

Effectiveness of Online Health Literacy Program for COVID-19 Prevention among Teachers in Childcare Centers: A Quasi-experimental Study

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Abstract: COVID-19 is a pandemic disease and has spread rapidly across the world including in Thailand, and requires prevention and control especially in children. Teachers play an important role in caring for children in childcare centers. Although the infection rate of children is less than adults, they may easily spread it in childcare centers and to their families, teachers and communities. Therefore, the health literacy and preventive behavior of teachers should be enhanced to prevent infection and transmission of COVID-19 in childcare centers. This quasi-experimental study aimed to test the effects of the Online Health Literacy Program for COVID-19 prevention and the preventive behavior of teachers in childcare centers. The experimental group ($n = 28$) participated in the program which consists of a package for self-directed learning, small group participation, and learning outcome evaluation. The control group ($n = 28$) received a COVID-19 prevention guidebook through self-directed learning. A Demographic Questionnaire, the Health Literacy Questionnaire, and the COVID-19 Preventive Behavior Questionnaire were used to collect data. Data were analyzed using descriptive statistics, independent t-test, Mann-Whitney U test, and Wilcoxon signed rank test.

The results revealed that teachers in the experimental group had a statistically significant improvement in COVID-19 preventive behavior when compared with the control group, one-week after completion of the program. This finding suggests that the program with multiple activities delivered online could enhance the COVID-19 preventive behavior of participants. Such an intervention could be directly beneficial to school nurses and other nurses to enhance health behaviors among teachers in childcare centers. School nurses and other nurses should develop online courses to promote the preventive behavior of people in childcare centers and schools, and need the support of educationalists and government for this.

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Introduction

The COVID-19 pandemic has spread rapidly worldwide.^{1,2} According to the report on 27 August 2021 from Department of Disease Control, there were 215,068,674 COVID-19 patients around

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the world and 649,765 deaths,³ however these figures may be vastly underestimated. In Thailand, there were 1,120,869 COVID-19 patients and 10,314 deaths.³ Among patients infected with COVID-19, 150,981 were children aged 0–19 years. In particular, there were 31,811 children aged 2–5 years infected with COVID-19, and 9 deaths.⁴ Although the number of infected children was lower than adults, they may have severe symptoms after infection with COVID-19 virus such as pneumonia, severe acute respiratory syndrome, or respiratory failure because of a short respiratory tract and incomplete immune system.⁵ Children aged 2–5 years are at risk of COVID-19 because they make contact a lot of people such as friends, teachers, staff, caregivers in childcare centers,⁶ and the current vaccine coverage is still not available for them.⁷ In order to prevent COVID-19 infection and dissemination in childcare centers, childcare directors and teachers should perform preventive behavior by seeking COVID-19 preventive information from various sources, evaluating, and applying knowledge to practice for protecting people in childcare centers from COVID-19 infection.

In 2020, Thailand's Ministry of Public Health provided a guideline for COVID-19 prevention for childcare centers and schools, requiring people (managers, teachers, caregivers, staff) who are involved in educational institutions to follow the guideline with an emphasis on 1) health screening of children, teachers, staff and caregivers before entering childcare centers and schools, 2) cleaning, disinfection, and safety in the environment, 3) promoting COVID-19 preventive behavior, and 4) promoting physical and mental health, and wellbeing for children, teachers, parents, and staff in childcare centers.^{8,9} Evidence suggests that such guideline can guarantee a higher value of COVID-19 prevention and control for childcare centers.^{6,8–10} Health screening can help to find children and staff at of COVID-19 infection and manage and rapidly control spread of COVID-19 such as notification

to close childcare centers, quarantine those at risk and infected people for 14 days, and manage the disinfection of the environment.^{4,11,12} This guideline can help to increase the preventive behaviors of children and teachers such as wearing masks and face shields, washing hands, and keeping social distancing.^{11–13} Therefore, the roles of teachers need to incorporate processes and care for COVID-19 prevention, aiming to try to ensure everyone in childcare center is safe from COVID-19 infection.

Studies have been undertaken on the effect of knowledge on preventive behavior of caregivers in a childcare center,¹⁴ the impact of health literacy on infection preventive behaviors^{15–18} and an online health literacy enhancement program for COVID-19 prevention to improve COVID-19 preventive behavior of village health volunteers.¹⁹ However, until this study there was no research on the COVID-19 preventive behavior of teachers in childcare centers during pandemic, lockdown, and reopening of school periods. Thus, this study aimed to determine the effectiveness of online health literacy program on COVID-19 preventive behavior and health literacy among teachers in childcare centers.

