# Usability Testing of a Self-Learning Computer Program on Exercise for Older Adults Used by Health Volunteers

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## ABSTRACT

***The purpose of this study was to test the usability, namely, the effectiveness in terms of exercise knowledge compared with a conventional training program, the efficiency and the satisfaction of the developed self-learning computer program (or the Computer-Assisted Instruction [CAI]) on exercise for older adults used by Health Volunteers (HVs). The samples were 63 HVs from Muang District, Chiang Mai Province. They were randomly assigned to the experimental group (31 HVs) and the control group (32 HVs). Data were collected using the Demographic Questionnaire, the Exercise Knowledge Questionnaire (EKQ), the Efficiency Regarding the Use of the Computer Program Questionnaire (EUCPQ) and the Satisfaction Regarding the Use of the Computer Program Questionnaire (SUCPQ). Data were analyzed using descriptive, two-way mixed-method ANOVA and paired t-test. The results showed that the exercise knowledge of HVs in the experimental group immediately after the training and after 3 weeks of using the CAI was statistically higher than that of before at $p < .001$ and $p < .05$, respectively. However, the findings showed that there was no statistically significant difference between the exercise knowledge of the experimental and control groups. Further results showed that there were 22 HVs who used the CAI for repeated learning at the mean time of 33 minutes. In total, they felt at ease and highly satisfied after using the CAI. The results suggest that the CAI holds promise as an option for HVs to learn health promotion knowledge.***

**Key words:** Older adults, Exercise, Health volunteers, Computer-Assisted Instruction, Usability

## INTRODUCTION

Owing to advanced medical and health care development, and especially effective family planning, which decreases birth and death rates of the population worldwide, the number and ratio of people aged 60 and over are increasing all the time. In Thailand, the most recent estimated number of the elderly in the year 2008 was 7.042 million (Institute for Population and Social Research, Mahidol University, 2008), 11.2% of the total population. Moreover, it was anticipated that this number would rise to 23.1% by the year 2030 (Office of the National Economic and Social Development Board, 2007). Clearly, Thailand is coming to the point where the elderly group will be the population age group whose size will be much bigger than at present, and also than any other age group, as is the case with other countries (Population Division, United Nations, 2009).

Life expectancy at birth of Thai population for 2008 was 69.5 and 76.3 years, and at sixty was 19.4 and 21.9 years for male and female, respectively (Institute for Population and Social Research, Mahidol University, 2008). Similarly, the World Health Organization (2009) presents the most recent health statistics that Healthy Life Expectancy (HALE) at birth of Thailand for 2002 was 66.0 years for males and 72.2 years for females. In addition, the research study showed that both male and female elders could further live without disability for 16.4 and 18.2 years, respectively, and with disability would live on average 3.9 and 5.7 more years, respectively (Jitapunkul et al., 1999). This change presents an increase of responsibility for health professionals in promoting the healthy life of older adults and extending the duration of their lives without disability as long as possible.

The 2004 Health and Welfare Survey (National Statistical Office, Ministry of Information and Communication Technology, 2004) demonstrated that 51.8% of persons aged 60 and over had chronic diseases. The major diseases were cardiovascular diseases, diseases of the endocrine system, metabolic and nutritional disorders and diseases and disease of the musculoskeletal system and connective tissue. The causes of mortality among aging population from 1985-2003 were heart disease, cancer, diabetes mellitus, liver and kidney diseases, paralysis, pneumonia and accident (Viboonphonprasert, 2004). Some of these diseases are preventable or at least their occurrences can be made less inevitable by healthy lifestyle.

Healthy lifestyles among older adults incorporate quitting smoking, ensuring good nutrition and increasing habitual physical activity (Kennie et al., 2003). Quitting cigarette smoking and consuming safety food have been the subjects of the national health campaigns in Thailand. Currently, the Thai government has just launched the latest national strategy to achieve the main goal, "Healthy Thailand," by the year 2017. One of the goals is that Thai people aged 6 and over exercise [a type of physical activity] regularly for health wherever they live (Chiasakul, 2004; Krittiyaphichartkul, 2005). The promotion of exercise, therefore, is significant.

Caspersen et al., (1985) and the American College of Sports Medicine (2006) defined exercise as a type of physical activity that is planned, structured and repetitive bodily movement done to improve or maintain physical fitness. From systematic reviews (Fransen and McConnell, 2008; Mead et al., 2008;

Howe et al., 2007; Shaw et al., 2006; Thomas et al., 2006; Hayden et al., 2005; Edmonds et al., 2004; Latham et al., 2003; Montgomery and Dennis, 2002), there are many benefits of regular exercise for older adults. The former recommendations for promoting exercise in older adults were: frequency—3 times per week; intensity—60%-85% maximum heart rate; and time—at least 20 consecutive minutes (Jones and Jones, 1997). The new recommendations are: frequency—5 days per week; intensity—moderate; and time—at least 30 minutes (which can be accumulated throughout the day in 10-minute bouts) (American College of Sports Medicine, 2007; British Heart Foundation, 2007; The Heart Association of Thailand, 2007; World Health Organization, 2008).

