Computer Assisted Instruction on "Learning Nutrition Flags for Deaf 5th Grade and 6th Grad Students": Effectiveness of Instruction

Suwat Srisorachatr PhD*, Yotsinee Huadong MSc**,
Chatrapa Hudthagosol Dr.PH*, Suksiri Danthanavanich PhD***

** Public Health, Mahidol University, Bangkok, Thailand*
*** Rajabhat Suandusit University, Bangkok, Thailand*
**** Rachasuda College, Mahidol University, Bangkok, Thailand*

Objective: *Deaf students are of a number of under privilege group for whom there are limited resources for their use, related to health including nutrition. The purpose of this research was to create computer-assisted instruction for "nutrition flags" for 5th and 6th grade students. The content of nutrition included the concept of a healthy balance diets and portion sizes of each food group.*

Material and Method: *The content and pictures for computer-assisted instruction came from existing curriculum, and focused on nutritional content. The contents in this instruction were divided into three units according to students' learning capacity. The story boards were developed by staff, including nutritionists, Thai sign language interpreters, and deaf students. Then, the contents and nutrition vocabulary were translated into Thai sign language. After recording the sign language on video, this material was merged with the contents and converted into a computer program. The computer assisted instruction was tested with students from Nakon Pathom School for the Deaf. The first trial was conducted with three students, the second with five students, and the third with 15 students during the academic year 2009. The computer- assisted instruction was revised until it met the standard criteria of 80/80. Effectiveness testing was carried out with 36 students for five consecutive days. On the first day, the pre-test was completed, and on days 2-4, the students performed self-study and completed the exercises for units 1-3, with 50 minutes spent on each unit. The post-test was completed on the last day. The study was conducted during the 2010 academic year. Data analysis was performed using the t-test.*

Results and Conclusion: *The results showed an effectiveness of 81.85/82.22, which was higher than the standard criteria of 80/80. The post-test average score was higher than the pre-test average score with a statistical significance level at $p<0.0001$. Suggestions for instruction for the deaf are that the length of the instruction in each unit should be no longer than 30 minutes and the sign language window should be large because this mode of communication relies on sight.*

Keywords: *Computer assisted instruction, Nutrition flag, Deaf*

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Human rights and provision of higher education opportunities for the deaf are administered by the Minister of Social Development and Sustainable Humanity and Ministry of Education[1]. Results from a survey conducted in schools for the deaf revealed that students often had physical problems, for instance, common cold, measles conjunctivitis and dental problem. The results of a survey on health status and health promotion behavior among 1,881 deaf students showed that incorrect health behavior in term of food consumption; 60% of them consumed instance food, 58.2% ate high fat food, 50% consumed soft drinks, 49.2% of them usually ate snacks, 43.2% consumed fast food, 29.8% and preferred sweet flavors[2]. In the curriculum there are many chapters about nutrition but there are few media for teaching these topics for tis group, especially computer assisted instruction. Deaf students have limited understanding in written language because they learn from sign language which is different from written language. There are insufficient tools to communicate the meaning of content to the deaf[3,4]. Computer-assisted instruction entitled on "nutrition flags" with sign language will be helpful for the deaf to know about proper consumption of daily meals.

Correspondence to:
Srisorachatr S, Public Health, Mahidol University, Bangkok 10400, Thailand.
Phone: 08-5155-7400
E-mail: suwat.srs@mahidol.ac.th

Objective and design of the study

This one group pre-test post-test quasi-experimental design study was conducted to investigate the effectiveness of computer assisted instruction entitled "Nutrition flags" for deaf 5th and 6th grade students within the standard criteria of 80/80, in which student should pass an examination with an 80% total score after each chapter and should pass an examination at 80% after finishing all sessions.

Material and Method

A computer tutorial entitled "Nutrition flags" was created according to Alessi and Trollip's step[5].

The first step: preparation

The second step: design instruction

The third step: content creation

The fourth step: supporting media for instructors

The fifth step: evaluation and revision

The sixth step: trial

The computer-assisted instrument entitled "Nutrition flags" was developed using Alessi and Trollip's step with the 80/80 criteria according to the standard of learning objective. The whole lesson was reviewed to determine misunderstanding of content of the nutrition flag instruction[6], picture and sign language in the first trial. During the second trial, the lesson efficiency was evaluated untilit met standard curriculum criteria of 80/80; five deaf students were involved in this step. The third trial was performed with 15 deaf students and confirmed hat tutorial effectiveness met the 80/80 standard criteria. The computer assisted instruction on "Nutrition flags" was used for this quasi experimental design.