Literature Review and Theoretical Framework

Children of all ages are susceptible to COVID-19 infection.²⁰ When they get the infection, the average incubation period for COVID-19 in children is about 6.5 days, which is longer than the 5.4 days reported in adults.²¹ In children with COVID-19 infection, many cases were either asymptomatic or diagnosed with a mild to moderate symptom, only few cases had developed severe complications such as pneumonia, severe acute respiratory syndrome, or respiratory failure. Causes of severe symptoms may come from immuno-compromised conditions, pulmonary pathology,

and the age of infants (< 3 months).²² Moreover, infected children have been found to have nasopharyngeal SARS-CoV-2 viral loading similar to the other age groups, indicating that children were at a similar risk of infection to adults, and that SARS-CoV-2 can transmit from adults to children but rarely from children to others.²³ In addition, the number of infected children is higher after schools and kindergartens open because of increasing exposure of children to the virus. This situation affects parents' psychological status increasing anxiety, stress, agitation, and depression.²⁴ Thus, the managers and teachers should seek COVID-19 preventive information, and then apply knowledge to practice to protect everyone in childcare centers from infection.

Previous research regarding teachers' behaviors for COVID-19 prevention revealed that some teachers lack knowledge about this. Teachers stated that they do not know exactly how to create a health screening system before reopening a childcare center, manage health screening in front of childcare centers,⁷ how to identify people at risk or COVID-19 infection,¹² or how to choose the right solution for cleaning and disinfection for each material such as plastic toys, wood, steel, paper.^{7,12} Teachers also revealed that they needed to know more about assessing the appropriate sources of information which can be applied in practice for COVID-19 prevention.²⁵ Moreover, teachers received high expectation from the Ministry of Public Health provincial administrative organizations, and parents about management for COVID-19 prevention in order to establish the safety of childcare centers. These high expectations might make them feel phobic, worried, stressed, or anxious when trying to avoid mistakes in managing during the COVID-19 pandemic.^{20,25,26} Moreover, teachers do not understand and confuse the knowledge of COVID-19 prevention from several sources of information, and they are unable to put their knowledge into practice.²⁵ These problems can be stressful for teachers, who do not know what to do in

the circumstance. Teachers identified the need for protocols or guidelines for enhancing the COVID-19 preventive behavior.²⁰

A study suggested that knowledge can influence change in the preventive behaviors for respiratory tract infections of caregivers,¹⁴ while health literacy education affected infection-preventive behaviors of undergraduate students, especially when assessing credible sources of information.¹⁵ People with insufficient health literacy have inferior understanding of COVID-19 symptoms, are less able to create behaviors to prevent infection, and experience more difficulty finding information and understanding about COVID-19 prevention than people with sufficient health literacy.¹⁶ Health literacy regarding knowledge of COVID-19 infection, social support, and assessing the news about COVID-19 affects the preventive behaviors of people.^{17,18} Moreover, an online health literacy enhancement program for COVID-19 prevention can improve COVID-19 preventive behavior of village health volunteers significantly.¹⁹

Health literacy²⁷ is related to people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make considerations and take decisions in everyday life focusing on healthcare, disease prevention and health promotion to maintain or enhance quality of life during the lifetime. Moreover, health literacy involves cognitive and social skills, which relate to knowledge and understanding through thought and experience, interaction, communication, and self-regulation skills of individuals to gain access, to understand, and use information in ways that promote and maintain good health.²⁸ The competences of health literacy consists of four dimensions: accessing refers to the ability to seek, find, and obtain health information; understanding refers to the ability to comprehend the health information that is accessed; appraising describes the ability to interpret, filter, judge and evaluate the health information that has

been accessed; and applying refers to the ability to communicate and use the information to make a decision to maintain and improve health.²⁷ Therefore, researchers expect that applying health literacy concepts into the research can improve and maintain the preventive behaviors of COVID-19 infection of teachers in childcare centers.

Therefore, this study applied the steps of learning in a program based on the health literacy concept of Sorensen and colleagues²⁸ and created the program content based on the guideline to prevent and control the spread of COVID-19 virus in childcare centers of the Ministry of Public Health in Thailand and Early Childhood Development Board.^{8,9} Moreover, this program was provided through an online system in order to help teachers to assess easily about the COVID-19 information, they can assess this information in anywhere and anytime as requirement.