From the most current report of the exercise behavior survey in Thailand (National Statistical Office, 2008), 12% of the elderly in Thailand exercised. Walking, running and exercising with a stick were types of exercise they often did. The major obstacles to exercising were illness, lack of time and lack of exercise instructors (Pothiban et al., 2002). Factors from several studies which were found to be related to exercise behavior were perceived benefits, interpersonal influences, social support and informational support (Chinuntuya, 2001; Thammasaeng, 2001; Charoenkitkarn, 2000; Totermsuck, 2000; Vananrit, 1999). Accordingly, it is evident that availability of instructors to support information about exercise and its benefits will facilitate older adults to exercise.

In Thailand, health volunteers are Thai nationals who volunteer to be coordinators between health professionals and people in communities, bring health information to people's attention and provide them with primary health care services. In 1992, the Public Health Act legitimized health volunteers to take part in caring for the health of people in their own communities (Pawabut 1994; Pothisiri, 2002). HVs are trained in general and local public health for 12 days (Primary Health Care Committee Office, 1997). At present, they are the key persons in the community to cure some simple illnesses and care for every age group, including older adults. Promoting exercise among elders is one of their roles. In particular, since the "Healthy Thailand" project was launched, this role has become more important. Moreover, in 2007, the Ministry of Public Health proceeded to train health volunteers in restoring and developing their potential for caring for people within their areas of responsibility in general and emergent health problems (Primary Health Care Division, Ministry of Public Health, 2007). It follows that this research will advance health volunteers' capabilities, particularly when exercise for older adults is concerned.

For the time being, although there are a variety of methods in educating health volunteers, such as individual or group training, these methods use more personnel, time, resources and money than educating by Information Technology (IT), e.g., computers, computer programs, CD-ROMs, etc. Furthermore, the knowledge gained from such training is not being sufficiently updated in this time of rapidly-growing health information. Meanwhile, health education by IT is well suited to provide accurate and up-to-date information, can interactively attract users' interest and can be accessed at any time and anywhere. This is especially the case as training health volunteers involves not only knowledge, but

also skill and practice. Education with multimedia including interactive motion pictures and voice instruction will promote learners through the coordination of eye and ear, ease of reviewing and at a cheaper cost than with group education (Carty and Phillip, 2001; Jeerapaet, 2001). With these advantages, it was a matter of necessity to develop a computer program which will assist in bringing health volunteers' exercise suggestions to older adults. This is in accordance with the policy of the Thai government which stresses the importance of IT development for improving the living condition of the Thai people (Ministry of Information and Communication Technology, 2005). Since the year 2000, an Internet Tambon system [sub-district] has been constructed and developed for every sub-district in Thailand (ThaiTambon Dot Com, 2005). In addition, Chiang Mai Province, the biggest in the north of Thailand, has been selected by the Thai government to be "The Information Communication Technology (ICT) City," by becoming a center for developing software and the ICT sector of the country (New software office, 2005). Computers have been rapidly made available and accessible throughout the province.

The researcher developed a self-learning computer program in the contents of exercise for older adults. The contents were divided into 10 objectives of learning, i.e., (1) reasons to exercise for older adults, (2) benefits of exercise for older adults, (3) types of exercise and benefits of each type, (4) beginners' guide to exercise, (5) practice before exercising, (6) appropriate exercise for older adults, (7) practice after exercising, (8) symptoms to stop exercising, (9) injuries from exercising and (10) medication that must pay attention. The developed computer program was the typical multimedia Computer-Assisted Instruction (CAI) program.

The usability test was implemented in three major components: effectiveness, efficiency and satisfaction with its context. Effectiveness is measured by the accuracy and completeness with which users achieve goals. For this study, the goal which the researcher wished users or health volunteers to accomplish was the instruction concerning exercise knowledge suitable for older adults. Thus, exercise knowledge was used to test the effectiveness of the program. Efficiency is reflected in the resources expended in relation to the accuracy and completeness with which users achieve goals. The efficiency in this study was pattern using, time spending and difficulty feeling of health volunteers in using the program. Satisfaction is freedom from discomfort, and the achievement of positive attitudes regarding the use of the program. Measured for this study, the satisfaction was health volunteers' views in aspects of convenience, preference, interest, speed, usefulness, acceptability, practicality and sufficiency in using the program.

The development of this kind of health education-assisting tool will enhance health volunteers' competency in performing their duty to promote health in their communities, in particular, conveying to older adults an understanding of the benefits of exercise and the appropriate methods of doing it, providing health volunteers with easy access to knowledge sources and helping them to be familiar with IT in the IT age. The results of this study will become basic knowledge for further research in developing other computer programs for promoting the health

of older adults in other contents and with other population groups.