Efficiency of the lesion (E_1)

$$E_1 = \frac{\frac{\sum X}{N} \times 100}{A}$$

E_1 = efficiency of the process

$\sum x$ = score from doing exercise after finish each lesson

N = number of students

A = total score tested of each lesson

Efficiency of the instruction E_2

$$E_2 = \frac{\frac{\sum X}{N} \times 100}{B}$$

when E_2 = efficiency of the outcome

$\sum x$ = score from doing the test after finish all lessons

N = number of students

B = total score of testafter finish all lessons

Samples and sampling technique

Nakon Pathom School for the Deaf provides education for deaf students from Grade 1 to Grade 6. For grade 5 and 6, the school uses the national curriculum which has been used since 2008 and was developed by the Department of Fundamental Education, Ministry of Education[7]. During academic year 2010, there were 36 students' in Grade 5th and Grade 6th. Samples were recruited from both grades because the curriculum includes lessons about nutrition, especially nutrition flags; the school did not have any media to teach the students properly. The samples were recruited with the criteria that they were deaf without any other handicap; they could operate a computer and were willing to participate in the study. Students were excluded if they could not participate in the whole program.

Data collection and data analysis

After pilot test, computer tutorial entitled "Nutrition flags" was developed to meet the standard criteria at 82.66/83.33. The experiment was conducted among 5th and 6th grade deaf students during the second semester of academic year 2010 with a sample group of 36 students. The total period of the present study was five days. The pre-test was administered on Day 1. On Day 2 to Day 4, students performed self-study for 50 minutes and completed exercise on each day. The post-test was completed on the last day. Then the output of computer assisted instruction was evaluated by total knowledge score from pre-test and post-test. T-test was used for testing the difference between pre-test and post-test scores.

Results

The general characteristics of the respondents revealed that there were 21 boys (58.33%) and 15 girls (41.67%). The majority was 13 years old and above (30.55%). The youngest participant was 10 years old (2.78%). None or the students had any experience with computer tutorial session. Nutritional status was assessed by using a weight by height index and it was found that most of students were normal weight (86.11%), with 11.11% underweight and 2.78% overweight as shown in Table 1.

The results of the exercises after learning each chapter showed that students could correctly answer questions about all three chapters. Among grade 5th students, from an average score of 90 in each chapter (five scores in each chapter and 18 students in each grade), students had the highest mean scores in Chapter 2, Chapter 1 and Chapter 3 with mean scores of 80/90, 71/90 and 65/90, respectively (or 88.89%, 78.89% and 72.22%). Effectiveness of the computer assisted instruction was revised by sum total scores from Chapter 1, 2 and 3. The total scores were 216 from a total of 270, so the effectiveness of the lessons was 80.0% from post-test scores; the effectiveness was 80.56% from a total of 180 scores. The effectiveness of computer assisted instruction was 80.0/80.56 which passed the educational standard criteria at 80/80 as showed in Table 2.

Among 6th grade students, students had the highest mean score for Chapter 3, Chapter 2 and Chapter 1 with mean score of 79/90, 78/90 and 69/90, respectively (or 87.78%, 86.68% and 76.68%). Effectiveness of the computer assisted instruction was revised by sum total scores from Chapter 1, 2 and 3. The total score was 226 out of 270 scores, so the effectiveness of the lesson was 83.70%. From post-test scores, the effectiveness was 83.89% from a total score of 180. The effectiveness of computer- assisted instruction was 83.70/83.89 which passed the educational standard criteria at 80/80 as showed in Table 3. Among 5th and 6th grades deaf students, results showed similar patterns. Students had the highest mean scores in Chapter 2, Chapter 3 and Chapter 1 with mean score of 158/180, 144/180 and 140/180, respectively (or 87.78%, 80% and 77.78%). Effectiveness of the computer-assisted instruction which was revised by sum total scores from Chapter 1, 2 and 3 and post-test scores; the effectiveness passed the educational standard criteria at 80/80 as shown in

Table 1. Basic characteristics of deaf students

Characteristics	Number	Percentage
Gender		
Male	21	58.33
Female	15	41.67
Age		
10 years	1	2.78
11 years	3	8.33
12 years	10	27.78
13 years	11	30.55
Above 13 years	11	30.55
Education level		
5th grade	18	50.00
6th grade	18	50.00
Computer tutorial		
previously	0	0.00
Never	36	100.00
Nutritional status		
Overweight	1	2.78
Normal	31	86.11
Underweight	4	11.11

Table 2. Comparison of scores and percentages from practice exercises on lessons 1, 2 and 3 and post-test of 5th grade deaf students (n = 36)

Total sum score from all students	Lesson			Total exercises Score	Total post-test score
	Lesson 1 (%)	Lesson 2 (%)	Lesson 3 (%)		
Score	71	80	65	216	145
Percentage out of 180	78.89	88.89	72.22	$\sum x(E_1) = 80.00$	$\sum x(E_2) = 80.56$

Table 3. Comparison of scores and percentages from practice exercises on lesson 1, 2 and 3 and post-test of 6th grade deaf students (n = 36)

Total sum score from all students	Lesson			Total exercises Score	Total post-test score
	Lesson 1 (%)	Lesson 2 (%)	Lesson 3 (%)		
Score	69	78	79	226	151
Percentage out of 180	76.68	86.68	87.78	$\sum x(E_1) = 83.70$	$\sum x(E_2) = 83.89$

Table 4.

