Effectiveness of Using Media Animation in Educating Thai Primary School Children on the Benefits of Consuming Five Colored Vegetables

ผลสัมฤทธิ์ของการใช้สื่อการสอนแอนิเมชันที่ได้รับการพัฒนาขึ้นสำหรับให้ความรู้ เรื่องการรับประทานผัก 5 สีแก่เด็กระดับประถมศึกษา

A. Singhato (อลงกต สิงห์โต)*
N. Rojroongwasinkul (นิภา โรจน์รุ่งวศินกุล)**
G. Charoonruk (จินต์ จรูญรักษ์)**

Abstract

The study aimed to improve nutritional knowledge and attitude on benefits of consuming five colored vegetables by viewing three developed media animation modules in 76 primary school children from grade 3 and 4. This study by was evaluated children knowledge and attitude by using four self-administered questionnaires (baseline, attitude, basic knowledge, and satisfaction questionnaires) evaluated against a five-scale Smileyometer to capture their responses (pre- and post-interventions). Children knowledge and attitude scores on benefits of consuming five colored vegetables**.** Paired t-test was used to compare the mean scores of the self-administered basic knowledge and attitude questionnaires, pre- and post-interventions. Independent sample t-test was used to test the mean scores between male and female. Results showed most children significantly improved their knowledge and attitude on consuming five colored vegetables after viewing the developed media animation. The developed media animation is an attractive learning tool and can help primary school children learn more about benefits of consuming five colored vegetables.

Keywords: Five colored vegetables, Media animation, Satisfaction, Smileyometer, Primary school children

* Faculty of Allied Health Sciences, Burapha University, Thailand; *Institute of Nutrition, Mahidol University, Thailand

*คณะสหเวชศาสตร์ มหาวิทยาลัยบูรพา; *สถาบันโภชนาการ มหาวิทยาลัยมหิดล

*Corresponding author. 169 Longhadbongsaen Rt., Sansook, Mueng Chonburi, 20131.

Email address: alongkote@buu.ac.th

Introduction

Vegetables are an excellent source of dietary fiber, vitamin, and mineral, and they assist in weight management and lowering risk of many chronic diseases (1, 2). Consuming large amount of vegetables over a period of time can help reduce hypertension, according to the Dietary Approaches to Stop Hypertension or "DASH" diet (3). The approach involves increasing consumption of fruits and vegetables, fat-free milk products, whole grains, nuts, white meats, and no added sugar beverages, while advocating the reduction of additional salt in the diet.

Many countries have now started to shift their campaigns in promoting vegetable consumption to promoting the importance and awareness of a rainbow of vegetables (or five colored vegetables). Five-colored vegetables is the variety of colors that can be generally found in vegetables---green, red, yellow/orange, blue/ purple, and white (4). Experts suggest regularly consuming five-colored vegetables daily over one or two colored vegetables (i.e., green, red, etc.) (5). Five-colored vegetables contain nutrients and phytochemicals which are beneficial to human health (6-10).

Studies have shown effects of nutritional knowledge on food behavior and also even in another knowledge and skills (11-13). Teaching children to know and have a positive attitude towards five-colored vegetables, their benefits and consumption thereof, is a task educators and health professionals should consider to promote and encourage in any vegetable consumption campaign. Experts, however, have suggested that educating school age children via media (i.e., cartoon animation) can make them better understand the content or message in a more attractive and entertaining learning environment as well as helping them to retain the message for a longer period of time than any other types of media (14, 15). As there are numerous studies using media animation to educate primary school children on various health topics, many of them have reported mixed results (16). In Thailand, no media animation has ever been developed to educate primary school children on consuming five-colored vegetables. Hence, the aim of this study was to develop media animations as an educational tool to educate primary school children to improve their knowledge and attitude of five-colored vegetables.