## OBJECTIVES

1. To compare exercise knowledge between health volunteers using the self-learning computer program on exercise for older adults and those receiving a conventional training program.
2. To examine the efficiency of the self-learning computer program on exercise for older adults used by health volunteers.
3. To examine the satisfaction of health volunteers in using the self-learning computer program on exercise for older adults.

## HYPOTHESES

1. The exercise knowledge of health volunteers using the self-learning computer program on exercise for older adults will be better than those receiving a conventional training program immediately after the training and after 3 weeks of using or training.
2. The exercise knowledge of health volunteers immediately after the training and after 3 weeks of using the self-learning computer program on exercise for older adults will be better than before using the computer program.

## QUESTION

Is the self-learning computer program on exercise for older adults efficient and satisfactory for health volunteers?

## MATERIALS AND METHODS

### Research Design

The randomized clinical trial (RCT), the two-group pretest-posttest design, was used in this study in order to test usability of the developed computer program.

### Population and Sample

The target population was health volunteers working in Muang District, Chiang Mai Province, totaling 2,788 persons (Primary Health Care Division, Ministry of Public Health, 2008). Because there had been no precedented relevant research of this kind, therefore, the researcher used the Central Limit Theorem (Norwood, 2000) to estimate the sample size of this study, that is, at least 30 participants per group. The researcher expected the attrition rate to be 30%, so at least 40 participants per group were needed to be enrolled in this study. Since this research design used two groups of study, the total sample then was 80 health volunteers.

The researcher received the name list of health volunteers from Chiang Mai Municipality and Muang District Health Office. The ratio of health volunteers for both areas is approximately 1:1, which means 40 health volunteers from Chiang Mai Municipality's responsibility area and 40 health volunteers from Muang District Health Office's responsibility area. Inclusion criteria in selecting to be the samples of this study for both groups were that health volunteers (a) were able to read and write Thai, (b) did not have any vision problem, (c) had computers available at home and (d) were interested and willing to participate in the study. Exclusion criteria were health volunteers who were not able to take part throughout the study (3 weeks).

Cluster random sampling was used to obtain subjects from both Chiang Mai Municipality and Muang District Health Office's responsibility areas. There are 81 communities in Chiang Mai Municipality. The communities were randomly selected and assigned to experimental (9 communities) and control (11 communities) groups. Furthermore, there are 9 sub-districts within Muang District Health Office's responsibility areas, and each sub-district was randomized to be selected for the experimental (5 sub-districts) and control (4 sub-districts) groups.

**Instruments**

*Instruments for the Intervention*

*1. The Handout of Exercise for Older Adults and the Teaching Plan.* First, the researcher reviewed the related literature from a variety of knowledge sources, e.g., electronic databases, Google, journals, books, etc. Then, the contents of exercise for older adults were written and revised under dissertation committee's supervision for many drafts. The contents included benefits of exercise, practice guides before and after exercise, essential information related to exercise and exercise prescription including type, intensity, duration, frequency and progression of exercise for general older adults. The mentioned contents were written in the form of a handout and a teaching plan for a conventional lecture by consulting with a health official who is currently giving health education to health volunteers in Chiang Mai Municipality. After revising the handout and the teaching plan according to the experts' suggestions and dissertation committee's agreements, both the revised handout and teaching plan were sent to the health official who gave a lecture in the conventional training program on exercise for older adults to use it as her teaching plan and handout for health volunteers in the control group.

*2. The Multimedia Computer-Assisted Instruction (CAI) and its Manual*. Using these similar contents as the control group, the researcher wrote the storyboard for CAI according to dissertation committee's suggestions. The storyboard was divided into three categories: messages, pictures and sound. After that, the researcher designed the flow chart of CAI or the algorithm with the programmer. Then, the programmer developed the computer program based on the storyboard by following the algorithm. After revising the computer program according to the experts' suggestions and dissertation committee's agreements, the researcher asked three health volunteers, who had their characteristics like the sample, to use this program and asked them for improvement. Finally, the researcher

revised the program again according to the three HVs' suggestions. The researcher tested the revised program and corrected it together with the programmer. Then, the program was ready to be tested for its usability by storing it in a CD-ROM. Moreover, its manual was written for better understanding of the first-time users according to the mentioned three HVs' suggestions.

*Instruments for Data Collection*

1. The Demographic Questionnaire was designed by the researcher to obtain information on gender, age, marital status, education, occupation, income, duration of being a health volunteer and previous computer use.

2. The Exercise Knowledge Questionnaire (EKQ) was developed by the researcher to ask health volunteers about the benefits of exercise, practice guides before and after exercise, essential information related to exercise and the appropriate exercise prescription for general older adults. The EKQ contained 30 items, which were 14 negative items (items no. 3, 7, 9, 10, 14, 15, 17, 18, 22, 24, 25, 27, 28 and 30) and the rest were positive items. A "right" or "wrong" format was the alternative answer for this instrument. The right answer was scored one and the wrong was scored zero. Scores of exercise knowledge ranged from 0-30.