Hypotheses

The childcare participants in the experimental group would have significantly higher mean scores on health literacy and COVID-19 preventive behaviors than those in the control group at one week (week 8) after completion of the 7-weeks program.

Method

Study Design: A quasi-experimental design was used. The Transparent Reporting of Evaluations with Non-randomized Designs (TREND) checklist was employed to guide reporting of this study.

Study Setting and Sampling: Five provinces in the central and western regions of Thailand were selected where the incidence rate of COVID-19 was high with a maximum and strict control zone and involved in the academic service program of the Faculty of Nursing, Mahidol University during the

academic year 2020. Then these five provinces were randomly assigned using simple random sampling to the experimental or control province (two provinces and three provinces respectively). Then researchers selected four to five childcare centers in each province. Childcare centers in each experimental or control province were matched based on childcare centers' sizes (small, medium, and large). In each group comprised two large, four medium, and four small childcare centers. The potential participants in each group were recruited using a convenience sampling technique based on the following inclusion criteria: 1) aged 18 years or over; 2) at least three or more months of continuous previous work experience in childcare centers; 3) having basic skills in using online media; 4) able to communicate in the Thai language; and 5) being healthy and not at risk of contracting COVID-19. The sample size was calculated based on the effect size of a previous study at $d = 0.96$ ²⁹ with a power of .80 and a significance level of .05. The sample size was calculated to be 26 participants per group with an added attrition rate of 5%. Therefore, the convenience sample finally included 28 participants per group.

Ethical Considerations: This study was approved by the Mahidol University Central Institutional Review Board (MU-CIRB) (COA No.: MU-COVID2020.009/2206). The research project and information about how to contact the primary investigator (PI) with questions was explained to all participants. All participants were engaged on a voluntary basis and were free to withdraw from the study at any time without any consequence on their work. Confidentiality was a key consideration for all participants. In both the experimental and the control groups, codes were assigned to each teacher at the beginning of the study to replace the participant's name, and the pretest and posttest questionnaires were paired. The researchers began data collection when the research participants gave informed consent.

Measures: There were three instruments used to collect data, the Demographic Questionnaire, the Health Literacy Questionnaire, and the COVID-19 Preventive Behavior Questionnaire. The Health Literacy Questionnaire and the COVID-19 Preventive Behavior Questionnaire were developed by the researchers and validated by three experts, including a faculty member in pediatric nursing and two nursing professors specialized in infectious diseases. The reliability was tested with another group of 30 teachers, yielding Cronbach's alpha coefficients of 0.96 and 0.96 respectively. Content validity index (CVI) was 0.91 and 0.93 respectively.

The Demographic Questionnaire consists of six closed questions about gender, age, education level, work experience in a childcare center, training experience in COVID-19 prevention, and sources of information about COVID-19 prevention.

The Health Literacy Questionnaire, developed by the researchers based on health literacy concepts²⁷ and literature review,^{8,9} comprises 28 5-point Likert scale items covering accessing, understanding, appraising, and applying in four subscales of COVID-19 prevention behaviors. The four subscales include: 1) COVID-19 health screening in children, caregivers, and teachers, 2) environmental management in childcare centers, 3) improving COVID-19 preventive behavior, and 4) health promotion during the COVID-19 pandemic. The item scores range from 1 (strongly disagree) to 5 (strongly agree), and the total score ranges from 28–140. Higher scores indicate higher health literacy. Examples of items are: “I can find information about how to prevent the infection and transmission of COVID-19 in childcare centers” and “I study and compare information about caring for the environment from many different sources to prevent the spread of COVID-19 before I believe or act.” Cronbach's alpha reliability in the actual study was 0.92.

The COVID-19 Preventive Behavior Questionnaire, developed by the researchers based on a literature review,^{6,8,9} includes 38 items on a four-point Likert scale encompassing four subscales of MOPH guideline.³⁰ The four subscales of MOPH guideline include: 1) COVID-19 health screening in children, caregivers, and teachers, 2) environmental management in childcare centers, 3) improving COVID-19 preventive behavior, and 4) health promotion during the COVID-19 pandemic. The item scores range from 0 (never practice) to 3 (practice 5–7 days per week). The total score ranges from 0–114, with a higher score indicating a higher level of COVID-19 preventive behavior. Examples of items are: “I wash my hands before and after touching each student” and “I screen all students for temperature before they are allowed to enter the childcare center.” Cronbach's alpha reliability in the actual study was 0.88.