Methods

Research design

This was a quasi-experimental study to evaluate the effectiveness of the developed media animation in educating Thai primary school children on benefits of consuming five colored vegetables using four self-administered questionnaires (pre- and post-test) on a

random sample of primary school in Singburi province, Thailand. Seventy-six children in grades 3 to 4 were randomly sampled. Signed inform consents were obtained from parents or legal guardians prior to participation. The study protocol of this study design was reviewed and approved by the ethics committees. Study inclusion criteria included children aged 8-10 years old (both male and female), and willingness to participate in the study. Exclusion criteria included children with medical history of vegetable allergies, siblings, exhibiting behavioral problems [i.e., attention deficit hyperactive disorder (ADHD)] and inability to participate throughout the study period.

Research instruments

1. Development of educational media animation

Three media animation modules developed with Adobe Photoshop CS5 and Adobe After Effects CS6 software programs (Adobe Systems Inc. San Jose, CA) were used in creating graphic animations. Production of sound and its effects, cover music, and dubbed voice/narration were added into the animations by means of computer graphic packages available freely on the internet. Three modules of media animation were developed. The message/content of each module covered the following topics: Module 1: Benefits of Vegetables (estimated viewing length, 5 minutes). This module lightly introduced the participants to the importance and health benefits of consuming vegetables and roughly recommended the amount of vegetable consumption per day. Module 2: Benefits and Advantages of Consuming Five-Colored Vegetables (estimated viewing length, 10 minutes). This module lightly introduced the participants to the importance and health benefits of consuming five-colored vegetables by providing examples of vegetables available from the local market for each of the five-colors (green, red, yellow/orange, purple/blue, white). Module 3: Suggested Methods for Cooking Vegetables and a Brief Overview of the Basic Food Exchange List of Vegetables (vegetables with comparable portion/serving sizes) (estimated viewing length, 5 minutes). This module lightly introduced the participants to the importance and health benefits of eating certain raw vegetables and preferred methods for cooking vegetables to help retain their nutrient quality, information on methods of cooking vegetables that may have deleterious health consequences, and briefly overviewed the basic methods of counting vegetable portion/serving sizes. A robotic cartoon character, Onizukot Robot, was created and designed to be the main character in introducing and guiding the viewers throughout the three developed media animation modules.

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2. Development of questionnaire: Satisfaction questionnaire

This study used the Smileyometer scale to determine satisfaction level of the developed media animation modules (17). Fourteen question self-administered satisfaction Smileyometer questionnaire were developed to elicit responses for evaluating five domains [graphic quality (visual), audio quality, content-based satisfaction, length of animation, and overall satisfaction] by using arithmetic mean to interpret level of satisfaction as follows (18):

4.21-5.00 points classified as Like very much (Brilliant)

3.41-4.20 points classified as Like (Really good)

2.61-3.40 points classified as Somewhat like (Good)

1.81-2.60 points classified as Dislike (Not very good)

1.00-1.80 points classified as Dislike very much (Awful)

Figure 1. The Smileyometer scale

3. Development of questionnaire: Attitude questionnaire

A thirty closed-ended self-administered questionnaire was developed to determine children's attitude on consuming five-colored vegetables to elicit responses based on a five level scale (i.e., Not at all true, not very true, somewhat true, true, and very true). Questions were divided into fifteen positive attitude questions and fifteen negative attitude questions adapted from the Knowledge, Attitude, and Practice (KAP) Guideline for use in children (19). An example of a positive question includes "Do you think that regularly consuming various colors of vegetables is necessary?" and an example of a negative question includes "Do you think that consuming vegetable is unnecessary in children?"

