to enhance confidence and the re-saliency they will need to face future challenges (Hurwitz, 2003).

Based on Ginsburg, et al. (2007), play is central to the academic environment as it assist children to adjust to the school surrounding and enhance children's learning readiness, learning behavior and problem solving skills.

CEG is expected to assist children in enhancing their creativity and imagination as they need to capture and digest the entire emails security threats clue before classifying it

accordingly. This would direct towards positive growth of mental and emotional among the children.

## 2.2 PLAY & TECHNOLOGY

According to Downey, Hayes and O'Neill (2007), there are many key skills that children can develop through collaboration between technology and play such as social skills and problem-solving strategies. Table 2 shows the interrelation between technology and multiple intelligences that give benefits to the children (Mayesky, 2009).

Table 2: Multiple Intelligences and Technology

| Multiple Intelligences | Technology Integration | Benefits |
|---|---|---|
| Linguistic Intelligence | Word Smart | • Desktop publishing program<br>• Program that allow children to create stories, poems and essays<br>• Multimedia authoring<br>• Videodiscs to create presentations<br>• Tape recorders |
| Logical-Mathematical | Logic Smart | • Problem-solving software<br>• Computer-aided design programs<br>• Graphing calculators |
| Visual/Spatial | Picture Smart | • Drawing programs<br>• Image-composing programs<br>• Paint programs<br>• Reading programs with visual clues<br>• Web-page programs<br>• Three-dimensional software<br>• Software games<br>• Spreadsheet programs that allow children to see charts, maps, or diagram<br>• Multimedia authoring programs |
| Musical Intelligence | Music Smart | • Music-computing software<br>• Videodisc player<br>• Programs integrating stories with songs and instruments<br>• Reading programs that relate letter/sound with music<br>• Programs that allow children to create their own music<br>• CD-ROMs about music and instruments<br>• Tape recorder<br>• Word processors to write about a movie or song |
| Bodily-Kinesthetic | Body Smart | • Software games that allows contact with the keyboard, mouse, joystick and other devices<br>• Programs that allow children to move objects around the screen<br>• Animation programs |
| Interpersonal | Person Smart | • Computer games that require two or more people<br>• Programs that allow children to create group presentation<br>• Telecommunication programs<br>• E-mail<br>• Distance education<br>• Help others with any programs |
| Intrapersonal | Self Smart | • Any programs that allow children to work independently<br>• Games involving only one person<br>• Brainstorming or problem-solving software<br>• Instructional games<br>• Word processors for journaling and recording feelings |

Based on the Table 2 above, CEG is believed to encourage the children towards developing their multiple intelligences especially logical-mathematical, visual/spatial and interpersonal skill.

## 2.3 GAME

### 2.3.1 The Game

Game is a difficult concept to describe. According to Adams (2010), game is defined as "a type of play activity, conducted in the context of a pretended reality, in which the participant(s) try to achieve at least one arbitrary, nontrivial goal by acting in accordance with rules". Salen and Zimmerman (2003) illustrated a game as a system in which players engage in simulated conflict, outline by rules that direct towards an experimental effect.

According to Sanford and Williamson (2005), social scientist define games through their psychological while social functions, anthropologists define them according to their historical origin. For businessmen, game is defined through their usage. Oblinger (2006) claimed that games should be thought of as a family of related items because they are different as they are not designed for the same audiences.

### 2.3.2 Game Types

Based on Grace (2005), there are six main categories of game types which are action, adventure, puzzle, role-playing, simulation and strategy. Table 3 shows the game types and the corresponding description.

Table 3: Game Types

| Game Types | Description |
|---|---|
| Action | Game that offer intensity of action as the primary attraction where it emphasized on physical challenges, including hand-eye coordination and reaction-time |
| Adventure | Game that focus on the main attractions which are exploration and puzzle solving instead of physical challenge |
| Puzzle | Game that offer puzzle solving |
| Role-playing | Game that offer the player an opportunity to immerse themselves in the player character's situation |
| Simulation | Game that attempts to replicate various activities in real life in the form of game for various purpose such as training, analysis and prediction |
| Strategy | Game that emphasizes on reasoning and problem-solving |

Grace (2005) defined game genre as 'the way the story is told'. The game genre would be drama, crime, fantasy, horror, mystery, science fiction and war espionage.

Based on the game types characteristics described in Table 3 above, CEG can be classified as a simulation game. According to Narayanasamy et. al (2005), Freedictionary defines simulation games as games that blend together the elements such as skill, chance and strategy which result in the simulation of a complex structure. Payne (2005) claimed that simulation games can be participatory, iterative, procedural or situational in nature. For CEG, this game is fall under procedural simulation games because it is designed to expose the children on email security threats issues which required them to respond to the email received by following set of guideline as given in tutorial part.

### 2.3.3 Game and Education

In the 21st century, we will all be living in a future of exponential change as the Information Technology (IT) power is rapidly transform across the time (Prensky, 2006). We can see the immediate tools switching as example iPad nowadays able to replace and enhance walkman functionality.

Sandford ,Ulicsak, Facer, and Rudd (2006) stated that in a recent survey, 36% of primary school teachers and 27% of secondary school teachers said that they had used games to teach. According to Koster (2005), games are a fundamental part of the evolving human experience and the way in which we learn, providing the opportunity to practice and explore in a safe environment, teaching skills like aiming, timing, hunting, strategy and manipulation of power.

If games are experiential, active, problem-based and collaborative then they have the potential to be effective environments for learning, not specifically because they are games but because the exhibit the characteristics of constructivist learning environment (Whitton, 2007).

## 2.4 GAME-BASED LEARNING

Games have been widely accepted as a good platform to promote learners to actively participate in learning activities (Baid and Lambert, 2010). According to Noor Azli, Nor Azan and Shamsul Bahari (2008), games are much similar like simulation in their fundamental structure and it can be divided into three main parts which are the introduction, the body of the game and the conclusion. Figure 5 below depicts the general structure and flow of the games.

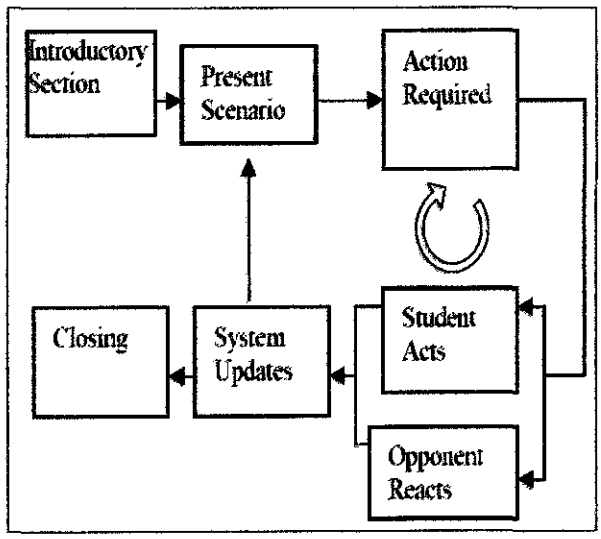


Figure 5: General Structure and Flow of the Games
(Noor Azli, Nor Azan and Shamsul Bahari, 2008)

Game-based learning is often experience-based or exploratory as it relies on experiential, problem-based or exploratory learning approaches (Freitas, 2006). Dickey (2010) claimed researchers have indicated that game-based learning could be the finest method to generate students' learning motivation.

According to Mitchel (2004), game-based learning approach can stimulate the enjoyment, motivation and engagement of users, aiding recall and information retrieval, and also encourage the development of various social and cognitive skills. Some research has also shown that games have been explored as a pedagogical approach to enhance child's learning environment. Based on Tang (2007), game-based learning should have the following characteristics:

- Motivating and engaging but not necessarily entertaining
- Requires participation from learners
- Has clear objectives defined in the game-play and scenarios presented while knowledge can be imparted through storytelling and narrative
- Provide freedom to interact in the game world through a set of defined actions
- Provides clear defined feedback for every action taken
- Match learners pace and intellectual ability
- Highly scalable so can be used for educating large numbers of learners concurrently

There are many game-based learning examples that are available in the market and it is cross-sector adoptions. Figures below are some of the game-based learning application examples according to the sector respectively (Corti, 2006).

Table 4: The Cross Sector Adoption of Game-Based Learning (GBL)

| Sector | Descriptions |
|---|---|
| **Hospitality**<br>  <br>Figure 6: Hospitality GBL | **Hospitality & Catering NVQ**<br>PIXELearning are creating a games-based application that helps students to progress through their NVQ in Hospitality and Catering. |
| **Computer Software**<br>  <br>Figure 7: Computer Software GBL | **"The Monkey Wrench Conspiracy"**<br>A first-person shooter game designed to teach mechanical design engineers to use 3D CAD software. |

## 2.5 INSTRUCTIONAL DESIGN PRINCIPLES

According to Kumaraguru et al. (2010), instructional design principles and methods allow education researchers to examine how people gain knowledge and learn new skills which assist them to develop effective educational materials. There are seven principles involved in designing the online security training which are learning-by-doing, immediate feedback, conceptual-procedural, contiguity, personalization, story-based agent environment and reflection principle. Table 5 summarized the instructional design principles used by Kumaraguru (2010).