3. The Efficiency Regarding the Use of the Computer Program Questionnaire (EUCPQ) was developed by the researcher. The EUCPQ contained ten items in accordance with ten objectives of learning. Its components were pattern using, time spending and difficulty feeling. In pattern using, health volunteers were asked whether they did not open, o only opened or opened and studied the computer program for each objective. In time spending, health volunteer recorded the time they used in learning each objective of the contents in the computer program. In difficulty feeling, the 5-Likert scale was used. Scores of difficulty feeling ranged from one to five. They were classified into five equal levels, namely, very easy (1-1.49), easy (1.5-2.49), not sure (2.5-3.49), difficult (3.5-4.49) and very difficult (4.5-5).

4. The Satisfaction Regarding the Use of the Computer Program Questionnaire (SUCPQ) was created by using the 7-level semantic differential scale to rate the opinions of the health volunteers using the computer program in aspect of convenience, preference, interest, speed, usefulness, acceptability, practicality and sufficiency towards their uses—eight items. Scores of difficulty feeling ranged from one to seven. They were classified into seven equal levels, namely, very highly dissatisfied (1-1.49), highly dissatisfied (1.5-2.49), fairly dissatisfied (2.5-3.49), not sure (3.5-4.49), fairly satisfied (4.5-5.49), highly satisfied (5.5-6.49) and very highly satisfied (6.5-7). Additionally, an open-ended questionnaire was used to ask them further about their problems and their suggestions for improvement by the research assistant.

**Instrument Testing**

All developed instruments were sent to the 5 experts in geriatrics, gerontology and exercise. After receiving the experts' suggestions, the researcher improved all instruments following their suggestions. The Content Validity Index (CVI)

was used to test the content validity of EKQ, EUCPQ and SUCPQ. The CVI of these three instruments were: EKQ = 0.933, EUCPQ = 1.0 and SUCPQ = 0.875. The tryout took place with 10 health volunteers who were not the samples of this study. The Kuder-Richardson Formula 20 (KR-20) was used to test reliability of the EKQ and the result was 0.75. The final test in 63 health volunteers reported the Cronbach's alpha coefficient of the EKQ, the part of difficulty feeling in the EUCPQ and the SUCPQ were 0.68, 0.79 and 0.71, respectively.

**Procedures**

The researcher contacted the staff of Chiang Mai Municipality and Muang District Health Office to ask permission to carry out the study. The researcher contacted health volunteers who were able to read and write Thai (a), who did not have any vision problem (b), who had computers available at home (c) and who were interested and willing to participate in the study (d). They were randomly allocated into two groups.

Group A: The experimental group received the demographic questionnaire and the EKQ from the research assistant to test exercise knowledge for older adults beforehand. Then this group was taught to use the developed computer program by the researcher. After that, they received the computer program in the form of a CD-ROM and were given time to use the program. If there was any question regarding computer program usage, they could ask the researcher. After this first use, they received the EKQ to test their knowledge immediately after using the program. Then the researcher made an appointment after this for a three-week follow-up to let them use this program in their community. After three weeks, they received the EKQ, the EUCPQ and the SUCPQ and were required to respond to them by the research assistant.

Group B: The control group received the demographic questionnaire and the EKQ from the research assistant to test exercise knowledge for older adults beforehand. Next, a lecture and a handout about exercise for older adults were given to this group by the previously-mentioned health official. If there were any questions regarding handout usage, they could ask the lecturer. After the lecture, they received the EKQ to test their knowledge after reading the handout. The researcher made an appointment after this for a three-week follow-up to let them read this handout in their community. After three weeks, they received the EKQ to test their knowledge after reading the handout by the research assistant.

**Protection of Human Rights**

This study was approved by the Research Ethics Review Committee of the Faculty of Nursing, Chiang Mai University. The participants were voluntarily selected to participate in this study. Before entering the study, the researcher fully described the nature of the study and the participants' rights. A consent form was given to them. Except for using in the study, no information regarding participants was disclosed. All participants in the control group received the computer program, as the experimental group had, after the study was completed.

**Data Analysis**

1. Descriptive statistics, i.e., frequency, percentage, mean, median, standard deviation (SD), were used for demographic data. For the efficiency, pattern using and time spending were summarized using frequency and percentage whereas difficulty feeling was summarized using mean and SD. The satisfaction and its attributes were sumed up using mean and SD.

2. A two-way mixed method ANOVA was used to compare the exercise knowledge (the EKQ) of health volunteers using the self-learning computer program on exercise for older adults and those receiving the conventional training program after first using or training and after three weeks of using or training (between Groups A and B), and to compare the exercise knowledge of health volunteers before and after first using and after three weeks of using the self-learning computer program on exercise for older adults (within Group A). Prior to the analysis of exercise knowledge, the assumption of normality was tested.

Paired t-tests were additionally used to compare the exercise knowledge of health volunteers using the self-learning computer program on exercise for older adults before, after first using and after three weeks of using (3 pairs of time within Group A), and also with those receiving the conventional training program (3 pairs of time within Group B).