4. Development of questionnaires: Three basic knowledge questionnaires

Three basic knowledge questionnaires were developed specifically for each of the three developed media animation modules to test knowledge improvement---pre-test (before viewing the developed media animation) and post-test (after viewing the developed media animation) as follows:

Basic knowledge questionnaire for module 1

The basic knowledge questionnaire used in module 1 (Benefits of Vegetables) was a ten question self-administered multiple choice questionnaire (four choices) developed to

determine children's knowledge on benefits of vegetables both before and after viewing the developed media animation module 1. An example question includes "What is the benefit of dietary fiber?" and "What is the recommended portion size of daily vegetable consumption?"
Basic knowledge questionnaire for module 2

The basic knowledge questionnaire used in module 2 (Benefits and Advantages of Consuming Five-Colored Vegetables) was a ten question self-administered multiple choice questionnaire (four choices) developed to determine knowledge and understanding on benefits and advantages of consuming five-colored vegetables both before and after viewing the developed media animation module 2. Example questions includes "What is the benefit of regularly consuming red-colored vegetables?" and "What is the benefit of regularly consuming purple-colored vegetables?"

Basic knowledge questionnaire for module 3

The basic knowledge questionnaire used in module 3 (suggested methods for cooking vegetables and a brief overview of the basic food exchange list of vegetables) was a ten question self-administered multiple choice questionnaire (four choices) developed to determine knowledge and understanding on the suggested methods for cooking vegetables and a brief overview of the basic food exchange list of vegetables in both before and after viewing the developed media animation module 3. Example questions includes "What method for cooking vegetable is not suggested for regular consumption?" and "How many calories does 1 portion size of vegetable provide?"

Intervention

Singburi province, Thailand, has a total of 6 districts, where one of the 6 districts was randomly selected (by drawing) to represent the location of the randomly selected primary school. The total number of primary schools (n=25) in the selected district was determined and subsequently used to randomly select one primary school (by drawing) to be the intervention school. The school provided the lists of names of children in grades 3 (total number of students=56) and 4 (total number of students=54) to be used in randomly selecting (drawing) seventy-six children for the intervention. Equal proportion of students in grades 3 and 4 with equal proportion of males and females were recruited (38 students from grades 3 and 38 students from grades 4). Parents or legal guardians of children who were randomly selected each received informed consents and a letter briefly describing the study protocol. All participants' parents or legal guardians of children received a letter describing in detail the purpose of the study (i.e., study objectives, informed consent, etc.). Parents signed the

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informed consents to confirm their agreement to allow their children to participate in this study. All seventy-six children had to complete the following steps for completion of the study: baseline data collection, viewing media animation modules, and self-administered questionnaires. All seventy-six children had to undertake three consecutive days to complete the study.

Study procedure

1. Data collection and viewing the developed media animation module 1

Randomly selected primary school children were invited to the school's computer lab for data collection on day 1 (morning session: 38 children from grade 3; afternoon session: 38 children from grade 4). The steps of data collection were as follows: 1) Baseline data collection: Selected primary school children from grades 3 (morning session) and 4 (afternoon session) were asked to complete the Respondent's attitude questionnaire on consuming five-colored vegetables as well as completing the self-administered basic knowledge on benefits of vegetable questionnaire before viewing the developed media animation module 1 (estimated time spent on task, 30 minutes). 2) After completing step 1, primary school children viewed the developed media animation module 1 on Benefits of Vegetables. Each child was seated in front of a computer monitor with individual headphones. The viewing session was programmed to start and end simultaneously on all individual computer monitor (estimated viewing length, 5 minutes). 3) After completing step 2, primary school children were asked to complete another set of a self-administered questionnaire testing their basic knowledge on Benefits of Vegetables (to compare basic knowledge score before and after viewing the developed media animation module 1). Furthermore, primary school children were asked to complete a self-administered developed media animation's satisfaction questionnaire for the developed media animation module 1 (estimated time spent on task, 20 minutes).