The results from the pre-test and post-test, including 10 questions (maximum scores = 10), showed that the pre-test scores was 4.39 for Grade 5th students and 4.94 for Grade 6th students; post-test score were 8.06 and 8.39, respectively. The data showed statistically significant between pre-test and post-test scores at both grades at the level of p-value <0.05 (shown in Table 5).

Discussion

Computer-assisted instruction on "Nutrition flags" was developed for normal and deaf student; therefore, this media is suitable for all groups of student because it includes both sign language and verbal language. The instruction showed a difference between pre- and post- test scores[8-10]. Among Grade 5th deaf students, scores from Lessons 1 and 2 was higher than those of Grade 6th students except for Lesson 3. These results might be due to the fact that the content in Lesson 3 was focused on portion sizes and the Grade 6th students were more mature than the Grade 5th students, so Grade 6th students got better scores in this lesson. However, the total exercise scores among Grade 5th students were lower than those of Grade 6th students. The effectiveness of computer-assisted instruction in Grade 5th and 6th deaf students met the standard criteria of 80/80 because the instruction followed the guidelines. Therefore, the results were similar to those of the studies of Arunprasert D[11], Ura J[12] and Reungkham P[13] that stated that for highly quality and highly effective computer-assisted instruction, it should be perform and corrected at least three times.

The computer tutorial on "Nutrition flags" was designed as a self-study instrument, and the instructor acted as a facilitator for students when they did not understand. Pre-test and post-test scores showed that computer-assisted instruction could increase student knowledge, similar to the result found in the studies of Kreisel[14], Campbell et al[15] and Ura J[12].

The deaf students learned from Thai sign language and pictures. The process used to develop the instruction utilized comments from deaf students so pictures and proper descriptions could be used to help deaf students understand the lessons. The present study of Atchara Phumchuchit[16] showed similar results as the present study.

Finally, correct sign or false sign appeared on the monitor when students selected the answer, and the total scores were shown when the students complete all questions, serving as an incentive. This finding was similar to studies of Sritongdee N[17] and Sittikaipong K[18] Pavena Reungkham[13] and Skinner[19] also mentioned that students will perform behaviors when they get more incentives.

Recommendation

Computer assisted instruction on "Nutrition flags" was designed as a self-learning, instruction, but Thai sign language has limited vocabularies, especially on the nutrition terms. Thai sign language should be

Table 4. Comparison of scores and percentages from practice exercises on lessons 1, 2 and 3 and post-test of 5th and 6th grade deaf students (n = 36)

Total sum score from all students	Lesson			Total exercises Score	Total post-test score
	Lesson 1 (%)	Lesson 2 (%)	Lesson 3 (%)		
Score	140	158	144	442	296
Percentage out of 180	77.78	87.78	80.00	$\sum x(E_1)/3 = 81.85$	$\sum x(E_2) = 82.22$

Table 5. Comparison on pre-test and post-test scores of 5th and 6th grade deaf students

Education level	Total	Pre-test		Post-test		t	p-value
		$\bar{x}$	SD	$\bar{x}$	SD		
Grade 5th	18	4.39	2.033	8.06	1.056	11.710	<0.0001*
Grade 6th	18	4.94	1.731	8.39	1.461	20.735	<0.0001*

developed for more detail and universal usage. The window for sign language interpreter should be big enough for deaf students to see, because small pictures can make them tired. Each session should take time no more than 30 minutes, and a back key should be included for them to revise the session any time they need.

Potential conflicts of interest

None.