Prior to using these statistics, the two groups were compared for the differences of their demographic data at baseline. Chi-square tests were used to test the variables in nominal and ordinal scales, i.e., gender, marital status, education and occupation. T-tests were also used to test the variables in interval scales, i.e., age, income and duration of being a health volunteer. Meanwhile, the Mann-Whitney U test was used for the variable income because its data did not meet the assumption of normal distribution.

3. Grouping was used for data in the open-ended question in the SUCPQ.

## RESULTS

The samples of this study were health volunteers who were working in Muang District, Chiang Mai Province. Initially, 64 participants (32 in the experimental group, 32 in the control group) met the research criteria and agreed to participate in the study. In the experimental group, one of them did not answer one question of the EKQ in the immediate posttest, so this participant was excluded from the study. Thus, the attrition rate of the experimental group was 3.125%. At last, the final sample total was 63 participants including 31 in the experimental group and 32 in the control group. The baseline of demographic characteristics of all participants is illustrated in Table 1.

The majority of the samples were female both in the experimental group (96.8%) and control group (75%). The age of participants in the experimental group ranged from 18 to 63 years of age, with a mean of 46.45 (SD = 1.83). In the control group, ages ranged from 23 to 69 years of age, with a mean of 50.38 years (SD = 1.65). The largest percentage of participants was in the age range

between 40 and 59, both in the experimental group (71%) and the control group (78.1%). Most of the participants in both groups (58.1% in the experimental group and 71.9% in the control group) were married. As to the formal education level, 41.9% of the participants in the experimental group completed the senior high school program or had received a certificate or a diploma or a bachelor's degree; whereas, exactly half of the participants in the control group completed the primary school program.

About 58% of the experimental group were unemployed or students or housewives, and almost 75% of the control group were unemployed or students or housewives (37.5%) or farmers (37.5%). The median income in the experimental group was 5,000 Baht per month while in the control group, it was 4,000 Baht per month. In the experimental group, the mean year of being a health volunteer was 7.06 years (SD = 4.99) with a range of 1 to 22 years, while the mean was 7.03 years (SD = 3.38) with a range of 2 years to 15 years 6 months in the control group. Most participants in both the experimental (71.0%) and control groups (68.8%) had previously used computers before participating in the intervention. Compared to the control group, the experimental group was similar in almost all demographic data at baseline, only gender ($p = .026$) showing a slight difference.

**Table 1.** Demographic characteristics of the experimental and control groups.

| Demographic characteristics | Group | | | | Statistic | p-value |
|---|---|---|---|---|---|---|
| | Experimental (n = 31) | | Control (n = 32) | | | |
| | n | % | n | % | | |
| **Gender** | | | | | | |
| Male | 1 | 3.2 | 8 | 25.0 | 6.097[b] | .026 |
| Female | 30 | 96.8 | 24 | 75.0 | | |
| **Age (year)** | | | | | | |
| Mean±SD | 46.45±1.83 | | 50.38±1.65 | | .448[t] | .825 |
| Range | 18-63 | | 23-69 | | | |
| <20 | 1 | 3.2 | 0 | 0 | | |
| 20-39 | 5 | 16.1 | 3 | 9.4 | | |
| 40-59 | 22 | 71.0 | 25 | 78.1 | | |
| ≥60 | 3 | 9.7 | 4 | 12.5 | | |
| **Marital status** | | | | | | |
| Single | 5 | 16.1 | 6 | 18.8 | 2.598[a] | .228 |
| Married | 18 | 58.1 | 23 | 71.9 | | |
| Separated, widowed | 8 | 25.8 | 3 | 9.4 | | |
| **Formal education level** | | | | | | |
| Primary school | 10 | 32.3 | 16 | 50.0 | 2.228[a] | .328 |
| Junior high school | 8 | 25.8 | 5 | 15.6 | | |
| Senior high school certificate, diploma, bachelor's degree | 13 | 41.9 | 11 | 34.4 | | |
| **Occupation** | | | | | | |
| Unemployed | 18 | 58.1 | 12 | 37.5 | 4.829[a] | .089 |
| Government and general employees | 2 | 6.5 | 8 | 25.0 | | |
| Farmer | 11 | 35.5 | 12 | 37.5 | | |
| **Income (Baht/month)** | | | | | | |
| Median | 5,000 | | 4,000 | | -1.833[z] | .067 |
| Range | 0-36,000 | | 0-15,000 | | | |
| **Year of service** | | | | | | |
| Mean±SD | 7.06±4.99 | | 7.03±3.38 | | .984[t] | .975 |
| Range | 1-22 | | 2-15.5 | | | |
| 1-5 | 13 | 41.9 | 14 | 41.9 | | |
| 6-10 | 4 | 45.2 | 14 | 45.2 | | |
| ≥11 | 4 | 13.0 | 4 | 13.0 | | |
| **Previous computer use** | | | | | | |
| Yes | 22 | 71.0 | 22 | 68.8 | .037[a] | .848 |
| No | 9 | 29.0 | 10 | 31.2 | | |

Note. [t] = t-test, [a] = Chi-square test, [b] = Fisher's Exact test, [z] = rank sum Mann-Whitney-U

**Exercise Knowledge**

For comparison of the two groups' mean scores of exercise knowledge over the three times of evaluation, repeated measures analysis of variance was used. As represented in Table 2, the finding demonstrated that there were no statistically significant differences in the exercise knowledge between the control and experimental groups (F = 1.967, p = .166). Also, the findings revealed that there was no influence of the group and time on exercise knowledge between the two groups (F = 1.113, p = .332). However, there were statistically significant differences within each group over time (Experimental group: F = 7.009, p = .002; Control group: F = 9.024, p < .000).