Online Health Literacy Program for COVID-19 Prevention

This program was developed by researchers based on the health literacy concept of Sorensen and colleagues.²⁷ The program content included the development of competencies in accessing, understanding, appraising, and applying health-related information within health care, disease prevention and health promotion settings.²⁷ This program focuses on providing the information, developing the teacher's health literacy, and improving behavior in preventing infection and transmission of COVID-19 in childcare centers. The program has five learning modules: 1) COVID-19, 2) COVID-19 health screening in children, caregivers, and teachers, 3) environmental management in childcare centers, 4) improving COVID-19 prevention behavior, and 5) health promotion during the COVID-19 pandemic. Each module includes video animation clips and PowerPoint, along with a test at the end of the module through

an online platform (Google Drive). The online program activities consist of small group discussions (MS Teams), analyzing case scenarios, creating guidelines for preventing COVID-19 in childcare centers, and telephone follow-up. The program content was reviewed for content validity by the same three experts who validated the two instruments above for

data collection. The comments and suggestions from all reviewers were incorporated in the final revision. The program requires a total of 11 hours in seven sessions over seven weeks. Participants in the experimental group were required to attend 100% of the intervention. The details of the program activities and the implementation are described in **Table 1**.

Table 1: Activities of the online health literacy program for COVID-19 prevention

Week/Duration	Objectives	Content and Activities
Week 1 60 minutes: completing an online pre-test 60 minutes: learning 5 modules of the program 30 minutes: taking the online test at the end of each module 10 minutes: counseling with telephone	To obtain pre-test data and increase knowledge, motivation, and competencies in accessing	<ul style="list-style-type: none">- Completing an online pre-test (Google Form)- Attending the online health literacy program for COVID-19 prevention in Google Drive and accessing the 5 modules to promote self-directed learning <ol style="list-style-type: none">1) COVID-19<ol style="list-style-type: none">1.1 SARS-CoV-21.2 The incubation period for COVID-191.3 Signs and symptoms of COVID-191.4 Infection and transmission of COVID-192) COVID-19 health screening in children, caregivers, and teachers<ol style="list-style-type: none">2.1 Guidelines for screening COVID-19 in childcare centers2.2 Guidelines for COVID-19 infection and control in childcare centers3) Environmental management in childcare centers<ol style="list-style-type: none">3.1 Environmental management in the childcare center:<ul style="list-style-type: none">- Disinfection and cleaning of school surfaces (toys, lunch tables, door and window handles, sports equipment, teaching and learning aids etc.)- Sanitation and waste management facilities- Implement social distancing practices4) Improving COVID-19 prevention behavior<ol style="list-style-type: none">4.1 Preventing the spread of COVID-19 in childcare centers4.2 Hand hygiene and the use of face masks during COVID-19 pandemic4.3 Guidelines for providing health education to children in childcare centers5) Health promotion during the COVID-19 pandemic<ol style="list-style-type: none">5.1 Physical and mental health promotion5.2 Nutrition and physical activity5.3 Vaccines for children

Table 1: Activities of the online health literacy program for COVID-19 prevention (Cont.)

Week/Duration	Objectives	Content and Activities
Week 2 60 minutes: participation in a small group 10 minutes: counseling with telephone	To increase knowledge, motivation, and competencies in “understanding”	5.4 Caring for the mental health of children <ul style="list-style-type: none"> - Taking the online test at the end of each module (self-assessment) (Google Form) - Counseling with telephone follow-up <ul style="list-style-type: none"> - Participation in a small group (the 28 students were divided into 3 small groups, discussing at the same time: 9–10 teachers with one researcher per group) to discuss the key concepts of modules 1–3 online (MS Teams) - Counseling with telephone follow-up - Participation in a small group to discuss the key concepts of modules 4–5 online (MS Teams) - Counseling with telephone follow-up
Week 3 60 minutes: participation in a small group 10 minutes: counseling with telephone	To increase knowledge, motivation, and competencies in “understanding”	
Week 4 60 minutes: analyzing case scenarios and discussion 30 minutes: summarizing the key concepts of the 5 modules 10 minutes: counseling with telephone	To increase knowledge, motivation, and competencies in appraising and making decisions	<ul style="list-style-type: none"> - Analyzing case scenarios and discussion with a small group online (MS Teams), for example, “A child had suspected COVID-19 infection: How to manage” - Summarizing the key concepts of the 5 modules with a small group online (MS Teams) - Counseling with telephone follow-up
Week 5 60 minutes: developing guidelines 30 minutes: planning a group presentation 10 minutes: counseling with telephone	To increase knowledge, motivation, and competencies in appraising, communicating, solving problems, making decisions, and applying	<ul style="list-style-type: none"> - Developing guidelines for preventing COVID-19 infection and transmission in childcare centers with a small group online (MS Teams) - Planning a group presentation with a small group online (MS Teams) - Counseling with telephone follow-up
Week 6 50 minutes: presentation of the guidelines 60 minutes: discussion with a small group 30 minutes: summarizing the key concepts of COVID-19 prevention 10 minutes: counseling with telephone	To increase knowledge, motivation, and competencies in appraising, communicating, solving problems, making decisions, and applying	<ul style="list-style-type: none"> - Presentation of the guidelines for preventing infection and transmission of COVID-19 in childcare centers with a small group online (MS Teams) - Discussion with a small group online (MS Teams) - Summarizing the key concepts of COVID-19 prevention in childcare centers with a group of 28 teachers online (MS Teams) - Counseling with telephone follow-up
Week 7 10 minutes	Increasing knowledge, motivation, and competencies in applying.	<ul style="list-style-type: none"> - Counseling with telephone follow-up - Counseling with telephone follow-up
Week 8 60 minutes	To obtain post-test data	<ul style="list-style-type: none"> - Completing online post-test (Google Form)