2. Viewing the developed media animation module 2

On day 2, the same group of primary school children (morning session: 38 children from grade 3; afternoon session: 38 children from grade 4) were re-invited to the school's computer lab for second day of data collection as follows: 1) Grade 3 children (morning session) and grade 4 children (afternoon session) completed a self-administered basic knowledge questionnaire on the Benefits and Advantages of Consuming Five-Colored Vegetables before viewing the developed media animation module 2 (estimated time spent on task, 10 minutes).2) After completing step 1, primary school children viewed the developed media animation module 2 on the Benefits and Advantages of Consuming Five-Colored

Vegetables using the same procedure as was conducted on day 1 (estimated viewing length, 10 minutes). 3) After completing step 2, primary school children were asked to complete another set of a self-administered questionnaire testing their knowledge on the Benefits and Advantages of Consuming Five-Colored Vegetables (to compare knowledge score before and after viewing the developed media animation module 2). Furthermore, primary school children were asked to complete a self-administered developed media animation's satisfaction questionnaire for the developed media animation module 2 (estimated time spent on task, 20 minutes).

3. Viewing the developed media animation module 3

On day 3, the same group of primary school children (morning session: 38 children from grade 3; afternoon session: 38 children from grade 4) were re-invited to the school's computer lab for third day of data collection as follows: 1) Grade 3 children (morning session) and grade 4 children (afternoon session) completed a self-administered basic knowledge questionnaire on the Suggested Methods for Cooking Vegetables and a brief overview of the Basic Food Exchange list of vegetables before viewing the developed media animation module 3 (estimated time spent on task, 10 minutes). 2) After completing step 1, primary school children viewed the developed media animation module 3 on the Suggested Methods for Cooking Vegetables and a brief overview of the Basic Food Exchange list of vegetables using the same procedure as was conducted on days 1 and 2 (estimated viewing length, 5 minutes). 3) After completing step 2, primary school children were asked to complete another set of a self-administered questionnaire testing their knowledge on the Suggested Methods for Cooking Vegetables and a brief overview of the Basic Food Exchange list of vegetables (to compare knowledge score before and after viewing the developed media animation module 3). Furthermore, primary school children were asked to complete a self-administered developed media animation's satisfaction questionnaire for the developed media animation module 3 (estimated time spent on task, 20 minutes). 4) Finally, children were asked to complete the Respondent's attitude questionnaire on consuming five colored vegetables after viewing all three developed media animation modules (estimated time spent on task, 15 minutes).

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Statistical analysis

Mean scores (±SD) of satisfaction questionnaire, self-administered basic knowledge questionnaires, and attitude questionnaire were reported. Paired t-test was used to compare the mean scores of the self-administered basic knowledge and attitude questionnaires, pre and post-interventions. Independent t-test was used to test the mean scores between male and female. Statistical analyses were performed by using the Predictive Analytics Software Statistics (PASW) version 18.0 (SPSS Inc., Chicago, IL,USA). Statistical significance was established at $p<0.05$.

Results

At baseline, most children (82%) were in the normal Weight for Height Z-score (Table 1). Also, most of them consumed vegetables (58%) and breakfast (79%) every day. Paired t-test revealed that children significantly improved their knowledge after viewing the developed media animation module 1 ($p<0.05$), module 2 ($p<0.05$), and module 3 ($p<0.05$). Furthermore, their positive attitude score increased significantly ($p<0.05$) and their negative attitude score decreased significantly ($p<0.05$) on their views toward consuming five-colored vegetables (Table 2).

Table 1. Baseline data of children with weight for height Z-score, and food intake behaviors.

Variables	*Grade 3* *(n =38)*	*Grade 4* *(n = 38)*	*Overall* *(n = 76)*
Gender			
Male, n (%)	19 (50)	19 (50)	38 (50)
Age			
Mean (SD)	8.4 (0.5)	9.3 (0.5)	8.9 (0.7)
Weight for height*			
Wasting, n (%)	3 (4)	4 (5)	7 (9)
Underweight, n (%)	2 (2)	0	2 (2)
Normal, n (%)	30 (39)	32 (42)	62 (82)
Overweight, n (%)	3 (4)	2 (2)	5 (7)
Obesity, n (%)	0	0	0
Vegetables consumption			
Every day, n (%)	20 (53)	24 (63)	44 (58)
3-4 times/week, n (%)	8 (21)	4 (11)	12 (16)
1-2 times/week, n (%)	7 (18)	4 (11)	11 (14)
never, n (%)	3 (8)	6 (16)	9 (12)
Breakfast consumption			
Every day, n (%)	29 (76)	31 (82)	60 (79)
3-4 times/week, n (%)	3(8)	5 (13)	8 (11)
1-2 times/week, n (%)	6 (16)	1 (3)	7 (9)
never, n (%)	0	1 (3)	1 (1)