Table 5: Instructional Design Principles

| Principle | Explanation |
|---|---|
| Learning-by-doing | People learn better when they practice the skills they are learning |
| Immediate feedback | Providing immediate feedback during the knowledge acquisition phase results in efficient learning |
| Conceptual-procedural | Conceptual and procedural knowledge influence one another in mutually supportive ways and build in an iterative process |
| Contiguity | Presenting words and pictures contiguously (rather than isolated from one another) enhances learning |

To develop an effective educational material, some of instructional design principles have been emphasized in CEG development process such as immediate feedback and contiguity.

## 2.6 RELATED WORKS

The proposed game objective is to cultivate early awareness about email security threats among children aged 6 to 12. By default, there are a few existing games that are quite similar to the proposed CEG. In this stage, research element is crucial to compare the differences among available resources with the proposed CEG. Table 6 below summarizes the key points of games comparison.

Table 6: Comparison between Existing Email Game

| Games | Email Quiz Game | Spam Swatter Game | Email & Spam |
|---|---|---|---|
| **Scope** | Safe and unsafe email | Legitimate email, spam and virus | Safe mail, spam and cyber bully |
| **Game instructions** | Read received emails, decide safe or unsafe email and then respond accordingly whether to open it or delete | Simply click and drag email icon into corresponding field which are x-ray (to scan mail with attachment), inbox (proper email) and trash (for spam) | Read received emails and respond by click on corresponding button which are delete (spam), reply (safe mail) and report (cyber bully) |
| **Level of exposure on email security threats** | Medium because the game emphasize on learning by doing, return immediate feedback and reflection principle | Low due to lack of contiguity between pictures and words | Medium as the game emphasize on learning by doing and personalization |

Based on the previous comparison, proposed CEG has been developed according to the certain criteria as described in Table 7 below.

Table 7: Proposed CEG criteria

| Criteria | Description |
|---|---|
| **Scope** | Legitimate emails, spam, virus and phishing |
| **Game instructions** | Level 1: Players need to classify the type of email security threats received by reading carefully the email context before simply click to its category accordingly.<br><br>Level 2: If the players earn more than minimum score, then they can move to next level. At this stage, the players are expected to respond to the email whether they want to reply, report spam, scan or delete the email. A badge will be given to the users if they earn exceed the minimum points. |
| **Level of exposure on email security threats** | To develop an effective educational materials, one of the instructional design principles has been used such as:-<br><br>• Immediate feedback: Provide feedback through interventions immediately when the player click to corresponding button<br><br>• Contiguity: Presenting the email security threats and it's icon contiguously |

Cyber Security Awareness for Everyone (CyberSAFE) is a CyberSecurity Malaysia's initiative in educating and enhancing the awareness of the general public on the technological and social issues facing by internet users. Various program conducted by this organization towards the cyber community nowadays in achieving the ultimate goals. CyberSAFE did provide cyber-tips, poster and games that can help to prepare the kids in facing the challenging of cyber world. Internet and email safety is one of the topics covered for the kids. Figure 8, 9 and 10 are the examples of mediums used to cultivate kid's awareness on email security threats issues.


Figure 8: Virus Poster


Figure 9: SPAM Poster


Figure 10: Email and SPAM Game

Although not all child have their own email, but the program conducted by CyberSAFE shown that it is important to nurture early awareness among them as they are the futures of tomorrow. Therefore, CEG is developed parallel with CyberSAFE mission.

CEG is a simulation game that developed by using game-based learning approach. Taking into account that child are also part of email users, they have the tendency to the email security threats issues exposure. Thus, it is crucial to meet the project objective which is to cultivate early awareness on email security threats issues among children. The main target would be the children aged 11 until 13. Game has been used as the platform to motivate the children in exploring the email security threats issues through fun medium. In achieving the objective, contiguity element has been embedded in preparing effective educational materials.

# CHAPTER 3

# METHODOLOGY

## 3. 1 RESEARCH METHODOLOGY

Game development flowchart has been chosen as a guideline upon completion of CEG development process. According to Vroman (2009), there are six main phases that involved when developing a game which are concept, plan, design, build, test and release. Figure 11 below shows a game development flowchart.

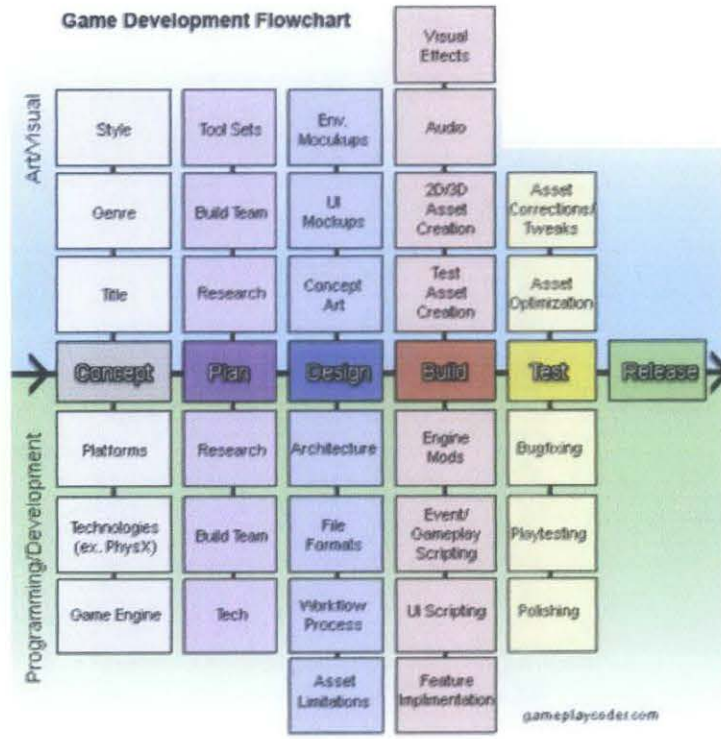


Figure 11: Game Development Flowchart

(Source: Vroman, 2009)

### 3.1.1 Concept

At the early stage, the game concept should be pre-determined in order to get an overview before move into the plan stage. CEG is an educational game that embedded with fun and attractive environment where intrinsically a good platform for children to identify and alert with existing email security threats.

### 3.1.2 Plan

Research is the most crucial in this stage in order to analyze the game requirements for end user. Related works have been examined and embedded in the literature review part as described in Chapter 2.

### 3.1.3 Design

For design phase, the CEG flowchart and storyboard has been prepared before proceed to build stage. Considering the concept used in Email Quiz Game, Spam Swatter Game and Email & Spam Game as discussed in chapter two, CEG has been designed to extend the email security threat issues covered in existing and related games. CEG tutorial and game have been inspired from CyberSAFE efforts through tips and posters for the children.

### 3.1.3.1 CEG Flowchart

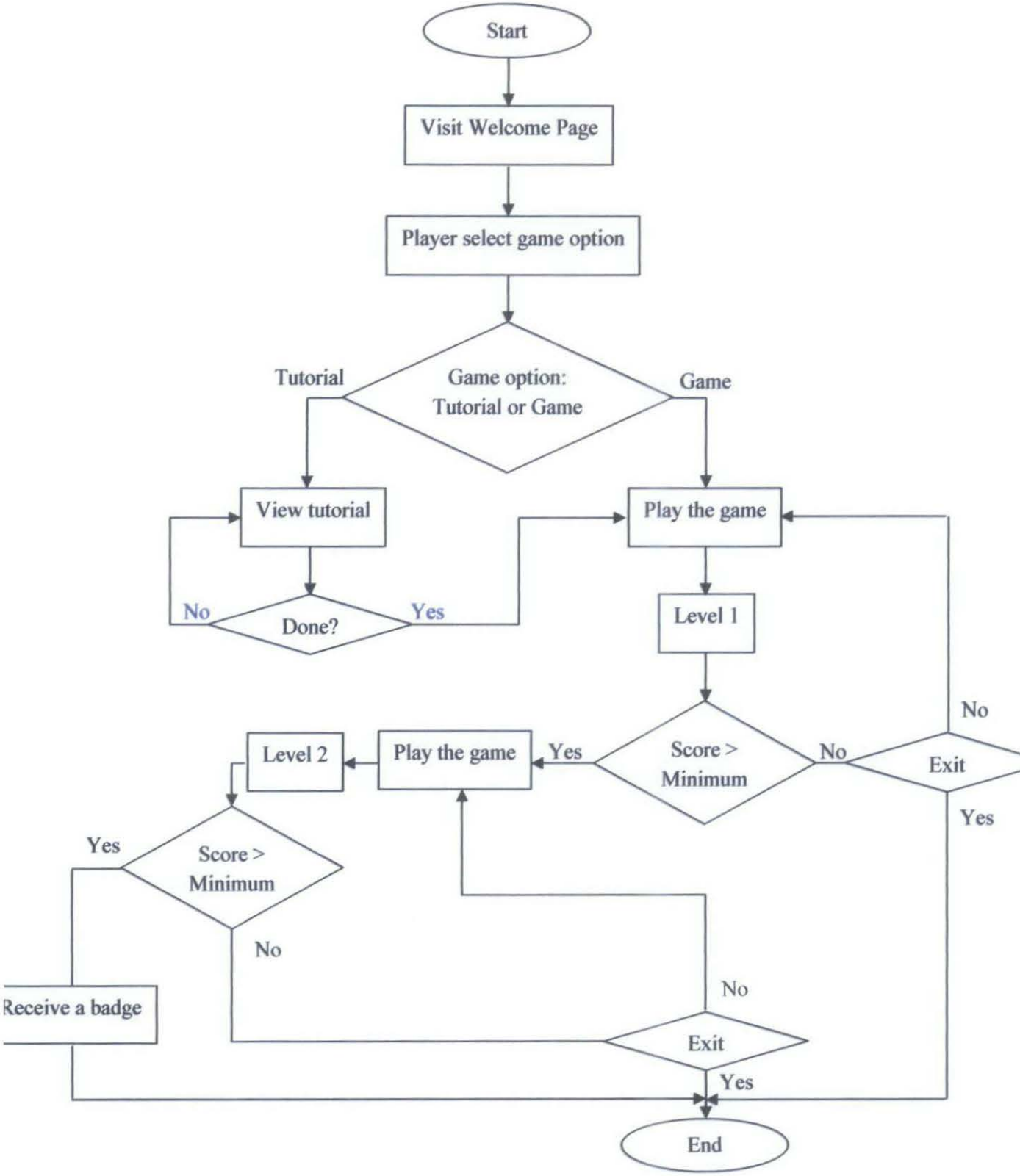


Figure 12: CEG Flowchart

### 3.1.3.2 CEG Storyboard

A storyboard of CEG was designed to provide a better visual interpretation of the game to be developed. Below are overviews on how the game should be look alike:


Figure 13: Welcome Page Screen


Figure 14: How to Play Screen

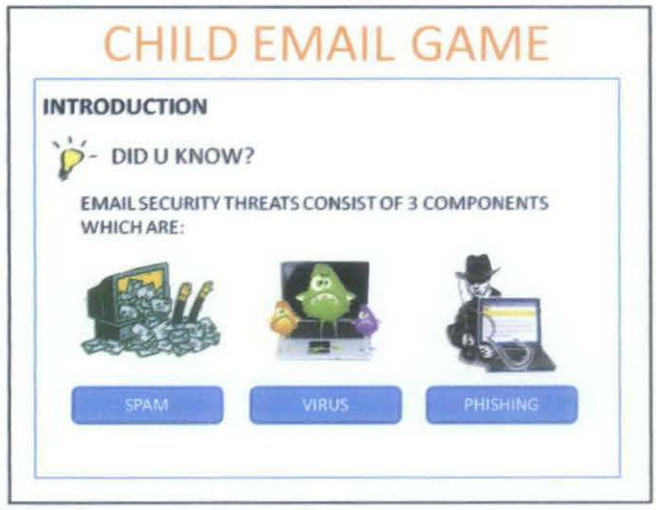


Figure 15: Did You Know Screen


Figure 16: Spam Tutorial Screen

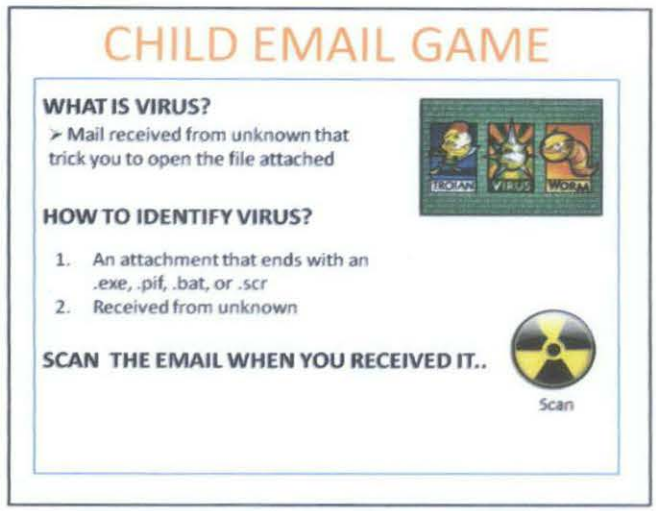


Figure 17: Virus Tutorial Screen

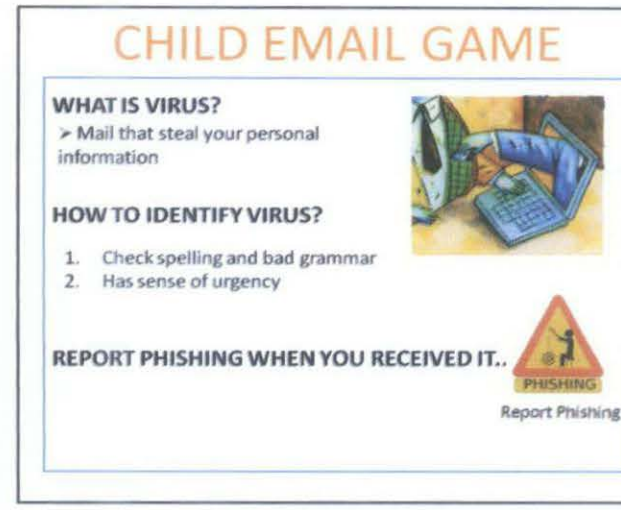


Figure 18: Phishing Tutorial Screen

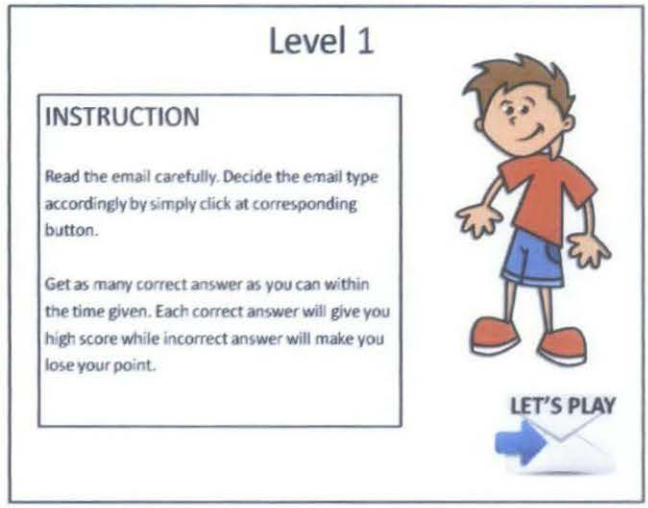


Figure 19: Level 1 Instruction

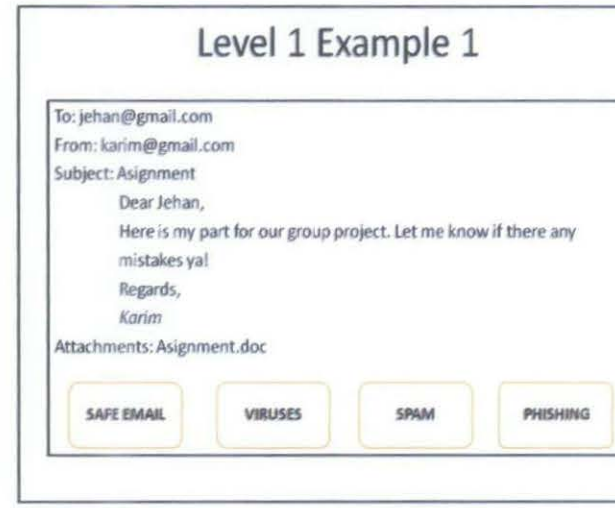


Figure 20: Level 1Question

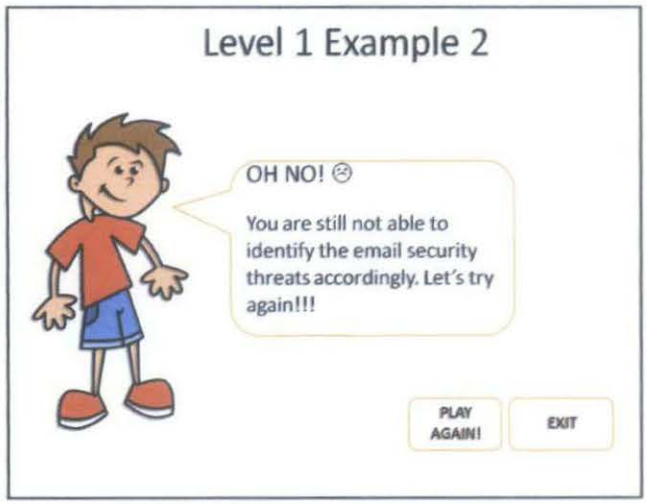


Figure 21: Let's Try Again Screen

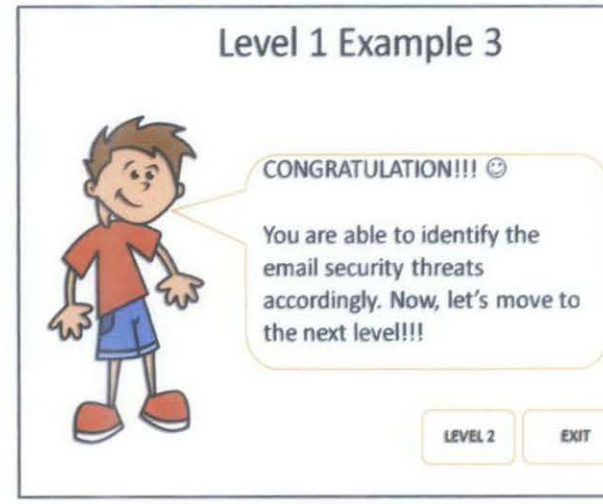


Figure 22: Congratulation Screen

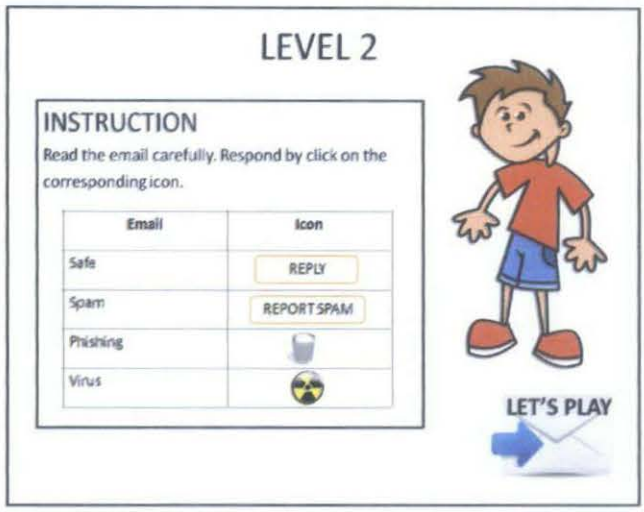


Figure 23: Level 2 Instruction

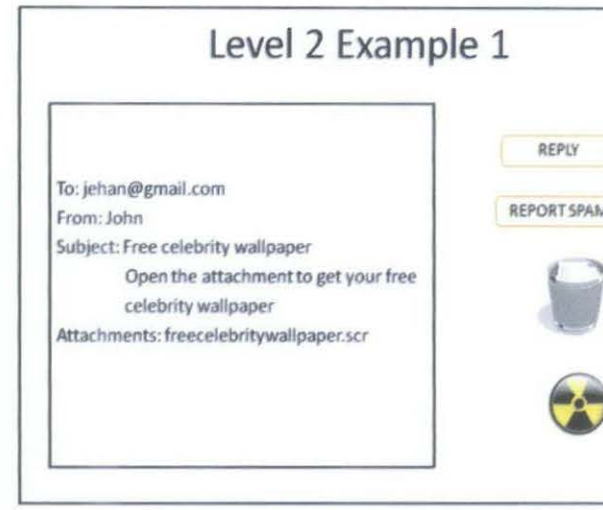


Figure 24: Level 2 question

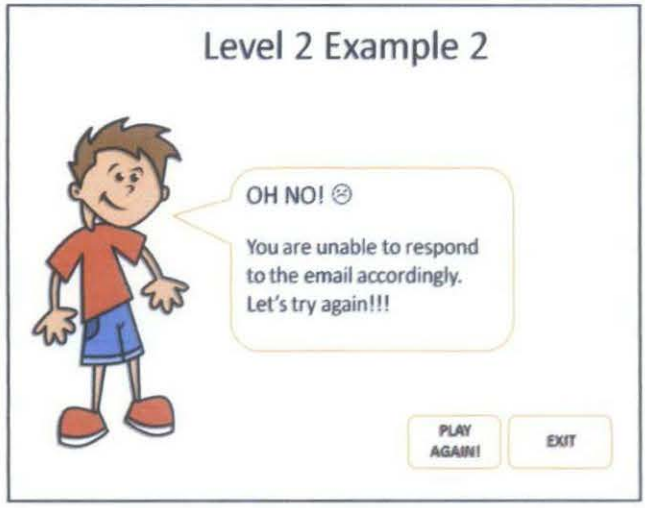


Figure 25: Let's Try Again Screen


Figure 26: Congratulation Screen

### 3.1.4 Build

Based on the storyboard design, CEG has been developed by using Adobe Flash Professional CS5 software. Zero knowledge about flash requires the game developer to explore the fundamentals of flash before moving into development stage.

### 3.1.5 Test

CEG functionality has been testing in the next steps of the game development flowchart.

### 3.1.6 Release

Upon completing test stage, the game then has been released to the target audience which is children aged 11 to 13. In this stage, play testing has been used to measure the awareness level on the email security threats among the players.

# CHAPTER 4

# RESULT AND DISCUSSION

## 4.1 CEG PROTOTYPE

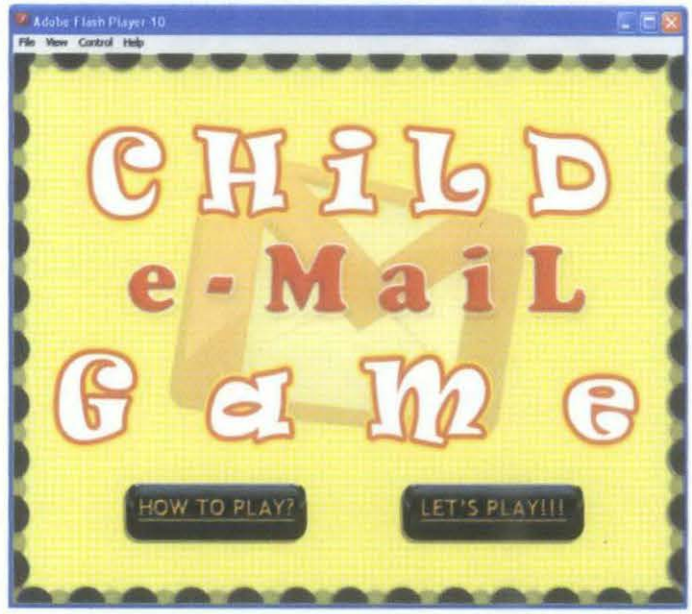


Figure 27: CEG Welcome Page

The player will visit the welcome page when first starting the game as shown in Figure 27. They can choose whether to explore how to play by clicking on the how to play button or straight away play the game by clicking the lets play the game button.

### 4.1.1 Tutorial Page

In this section, the player is given the opportunity to explore and identify the tips and tricks in identifying the email security threats.