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บทเรียนคอมพิวเตอร์ช่วยสอนเสริมการเรียนรู้เรื่องธงโภชนาการระดับชั้นประถมศึกษาปีที่ 5 และ 6 ของนักเรียนหูหนวก

สุวัฒน์ ศรีสรฉัตร์, ยศสินี หัวดง, ฉัตรภา หัตถโกศล, สุขสิริ ด่านธนาวาณิช

วัตถุประสงค์: *นักเรียนหูหนวกเป็นกลุ่มผู้ด้อยโอกาสทางสังคมและมีปัญหาในด้านสื่อข้อมูลข่าวสารและสื่อการสอน ที่เกี่ยวกับสุขภาพโดยเฉพาะด้านโภชนาการ วัตถุประสงค์การศึกษาเพื่อสร้างสื่อช่วยสอนโดยใช้คอมพิวเตอร์ในหัวข้อ 'ธงโภชนาการ' สำหรับนักเรียนหูหนวกชั้นประถมปีที่ 5 และชั้นประถมปีที่ 6 สำหรับเนื้อหาในบทเรียนคอมพิวเตอร์ เนื้อหาด้านโภชนาการประกอบด้วยการรับประทานอาหารที่สมดุลเพื่อสุขภาพและอัตราส่วนอาหารบริโภคแต่ละประเภท*

วัสดุและวิธีการ: *เนื้อหาและรูปภาพที่ใช้ประกอบ ในโปรแกรมคอมพิวเตอร์สำหรับช่วยสอน ปรับจากเนื้อหาจากหนังสือในหลักสูตรกระทรวงศึกษาธิการ เนื้อหาในโปรแกรมคอมพิวเตอร์แบ่งเป็นสามหน่วยการเรียนรู้ตามหลักสูตร และให้สอดคล้องกับศักยภาพการเรียนรู้ของนักเรียน การพัฒนาร่างการสร้างภาพตามลำดับขั้นตอน (story broad) โดยพัฒนาทั้งเนื้อหาด้านโภชนาการ ภาษามือที่เหมาะกับนักเรียนหูหนวกไทย โดยภาษามือและคำศัพท์ที่เหมาะสมสอดคล้องกับเนื้อหามีนักโภชนาการ ล่ามภาษามือและนักเรียนหูหนวกร่วมมือกันพิจารณาเนื้อหา และกำหนดภาษามือที่ถูกต้องเข้าใจง่ายเพื่อถ่ายทำวีดิโอไว้ จากนั้นเนื้อหาและภาษามือทั้งหมดจะถูกแปลงเข้าโปรแกรมคอมพิวเตอร์ที่เหมาะสมตามลำดับ การทดสอบประสิทธิภาพของบทเรียนคอมพิวเตอร์โดยทดสอบกับนักเรียนโรงเรียนโสตศึกษาจังหวัดนครปฐม ในปีการศึกษา 2553 มีขั้นตอนการทดสอบรายบุคคลจำนวน 3 ราย จากนั้นทดสอบกับกลุ่ม 5 ราย สุดท้ายทดสอบกับกลุ่มนักเรียน 15 ราย ในการทดสอบทุกขั้นตอนมีการปรับบทเรียน เพื่อให้ได้ประสิทธิภาพตามเกณฑ์ 80/80 เมื่อได้โปรแกรมคอมพิวเตอร์ที่มีคุณสมบัติตามต้องการแล้วทำการเทดลอง โปรแกรมกับนักเรียนหูหนวก 36 ราย โดยเรียนบทเรียน 5 วันต่อเนื่องกัน วันแรกทำแบบทดสอบความรู้ก่อนการทดลองและในวันที่ 2 ถึง วันที่ 4 นักเรียนเรียนรู้จากบทเรียนคอมพิวเตอร์หน่วยการเรียนรู้ที่ 1 ถึง 3 โดยใช้เวลาหน่วยละ 50 นาที และทำแบบทดสอบหลังบทเรียน วันที่ 5 ทำแบบทดสอบความรู้หลังการทดลองการวิเคราะห์ข้อมูลใช้สถิติทดสอบที (t-test) สำหรับข้อมูลที่ไม่เป็นอิสระต่อกัน*

ผลการศึกษาและสรุป: *บทเรียนคอมพิวเตอร์มีประสิทธิภาพ ระดับ 81.85/82.22 ซึ่งบทเรียนคอมพิวเตอร์ช่วยสอนมีประสิทธิภาพสูงกว่าเกณฑ์ที่กำหนดที่ 80/80 คะแนน ผลการทดสอบก่อนและหลังการทดลองพบว่า คะแนนเฉลี่ยความรู้เรื่องธงโภชนาการหลังการทดลองสูงกว่าก่อนการทดลองอย่างมีนัยสำคัญทางสถิติที่ระดับนัยสำคัญ <0.0001 ผลการทดลองมีข้อเสนอแนะว่าการพัฒนาโปรแกรมคอมพิวเตอร์ช่วยสอนสำหรับคนหูหนวกควรใช้เวลาในการเรียนน้อยกว่า 30 นาทีต่อหน่วยการเรียนรู้และภาพภาษามือในจอคอมพิวเตอร์ควรมีขนาดใหญ่ เพื่อให้คนหูหนวกซึ่งสื่อสารด้วยการมองภาพเห็นภาษามือได้ชัดเจน*