*Weight for Height: classified by Z-score, < (-2SD) as Wasting, (-1.5SD) - (-2SD) as Underweight, (-1.5SD) - 1.5SD as Normal, 1.5SD - 3SD as Overweight, and > 3 SD as Obesity.

Table 2. Knowledge and attitude improvement on consuming five-colored vegetables compared between before and after watching three animation educational media modules.

Intervention	*Pre-test**	*Post-test**	*P value*
Knowledge			
Module 1	4.2 (1.0)	7.4 (1.0)	0.00**
Module 2	5.3 (0.8)	8.3 (0.9)	0.00**
Module 3	3.6 (1.0)	6.6 (0.8)	0.00**
Positive attitude score (Total score=75)	66.3 (2.9)	67.8 (2.6)	0.00**
Negative attitude score (Total score=75)	23.5 (4.1)	22.0 (3.5)	0.00**

* Mean (±SD)
**Significant difference
Module 1 on the benefits of vegetables (Total score=10)
Module 2 on benefits and advantages of consuming five-colored vegetables (Total score=10)
Module 3 on suggested methods for cooking vegetables and basic food exchange list of vegetables (Total score=10)

When compared by gender, unpaired t-test revealed that there were no significant differences on knowledge between male and female in all three developed media animation modules. For attitudes, there were significant differences between males and females in both positive and negative attitude scores (pre- and post-test) (Table 3).

Table 3. Knowledge and attitudes on consuming five-colored vegetables compared by gender between before and after viewing three animation educational media modules.

Intervention	*Pre-test**		*P value*	*Post-test**		*P* value
	Male	*Female*		*Male*	*Female*	
Knowledge						
Module 1	4.3 (1.1)	4.2 (0.9)	0.57	7.4 (1.0)	7.4 (1.0)	0.79
Module 2	5.4 (0.8)	5.1 (0.9)	0.16	8.1 (0.8)	8.4 (0.9)	0.14
Module 3	3.5 (1.1)	3.7 (0.9)	0.51	6.7 (0.9)	6.6 (0.8)	0.59
Positive attitude score (Total score=75)	65.0 (2.7)	67.5 (2.5)	0.00**	66.8 (2.8)	68.8 (2.0)	0.00**
Negative attitude score (Total score=75)	24.6 (4.0)	22.4 (4.0)	0.00**	22.9 (3.4)	21.2 (3.3)	0.00**

*Mean (±SD)
**Significant difference
Module 1 on the benefits of vegetables (Total score=10)
Module 2 on benefits and advantages of consuming five-colored vegetables (Total score=10)
Module 3 on suggested methods for cooking vegetables and basic food exchange list of vegetables (Total score=10)

Satisfactions of the developed media animation in all three modules were evaluated by the Smileyometer scale. In Table 4, results showed that all children were satisfied with the three media animation modules by scoring as "like very much" for medias length in module 1, visual quality and contents in module 2, and medias length and contents in module 3. In addition, children were overall satisfied with all three developed media animation modules as "like very much" level.

Table 4. Satisfaction scores of all three animation educational media module evaluated by children used of smileyometer.