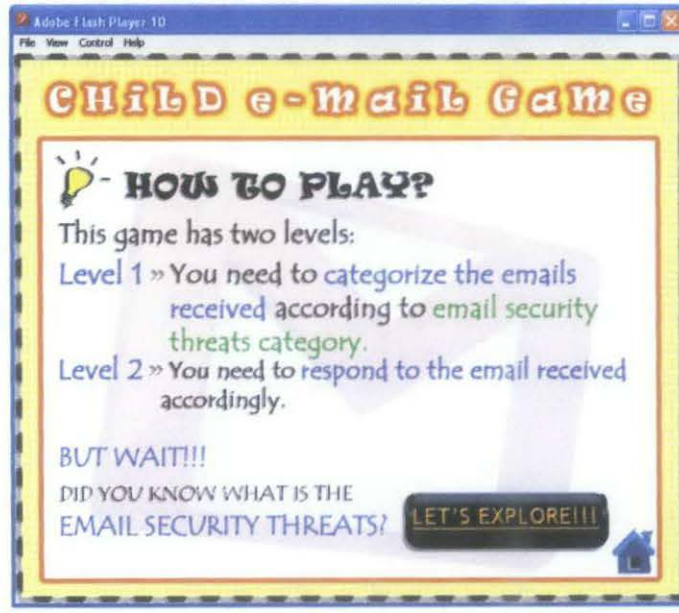


Figure 28: CEG How to Play? Page

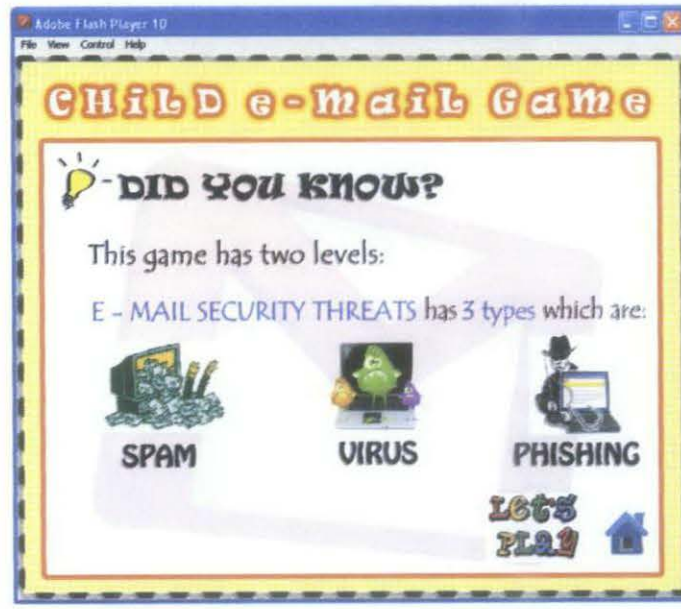


Figure 29: CEG Did You Know? Page

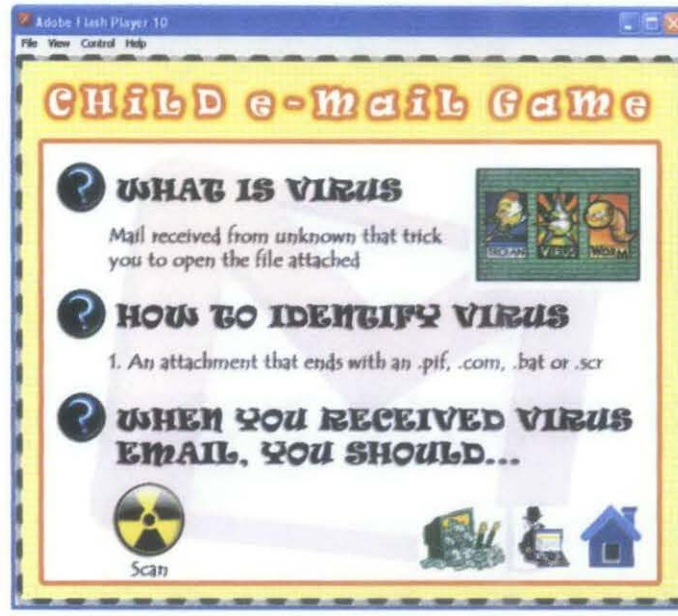


Figure 30: CEG Virus Page

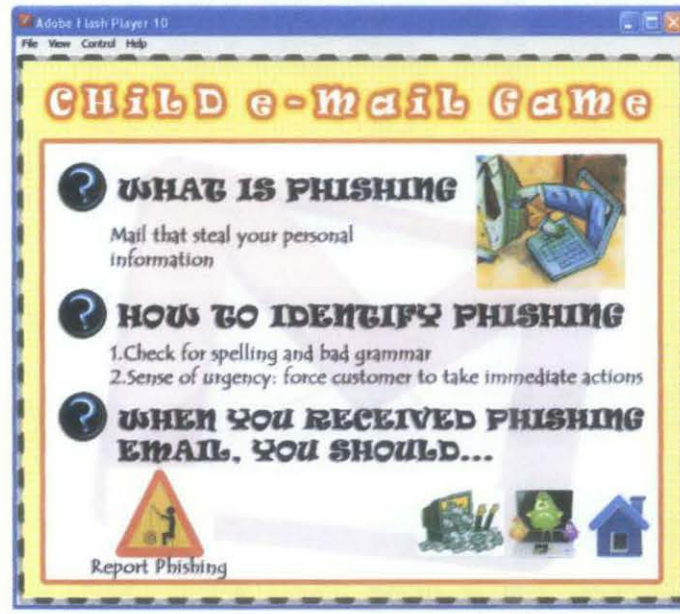


Figure 31: CEG Phishing Page

Each icon at the bottom of the CEG tutorial page is functional where it link to the respective tutorial page when clicked by the player. Home button will direct the player to the CEG Did You Know? Page.


Figure 32: CEG Spam Page

### 4.1.2 CEG Level 1

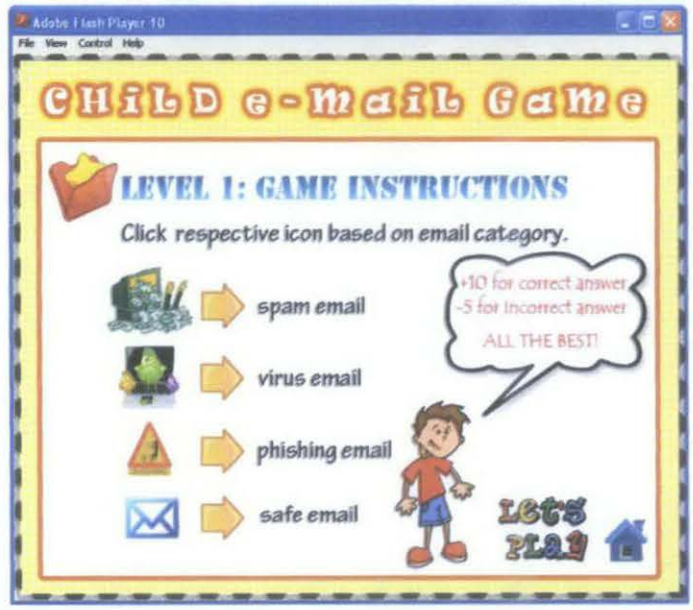


Figure 33: CEG Level 1 Page

For the first level, the player needs to identify the characteristic of the received email before classifying to the email security threats accordingly.


Figure 34: CEG Level 1 Q1 Page


Figure 35: CEG Level 1 Q2 Page

By default, the score is zero at the beginning of the game. For any correct question answered by the player, the score will be increased by 10 points.


Figure 36: CEG Level 1 Q3 Page


Figure 37: CEG Level 1 Q4 Page

However, if the answer is wrong, the score will be deducted 5 points. The score is updated along the way the player plays the game.