**Table 2.** Baseline and posttest means and standard deviation for exercise knowledge by group.

| Group | Time of evaluation | | | | | | Time effect | | Group *Time effect | | Group effect | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Time 1 | | Time 2 | | Time 3 | | | | | | | |
| | Mean | SD | Mean | SD | Mean | SD | F | p | F | p | F | p |
| Experimental (n = 31) | 21.87 | 2.05 | 23.10 | 2.24 | 22.39 | 1.94 | 7.01 | .002** | | | | |
| Control (n = 32) | 22.03 | 2.01 | 23.81 | 2.56 | 22.34 | 1.94 | 9.02 | .000** | 1.11 | .332ns | 1.97 | .166 ns |

Note. Time 1 = Baseline assessment, Time 2 = Immediate post-intervention, Time 3 = Three-week post-intervention, ** = p <. 01, ns = not significant

Regarding the significant differences between the three times of exercise knowledge in the experimental group, post hoc testing and paired t-test showed that the mean scores of exercise knowledge immediately post-intervention (Time 2) were significantly higher than those at the baseline (Time 1) (t = 3.712, p = 0.001). Moreover, there was significantly less exercise knowledge at three-week post-intervention (Time 3) than that at immediate post-intervention (t = -2.160, p = 0.039) as shown in Table 3. However, there was no significant difference in exercise knowledge between the baseline and the three-week post-intervention. Accordingly, the second hypothesis was supported by these research findings.

**Table 3.** Comparison of exercise knowledge in the experimental groups (n = 31) by time.

| Variables | Mean difference | SD | t | df | p value |
|---|---|---|---|---|---|
| EKT2-EKT1 | 1.226 | 1.839 | 3.712 | 30 | 0.001** |
| EKT3-EKT2 | -0.710 | 1.829 | -2.160 | 30 | 0.039* |
| EKT3-EKT1 | 0.516 | 1.823 | 1.576 | 30 | 0.126ns |

Note.

EKT2-EKT1 = Exercise knowledge between baseline (Time 1) and immediately post-intervention (Time 2)

EKT3-EKT2 = Exercise knowledge between three week post-intervention (Time 3) and immediately post-intervention (Time 2)

EKT3-EKT1 = Exercise knowledge between baseline (Time 1) and three-week post-intervention (Time 3)

ns = not significant, * = p < .05, ** = p <. 01

**Efficiency**

***Pattern using and time spending.***

After receiving the developed computer program for self-learning in their communities for three weeks, 22 participants (71.0%) opened the multimedia CAI whereas nine participants (29%) did not open it again after first training (Table 4). Among 22 participants, there were about two to three health volunteers (6.5-9.7%) who opened the CAI only to see and hear it, not to study, while the others opened and studied the total CAI for the mean time of 33 minutes. Most of the experimental group (61.3-64.5%) spent their time in studying objectives 1 to 10 between 2.76-3.76 minutes for each objective.

***Difficulty feeling.***

After asking the participants again after first training to use the program about the feeling of difficulty when studying the program (content/program), the mean score was 2.15 (SD = 0.07), which meant that they felt it easy to use (Table 5). Among ten objectives of learning, the sixth objective was the easiest one whereas the fourth objective was the most difficult one.

**Table 4.** Pattern using and time spending.

| Objective Of learning | Not studied | | Studied | |
|---|---|---|---|---|
| | Not opened n (%) | Only opened n (%) | n (%) | Mean time used (min) |
| 1 | 9 (29.0) | 2 (6.5) | 20 (64.5) | 3.56 |
| 2 | 9 (29.0) | 3 (9.7) | 19 (61.3) | 3.44 |
| 3 | 9 (29.0) | 2 (6.5) | 20 (64.5) | 3.66 |
| 4 | 9 (29.0) | 3 (9.7) | 19 (61.3) | 3.76 |
| 5 | 9 (29.0) | 2 (6.5) | 20 (64.5) | 3.37 |
| 6 | 9 (29.0) | 3 (9.7) | 19 (61.3) | 3.18 |
| 7 | 9 (29.0) | 3 (9.7) | 19 (61.3) | 2.76 |
| 8 | 9 (29.0) | 3 (9.7) | 19 (61.3) | 2.95 |
| 9 | 9 (29.0) | 2 (6.5) | 20 (64.5) | 3.08 |
| 10 | 9 (29.0) | 2 (6.5) | 20 (64.5) | 3.24 |
| Total CAI | | | | 33 |