Satisfaction	*Module 1**	*Module 2**	*Module 3**
Visual quality	3.6 (0.6)	4.4 (0.5)	4.2 (0.4)
Audios quality	3.3 (0.8)	3.9 (0.5)	4.2 (0.3)
Medias length	4.4 (0.9)	4.1 (0.6)	4.4 (0.9)
Contents	4.1 (0.5)	4.4 (0.4)	4.6 (0.2)
Overall	4.4 (0.6)	4.4 (0.7)	4.4 (0.5)

*Mean (±SD)

Discussion

The main objective of this study was to develop and evaluate media animations of five-colored vegetables by focusing on whether the developed media animations was effective in improving knowledge and attitude of children after viewing the media animations or not. Overall results indicated most children's knowledge and attitudes were significantly improved after intervention. Also, they were satisfied with all three modules of media animation. The study found that educating primary school children via animation educational media to improve their nutrition knowledge and attitude toward healthy eating such as consuming vegetable was an effective strategy. The results support the findings of studies which showed significant improvements in knowledge for children on the topic of Science and reading comprehension after viewing the developed media animations, respectively (20, 21), and also improved their attitude toward healthy eating after completed nutritional education program by trained teachers (22). When comparing by sexes, the results can be concluded that the developed media animation modules had no effect on learning the basic knowledge between males and females. For attitude, the results indicated females had significantly higher positive attitude scores than males, and also significantly lower negative attitude scores than males.

The results support the findings of Gerson et al. which showed that females had a higher positive attitude toward healthy eating (i.e., fruits, vegetables, etc.) than males (23). This could be due to a greater sense of awareness and concern on body shape among females than males, and therefore females had different attitude on healthy eating than males, according to the findings of Conner et al. (24). Finally, the results supported the findings of Sim et al. indicating that children had fun and they enjoyed learning through the developed educational software (25). Unfortunately, due to limitation of research duration, a longer period of study as well as a follow-up of whether knowledge, attitude, food behavior after the intervention period is still retained among this group of people is suggested. The samples of this study were limited to rural children in Singburi province, Thailand, therefore the results cannot be generalized to all Thai children. It is important to note that the intent of this study was not to develop a tool to replace educational tools currently in use but to supplement existing tools for educational purposes hence the use of a control during intervention was not justified. In conclusion, the developed media animation is an attractive learning tool to help primary school children learn about the benefits of consuming five colored vegetables.

Implications for Research and Practice

The implications of this research were to aid professionals in health and nutrition to help educate and promote the consumption of various colored vegetables via an attractive, effective, and acceptable media animation for promoting healthy eating among children and to improve children's knowledge on the benefits of consuming five-colored vegetables.

References

World Health Organize. Fruit and Vegetables for Health. Report of a Joint FAO/WHO Workshop, 1–3 September 2004, Kobe, Japan

Grunwald GK, Seagle HM, Peters JC and Hill JO. Quantifying and separating the effects of macronutrient composition and non macronutrients on energy density. *British Journal of Nutrition*. 2001; 86: 265-276.

U.S. Department of Health and Human Services. Your guide to lowering blood pressure with DASH. Available at: https://www.nhlbi.nih.gov/files/docs/public/heart/new_dash.pdf, Accessed July 2014

Whole Kids Foundation Eat the Rainbow! Available at: https://www.wholekidsfoundation.org/downloads/better-bites/better-bites-eat-a-rainbow.pdf, Accessed July 2014

Centers for Disease Control and Prevention. Strategies to Prevent Obesity and Other Chronic Diseases: The CDC Guide to Strategies to Increase the Consumption of Fruits and Vegetables. Atlanta: U.S. Department of Health and Human Services. Available at http://www.cdc.gov/obesity/downloads/FandV_2011_WEB_TAG508.pdf, Accessed August 2014

He FJ, Nowson CA and MacGregor GA. Fruit and vegetable consumption and stroke: meta analysis of cohort studies. *Lancet*, 2006; 367 (9507): 320-326.

Palozza P, Simone RE, Catalano A and Mele MC. Tomato lycopene and lung cancer prevention: From Experimental to Human Studies. *Cancer*, 2011; 3: 2333-2357.