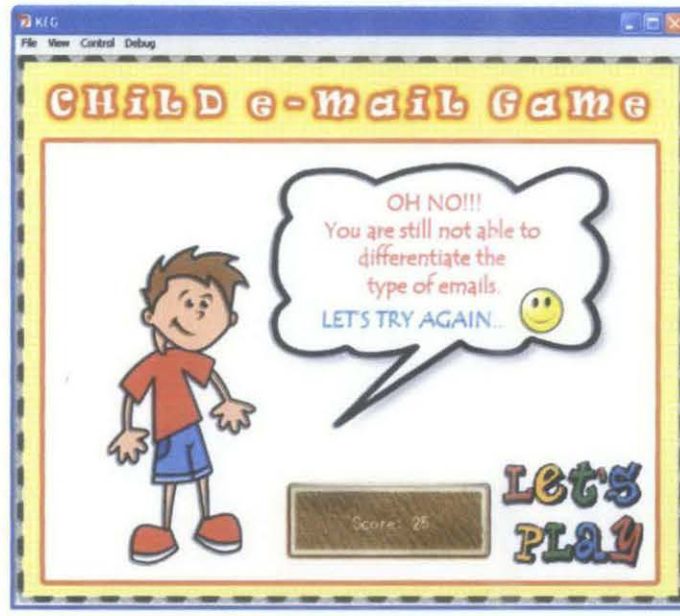


Figure 38: CEG Let's Play Again Page

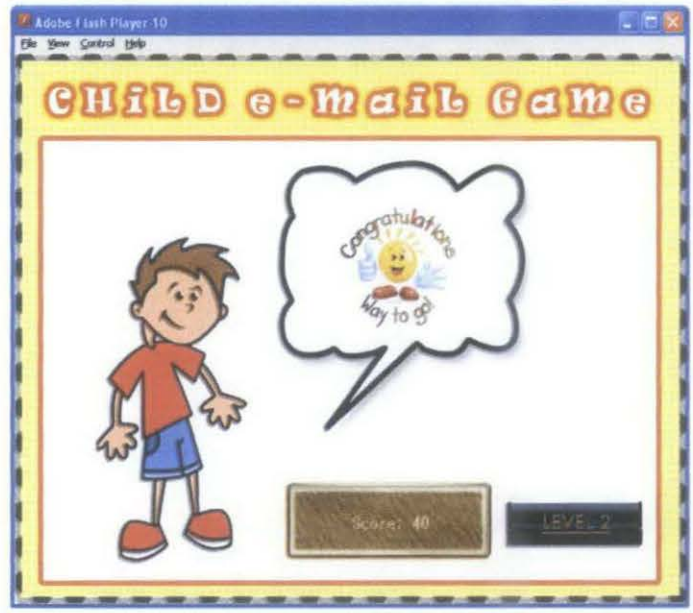


Figure 39: CEG Let's Play Level 2 Page

For level 1, the player needs to answer 4 questions. If the accumulated score is lesser than 30, the player is given another chance to play again. Otherwise, the player will continue to the next level.

### 4.1.3 CEG Level 2

In the Level 2, the level of difficulties is increased as the player need to identify the email type first before react to the corresponding email received.

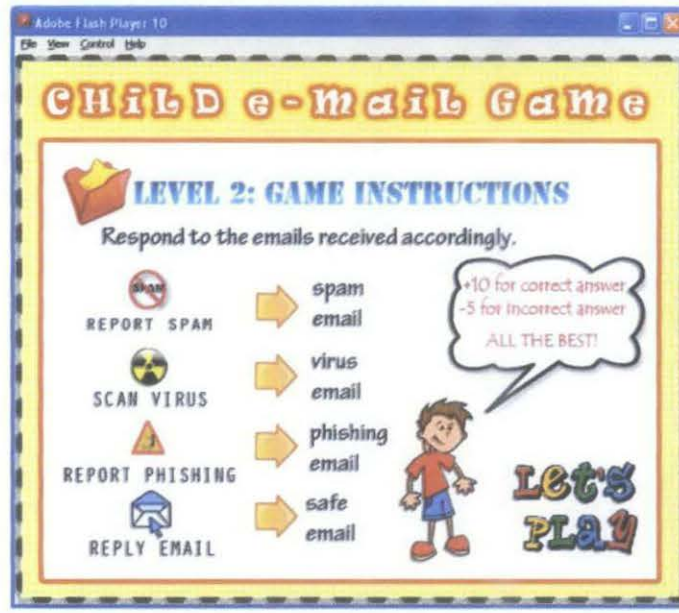


Figure 40: CEG Level 2 Page


Figure 41: CEG Level 2 Q1 Page

The accumulated score from level 1 will continuously update in the Level 2. As mentioned before, correct answer will get additional 10 marks.

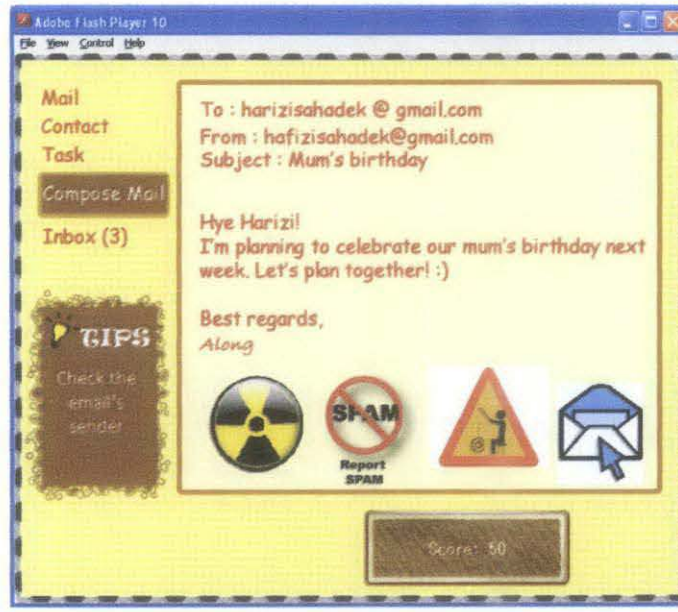


Figure 42: CEG Level 2 Q2 Page


Figure 43: CEG Level 2 Q3 Page


Figure 44: CEG Level 2 Q4 Page


Figure 45: CEG Let's Play Again Page 2

To earn an email badge, the player need to score higher points more than 70. If not, the player is given opportunity to play again which can boost the motivation to explore email security threats issues carefully.