**Table 5.** Difficulty feeling.

| Objectives of Learning | Difficulty | | |
|---|---|---|---|
| | Mean | SD | Level |
| 1 | 2.16 | 0.12 | Easy |
| 2 | 2.19 | 0.14 | Easy |
| 3 | 2.10 | 0.10 | Easy |
| 4 | 2.48 | 0.15 | Easy |
| 5 | 2.06 | 0.11 | Easy |
| 6 | 1.90 | 0.10 | Easy |
| 7 | 2.19 | 0.11 | Easy |
| 8 | 2.06 | 0.10 | Easy |
| 9 | 2.00 | 0.10 | Easy |
| 10 | 2.39 | 0.12 | Easy |
| Total | 2.15 | 0.07 | Easy |

**Satisfaction**

Using the 7-level semantic differential scale to justify the level of satisfaction in total, the average score was 6.16 (SD = 0.11), indicating that the satisfaction of the samples in using this CAI was at the high-satisfactory level (Table 6). Among attributes of the satisfaction, speed was the lowest one while usefulness was the highest one.

**Table 6.** Satisfaction level.

| Satisfaction | Mean | SD | Level |
|---|---|---|---|
| Convenience | 6.16 | 0.18 | Highly satisfied |
| Preference | 6.52 | 0.11 | Highly satisfied |
| Interest | 6.23 | 0.22 | Highly satisfied |
| Speed | 5.23 | 0.27 | Fairly satisfied |
| Usefulness | 6.71 | 0.10 | Very highly satisfied |
| Acceptability | 6.35 | 0.15 | Highly satisfied |
| Practicality | 6.26 | 0.17 | Highly satisfied |
| Sufficiency | 5.84 | 0.25 | Highly satisfied |
| Total | 6.16 | 0.11 | Highly satisfied |

***Problems and other suggestions.***

From the open-ended questions in relation to the satisfaction regarding the use of the computer program, five participants did not offer any suggestions about the developed computer program. However, 26 participants offered suggestions and problems that could be classified under 4 headings: (a) satisfaction, (b) opinions about the contents, (c) suggestions for improving the program and (d) other matters.

Satisfaction. Some participants mentioned that they liked the program because they had learned how to use a computer, including how to turn it on

and off. One of them reported that it was convenient in that tasks could be completed in a short time. Another participant indicated that using CAI was better than learning from reading a handout. Only one participant claimed to have difficulty owing to lack of computer skills. Another difficulty for this participant was the non-availability of the computer because her daughter was using it most of the time.

Contents. Five participants expressed the opinions that the contents in the developed CAI were good and beneficial. One considered that it was beneficial to older adults and their informal caregivers and thought the activities suggested were safe for older adults to use. Nevertheless, one of them indicated that the contents in each title were insufficient. Furthermore, some health volunteers wanted to add more contents, such as (a) having older adults who regularly exercise, or a physician expert in older adults giving explanations and offering benefits; (b) having a picture of older adults expressing their feelings after exercise. Some health volunteers suggested having additional contents such as guidelines about exercise for the elderly who had knee osteoarthritis or an illness and other health-promoting behaviors concerning—for example—eating healthy food, taking care of mental health, etc.

Improving the CAI. One participant thought that pictures were inadequate. There should be motion pictures of the postures during exercise for older persons. Some of them expressed that they wanted to be trained and learn more.

Other suggestions. Additionally, they requested frequent home-visiting, affording training in the use of CAI.

## DISCUSSION

### Effectiveness

From the findings of this research study, it appears that there was no statistically significant difference in the effectiveness measured for exercise knowledge between learning from the developed computer program and the conventional lecture. However, knowledge was increased in a statistically significant way within each method. This result indicates that both learning methods are effective for health volunteers studying health information.

This does seem to be in congruence with despite the fact that many studies (Burasirilak, 1996; Choyhirun, 2002; Lertpoonwilaikul, 2005; Namprom et al., 2005) which found that CAI transfers knowledge better than lectures do. However, most of their studies used the quasi-experiments and were conducted in formal education settings where learners tended to have basic computer knowledge and were youthful enough to learn new technology like that of the computer. This research study, on the other hand, was conducted with health volunteers who had not usually learned to use the computer, and most were middle aged (40-59 years), and thus found it hard to learn about the new information technology.

Moreover, very few studies have directly compared CAI with conventional teaching methods by using randomized controlled trials. In one study (Jenkins et al., 2008), medical students were randomized into two groups to compare the

effectiveness of CAI with the conventional lecture in dermatology morphology. The results revealed that there was no statistically significant difference between the scores of the conventional teaching method and the CAI online tutorial. This is congruent with the results of this research study.