Grune T, Lietz G, Palou A, Ross AC, Stahl W, Tang G, Thurnham D, Yin SA and Biesalski HK. Beta-carotene is an important vitamin A source for humans. *Journal of Nutrition*, 2010; 140 (12): 2268-2285.

He J and Giusti MM. Anthocyanins: natural colorants with health-promoting properties. *Annual Review of Food Science and Technology*, 2010; 1: 163-187.

Rahman K, and Lowe GM. Garlic and cardiovascular disease: a critical review. *Journal of Nutrition*, 2006; 136 (3): 736-740.

Worsley A. Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour? *Asia Pacific Journal of Clinical Nutrition*, 2002; 11: 579–585.

Jumpaluang M, Chinaworn A, and Chairam P. A study on process for developing research skills in the aspect of logical thinking by using excercises as teaching materials of students in Faculty of Education at Phetchaburi Rajabhat university. *Veridian E-Journal Silpakorn University*, 2016; 9(4): 137-154.

Plitakul P, and Banternghansa P. Teaching method of music skill based on Dmitry Sitkovetsky, Wolfram Christ, and Raphael Christ. *Veridian E-Journal Silpakorn University*, 2016; 9(4): 232-246.

Bucholz, JL and Julie LS. Creating a Warm and Inclusive Classroom Environment: Planning for All Children to Feel Welcome. *Electronic Journal for Inclusive Education*, 2009; 2: 4.

Yang DC and Li MN. Assessment of animated self-directed learning activities modules for children's number sense development. *Educational Technology & Society*, 2013; 16 (3): 1–13.

Tversky B and Morrison JB. Animation: can it facilitate?. *International Journal of Human-Computer Studies*, 2002; 57: 247–262.

Karimi A and Lim YP. Children, engagement and enjoyment in digital narrative. *Proceedings*

Ascilite Sydney, 2010; 475-483.

Pongwichai S. การวิเคราะห์ข้อมูลทางสถิติด้วยคอมพิวเตอร์ [Statistical data analysis using the computer]. Bangkok: Chulalongkorn University press, 2008

Holman A, Lilley S, Stuckenbruck D, Ghorkhmazyan M and D'Souza R. Knowledge, attitude and practice surveys in child protection. The Child Protection Initiative, Save the Children, 2012; 45-56. Available at http://resourcecentre.savethechildren.se /sites/default/files/documents/7245.pdf, Accessed April 2014

Dalacosta K, Kamariotaki-Paparrigopoulou M, Palyvos JA and Spyrellis N. Multimedia application with animated cartoons for teaching science in elementary education. *Computers & Education*, 2009; 52: 741–748.

Seyit I. The effect of electronic storybooks on struggling fourth graders' reading comprehension. *The Turkish Online Journal of Educational Technology*, 2010; 9 (4): 140-155.

Shariff ZM, Bukhari SS, Othman N, Hashim N, Ismail M, Jamil Z, Kasim SM, Paim L, Samah BA and Hussein ZAM. Nutrition education intervention improves nutrition knowledge, attitude and practices of primary school children: A Pilot Study. *International Electronic Journal of Health Education*, 2008; 11: 119-132.

Gerson A, Goto K, Wolff C and Giovanni M. Food, health and values: The effects of attitudes and behaviors regarding sustainable food practices on overall diet quality among college students. *Californian Journal of Health Promotion*, 2011; 11 (2): 53-60.

Conner M, Johnson C and Grogan S. Gender, Sexuality, Body Image and Eating Behaviours. *Journal* of *Health Psychology*, 2004; 9(4): 505-515.

Sim G, MacFarlane S and Horton M. Evaluating usability, fun and learning in educational software for children. In: World Conference on Educational Multimedia, Hypermedia and Telecommunications. Chesapeake, VA, 27 June 2005, pp. 1180-1187.