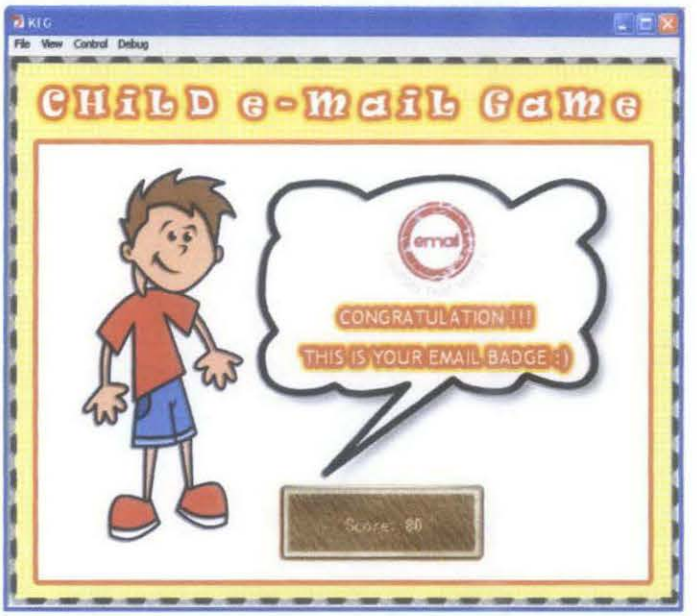


Figure 46: End Page

## 4.2 CEG TESTING

CEG Testing has divided into two categories which are Usability Testing and also Effectiveness Testing. Both are important in evaluating the project outcome.

### 4.2.1 Usability Testing

Usability testing is a technique used to evaluate CEG prototype by testing it with the respective users. The goals are to identify any usability problems, collect quantitative data and determine the participant's satisfaction with the game. The sample consist of 10 children aged 11 to 13 with various education background.

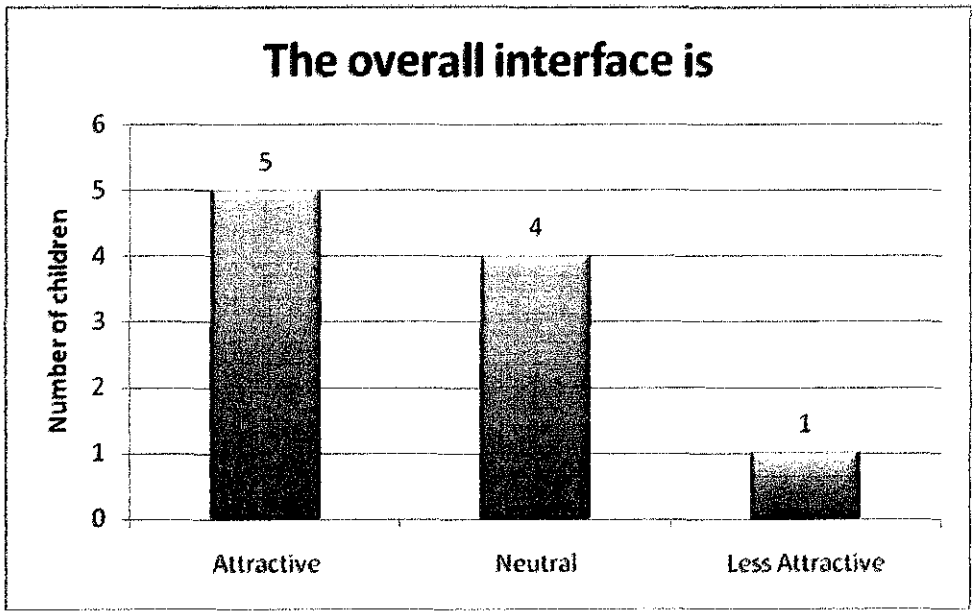


Figure 47: CEG Overall Interface

Referring to the Figure 47, 50% of the sample agreed that the overall interface of CEG is attractive. Presenting words and pictures contiguously rather than isolated from one another (contiguity) is one of the design principle used to enhance learning process.

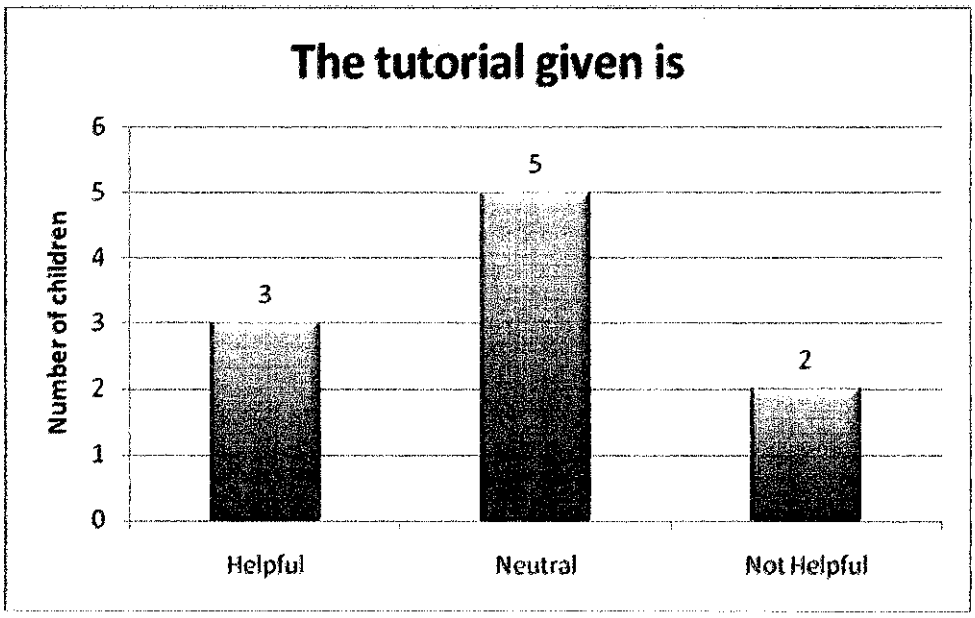


Figure 48: CEG Tutorial

Based on the Figure 48, the result shows that most of the children feel neutral on the tutorial provided. In fact, 2 out of 10 claimed that it is not helpful. Only 3 children fully utilized the contents of tutorial and tips provided during playing the game. There are many assumptions that can be made on why the children found that the tutorial given is not helpful. First, as English is used as a language medium in this game, the children may thought it is difficult to understand especially if they are English illiterate. If this assumption is valid, for the future work, the game should provide two version of language.

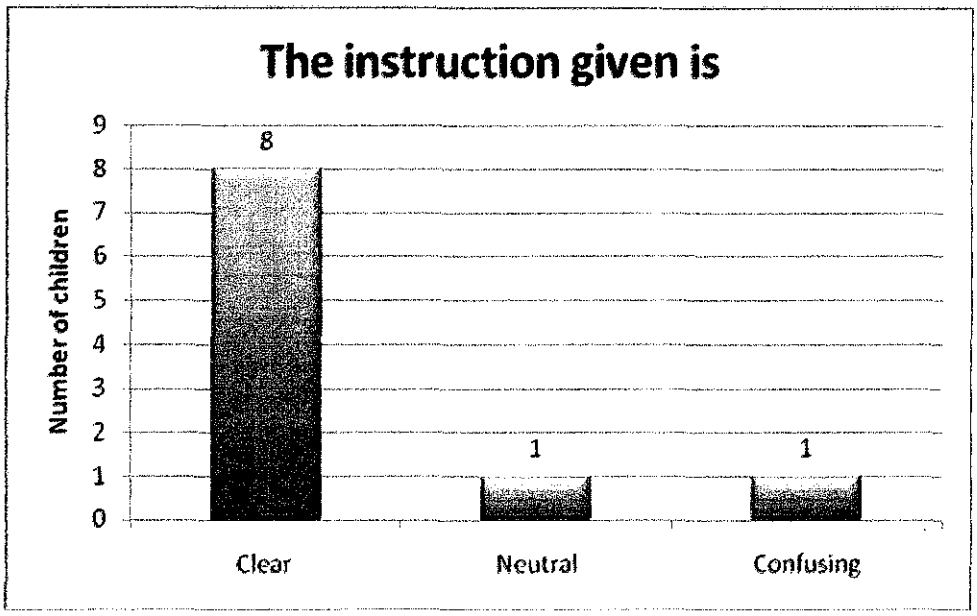


Figure 49: CEG Instruction

Most of the children agreed the CEG instruction is clear as it is short and understandable. Moreover, the instruction given has contiguity element which help the children while playing the game. However, 10% of the sample claimed that the instruction given is confusing while another 10% is neutral.

### 4.2.2 Effectiveness Testing

Effectiveness testing is used to measure whether CEG is an effective medium that can be used in cultivating early awareness on email security threats issues among the sample tested or not. For the first part, the previous sample has been used to test the CEG effectiveness.