Two other studies using the RCT design (Tsai et al., 2004) have compared electronic learning programs with face-to-face teaching. First, novice nurses were randomly assigned to the computer-assisted multimedia training course for intravenous injection, and the conventional lecture. The study concluded that the CAI training course had a significant effect on the knowledge of intravenous injection, both immediately and with two-week posttests. Second, pregnant and postpartum women were randomly assigned to either the experimental group, using the CD-ROM with exercise content, or to the control group, using the CD-ROM with neutral content, for one hour. The results showed that the experimental group, compared with the control group, had significant increases in self-efficacy and knowledge. Hence, both findings are incongruent with the present findings of this research.

This is a pioneer study of teaching health volunteers to use CAI in learning health contents. Furthermore, this study is a randomized, controlled study comparing CAI with conventional lecture training. In an effort to address the concern of internal validity that many other studies have encountered, this study's subject material in the exercise for older adults tutorial was identical to the material covered in the lecture. Thus, both groups of health volunteers received identical subject contents. The only difference was the ways subject contents were presented.

Considering all the collected data, this study revealed that there was no statistically significant difference between the scores of the health volunteers in the intervention group (CAI) and the control group (conventional teaching) in the immediate time and three weeks after initial exposure to the material. However, both methods showed a statistically significant difference within its method. Accordingly, it can be concluded from this study that the use of computer tutorial to teach health volunteers allows at least the same learning performance and short-term knowledge retention as those health volunteers attending conventional lectures with a health official. The results therefore are inconsistent with the first hypothesis.

There are several possible reasons that this study showed no significant difference between teaching methods. Owing to lack of experiences in using computer, health volunteers might have fears in using the CAI which has an effect on decreasing their concentration and learning ability. Also, the language used in the computers was English. This may present difficulties in the Thai context. In addition, one of the limitations of the CAI technique is the lack of the capability to have a dialogue with the lecturer to pose questions and gain clarification when confusion arises. For knowledge retention, this study covered a three-week period, so this was a too short period for the health volunteers to improve their computer skills and interact with the CAI program.

In line with the second hypothesis, this kind of learning showed significant

increases in exercise knowledge of the health volunteers after the first and third weeks of using it. These results can be explained by assuming that knowledge increases with the four CAI characteristics as discussed earlier. This provides evidence to indicate that health volunteers could use CAI for learning health-related contents by themselves.

**Efficiency**

From the study of pattern using and time spending, nine health volunteers did not open the CAI and two to three health volunteers opened the CAI but did not study it. Two possible explanations of this are that they had little time to use the CAI, and had not computer available to use whenever they needed one, as with the participant mentioned above. Most participants studied the received multimedia CAI and spent on average of three minutes for each learning objective for a total of 33 minutes, which is suitable with the time length set by the program (33-35 minutes depending on the speed of the user's click). This implies that health volunteers could learn to use the multimedia CAI after receiving the intervention.

Asked about feelings of difficulty, most of the health volunteers expressed the view that this CAI was easy to use. Nevertheless, there were some objectives of learning or modules that they felt difficult to learn, such as Objective 4, and very difficult with Objective 2. The contents of Objective 4 were the beginners' guide to exercise. There were three proper steps of the exercise and details explaining each step, which might be difficult for the health volunteers to understand and learn. The contents of Objective 2 were about the benefits of exercise for older adults. They involved many body systems. They may have raised formidable problems of understanding for health volunteers who had had prior training only in basic knowledge in caring for the health of older adults.

**Satisfaction**

The result revealed that the satisfaction level of using multimedia CAI program among most health volunteers was at the high level in total. For each attribute of satisfaction, most of them felt satisfied either at the high or the highest level. The outcome of satisfaction in using CAI in this study parallels that of the study of Tsai et al. (2004) which showed a high rate of satisfaction for the multimedia computer program for intravenous injection among novice nurses. Nevertheless, there were some attributes, i.e., interest, speed and sufficiency, for which their satisfaction levels were at the low and lowest levels. These findings suggest improvements for these attributes of this CAI. Furthermore, it was found that some health volunteers preferred computer tutorials over learning from documents because of its convenience and the usefulness of its contents. Moreover, a few volunteers mentioned that they had limited time to learn the multimedia CAI. These results imply that health volunteers will feel more satisfied if some attributes of this CAI are improved, and more time is given to them to learn.

In conclusion, the multimedia CAI was at least as effective as the conventional lecture teaching of exercise for older adults to health volunteers. From

the studies of efficiency and satisfaction, most of the findings were at the high levels. This lends support to the assumption that CAI might offer many potential advantages over conventional teaching and therefore, can be used to further improve the knowledge of health volunteers if they have more computer skills and the time to use it, and the computer program is improved according to their suggestions.

## RECOMMENDATIONS FOR FURTHER RESEARCH

Using a longer time and a larger number of samples to test effectiveness, recording pattern using in the computer of health volunteers or users to examine efficiency (through each click and each time used), conducting focus group discussion or interviewing the samples to examine satisfaction and difficulty feeling are strategies for further research studies to test the usability of the CAI.

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