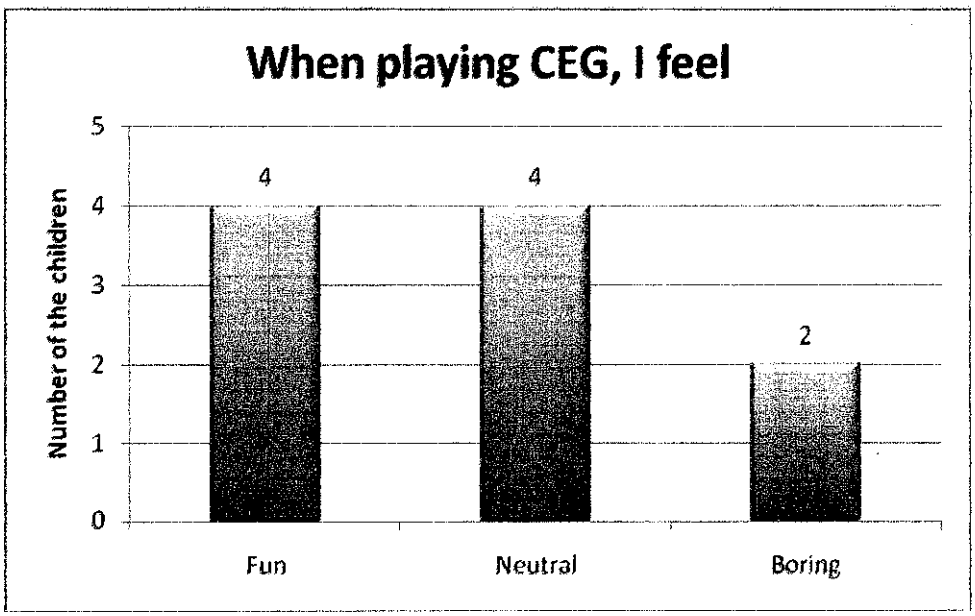


Figure 50: Children's Feeling When Playing CEG

According to the Figure 50, 40% of the sample tested feels fun and neutral while playing the game. This indicates that CEG has a potential to provide fun learning environment. Only 20% find it boring to play CEG. It may because they are never playing game or email security threats topic covered is beyond their interest.

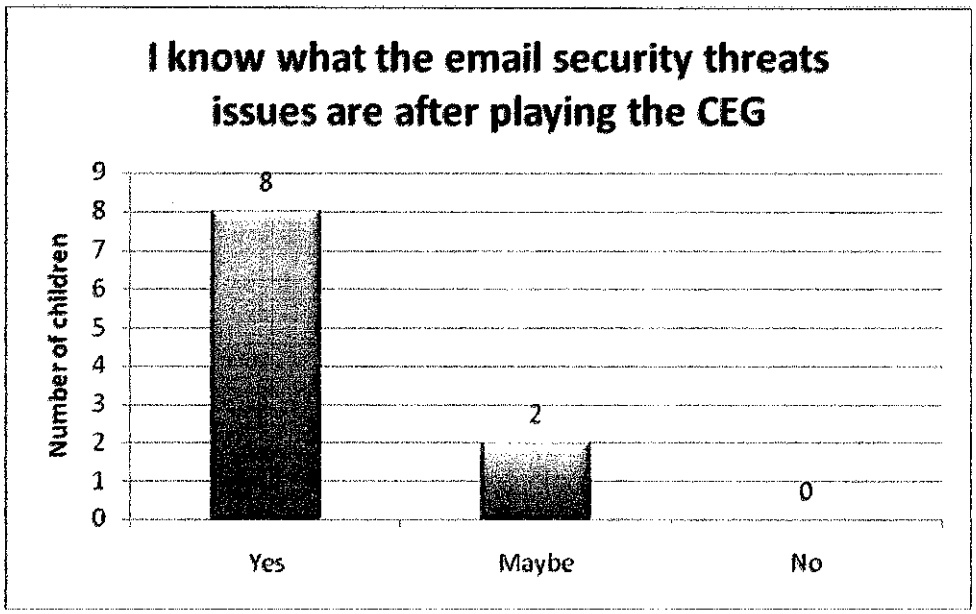


Figure 51: Email Security Threats Issues Awareness

According to the result received, 80% from the sample stated that they gain their early awareness on email security threats issues right after playing the CEG. 20% of them are answered maybe as they know the issues of virus and spam through participating in seminar conducted by Cyber Security teams in their school. However, they did not know about phishing and all these issues are grouped under email security threats.

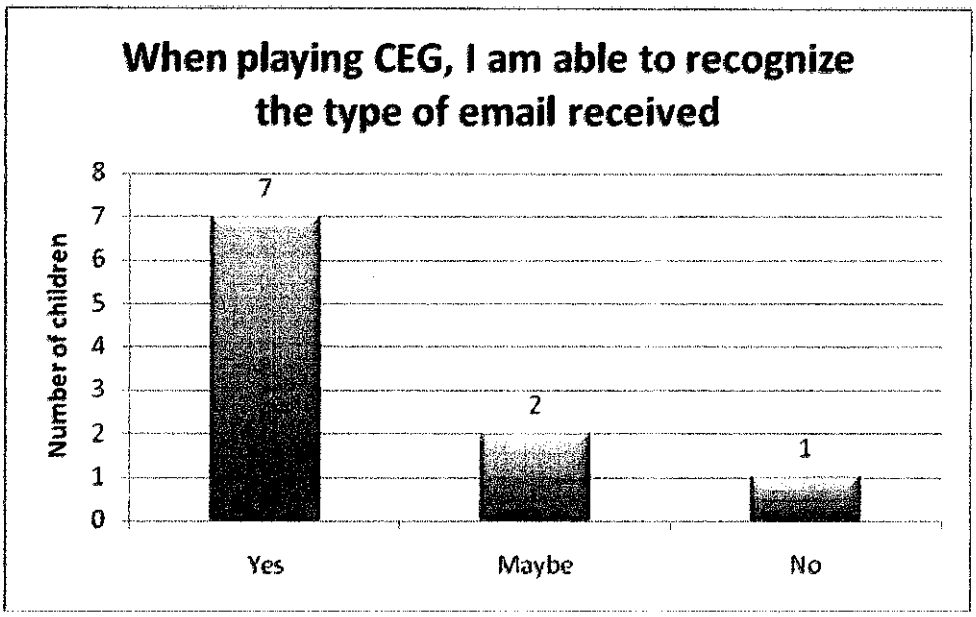


Figure 52: Type of Email Recognition

Based on Figure 52, most of the children (70%) are able to recognize the type of email received. Only one child unable to identify well the email pattern and he did answered wrongly 3 questions out of 4 in level 1.

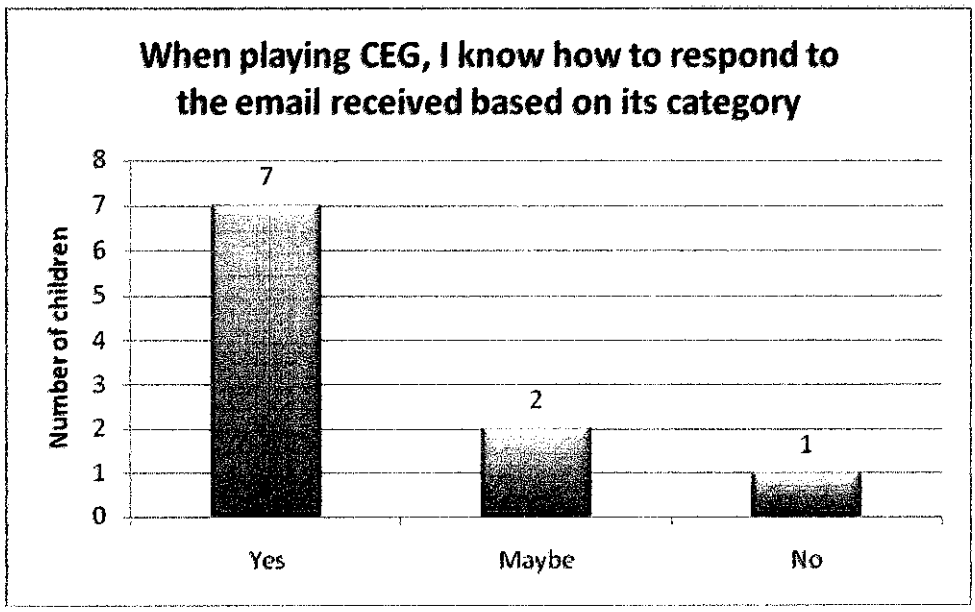


Figure 53: Email Response

Figure 53 shows that the ability of the children on email response. Those who are able to recognize the email type earlier are able to respond accordingly. Some of them chose maybe because they able to identify the email type but did not meet the minimum score requirement which allow them to move into level 2.

Apart from that, another session has been conducted. The objective of this session is to measure the effectiveness of various medium used to expose the children on email security threats issues such as reading and playing a game. For this part, a total of another 15 children aged 11 to 13 were involved. The 15 children were split into 3 different groups in which each of the group consist of 5 children. The details are as below:

- Group A: Reading email security threats notes
- Group B: Playing CEG
- Group C: Playing CEG right after reading the notes.

All of them were required to answer the same short paper-based questions (5 questions) which regard to the email security threats issues. Comparison on the marks of the paper-based question has been made to analyze the ability of CEG as another mechanism that can be used in exploring the email security threats issues.

Below is the result of the three different groups of children that involved:

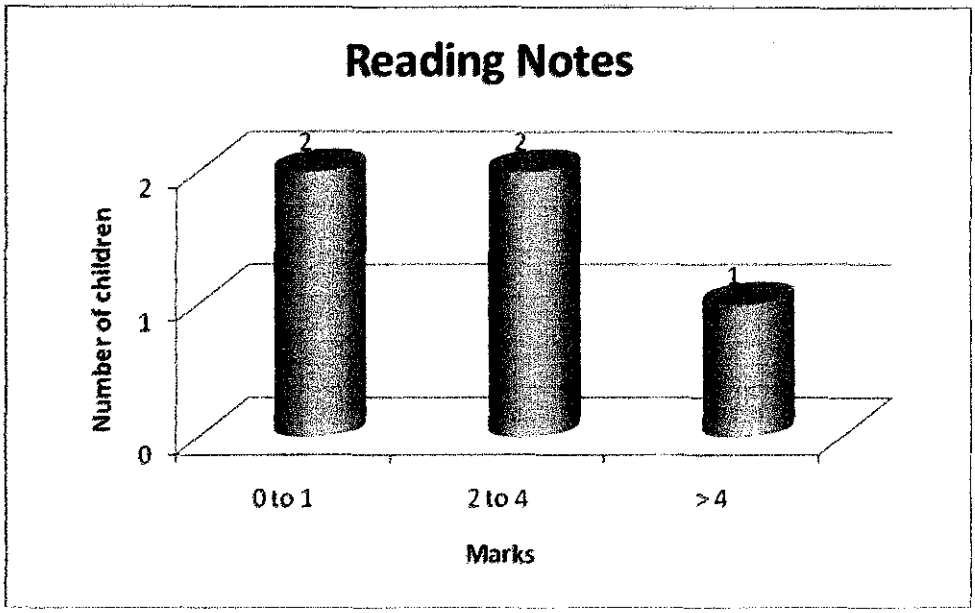


Figure 54: Reading Notes Result

According to Figure 54, only 20% from the Group A sample got highest mark in answering the questions given. The other 40 % scored 4 and below.

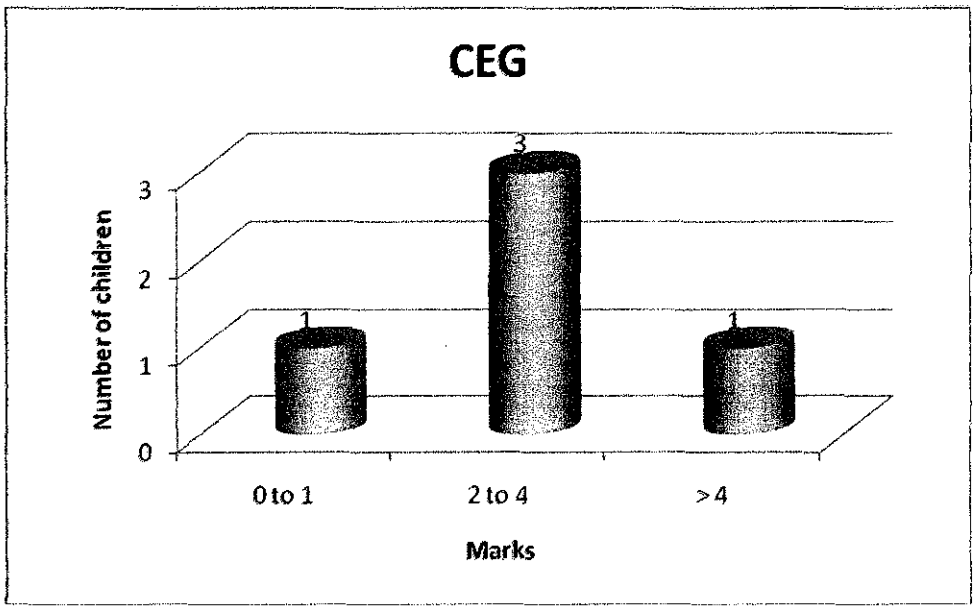


Figure 55: Playing CEG Result

Based on Figure 55, 60% from the Group B sample are able to score medium mark which is between 2 to 4. Only 20% from them got highest mark in answering the questions given.

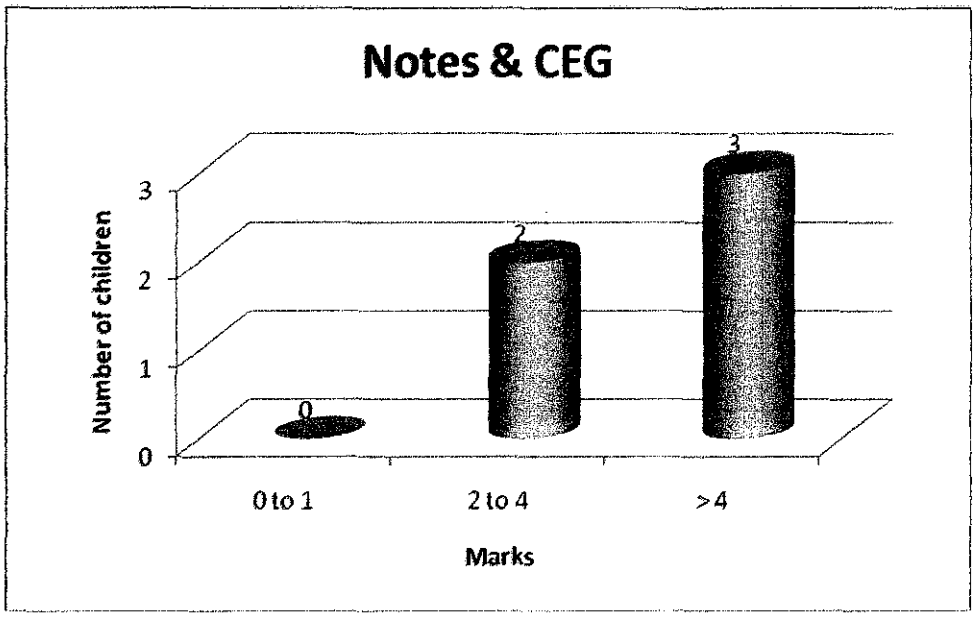


Figure 56: Reading Notes & Playing CEG Result

Referring to Figure 56, the number of children in Group C sample that are able to score highest mask increased compared to the Group A and Group B.

From these results, we can see that the combination of reading the notes and playing CEG is the most effective means for the children in acquiring new knowledge. However, the existence of CEG is to support the learning process done by reading the notes but not to replace the existing methods. This fall under learning-by-doing principle as the children is able to practice the skills that they have learned before. Therefore, it is interesting to see if this indicator can be implemented in our education system especially school children as play is part of their daily life.

# CHAPTER 5

# CONCLUSION AND RECOMMENDATION

Email security threats are one of the cyber threats problem that child should aware to avoid any incidental causes which lead towards negative impact. Therefore, Child Email Game (CEG) is developed to nurture early awareness on email security threats among the kids nowadays. Besides providing fun element, the player is motivated to explore these issues through the given opportunity in play again the game.

This game is successfully replicating the email security threats issues that have been identified in the early stage of this project. The issues then conveyed to the target user via attractive mean which is by developing the CEG.

Usability testing revealed that although there is lack of information provided in the tutorial contents, the player has been given the tips to assist them in identifying the email type as well as respond accordingly. Apart from that, due to some limitations that CEG have, the most effective way to instill the awareness on these issues are through the combination of reading the notes and playing the CEG.

Through the feedbacks gathered, several recommendations have been found to be useful for further improvement in CEG. It is recommended that first, the content of tutorial itself must convey valid and useful information as according to the security expert people, sometimes there are also attachments that hide the file extension. This will lead towards misunderstanding on the contents itself. Besides that, the question has been proposed to provide validation before the player easily select the corresponding answer. The level of difficulties has been suggested by leveraging the questions according to the age of the player.

CEG is another alternative used to enhance children awareness on email security threats issues. It is also developed parallel with CyberSAFE effort in avoiding the children become one of the indirect victims of internet drawback.

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**SURVEY QUESTIONS**

Upon completion of my project, I'm Nurul Hazwani binti Sahadek, would like to conduct a survey for my Kids Email Game. The objectives of this survey are as below:

- To measure the level of awareness among Malaysian school children on email security threats issues.
- To gather feedback on the effectiveness of Child Email Game (CEG) in nurturing early awareness about email security threats issues among the Malaysian school children.

Appreciate if you could answer the questions below. Indicate (/) where necessary.

**Usability Testing**

1. The overall interface is

- ☐ Attractive
- ☐ Neutral
- ☐ Less Attractive

2. The tutorial given is

- ☐ Helpful
- ☐ Neutral
- ☐ Not Helpful

3. The instruction given is

- ☐ Clear
- ☐ Neutral
- ☐ Confusing

**Effectiveness Testing**

1. When playing CEG, I feel

- ☐ Fun
- ☐ Neutral
- ☐ Boring

2. I know what the email security threats issues are after playing the CEG

- ☐ Yes
- ☐ Maybe
- ☐ No

3. When playing CEG, I am able to recognize the type of email received

- ☐ Yes
- ☐ Maybe
- ☐ No

4. When playing CEG, I know how to respond to the email received based on its category

- ☐ Yes
- ☐ Maybe
- ☐ No