Data Collection : The study was conducted between August 2020 and December 2020. After IRB approval, the research was introduced to the manager of the project entitled “Developmental System and Strategy for Early Childhood Well-being:

The Central and Western Regions of Thailand” and the researchers asked for permission to propose the banner of research project on the teachers’ Line groups. The qualified teachers were invited to participate in this study, then, they responded

by contacting the researchers through the Line application or telephone and the researchers asked them to complete a COVID-19 risk assessment form. The participants were requested to complete the Health Literacy Questionnaire and the COVID-19 Preventive Behavior Questionnaire online (Google Form) before commencing the program (pre-test). Study participants in both the experimental and the control groups were supported with a free internet code and a guidebook for accessing the questionnaires and attending the online health literacy program for COVID-19 prevention. The experimental group received a 7-week online health literacy program for COVID-19 prevention conducted by the researchers. The control group received only a COVID-19 prevention guidebook developed by the researchers based on the knowledge and guidelines of the MOPH. After another week, health literacy and COVID-19 preventive behavior were assessed online (Google Form) by the researchers using questionnaires (post-test). The single-blind technique was used in this study whereby the study participants were blinded to group assignments.

Data Analysis: Data were analyzed with SPSS version 22.0. The demographic data of both groups were analyzed using descriptive statistics. The Chi-square test, independent t-test, and Fisher's exact test were used to examine the differences in demographic data. Prior to running statistical analyses, the assumptions of normal distribution were tested. Normality distribution of health literacy

and COVID-19 preventive behavior was not met. Therefore, Mann-Whitney U test was used to compare the mean scores of health literacy and COVID-19 preventive behavior between the experimental and control groups. Wilcoxon signed rank test was used to compare the pre-and post-test scores among the two groups. The statistical significance level for this study was set at $p < .05$.

Results

All study participants in the control and the experimental groups were female with an age range of between 22 and 59 years, had completed a bachelor's degree and had accessed the information about COVID-19 prevention through television. Additionally, 78.6% of the participants in the control group had previous experience of participating in COVID-19 prevention training, whereas only 21.4% of the participants in the experimental group had such previous experience.

There were no significant differences in the demographic characteristics of the participants between the control and the experimental groups in terms of age, education level, work experience in a childcare center, and sources of information about COVID-19 prevention. However, participants in the control group received significantly higher training experience in COVID-19 prevention than participants in the experimental group. The study participants' demographic characteristics are shown in Table 2.

Table 2. Summary of demographic data for study participants in the control and experimental groups (N = 56)

Characteristics	Control (n = 28)		Statistic value	p-value
	n (%)	n (%)		
Gender			-	-
Male	-	-		
Female	28(100)	28(100)		
Age (years)				
20-29	6(21.4)	8(28.6)		
30-39	7(25)	9(32.1)		
40-49	11(39.3)	9(32.1)		
50-59	4(14.3)	2(7.1)		
Mean \pm SD	39.21 \pm 9.34	35.96 \pm 9.14	1.316 ^a	.194
(Range)	23-59	22-54		

Table 2. Summary of demographic data for study participants in the control and experimental groups (N = 56) (Cont.)

Characteristics	Control (n = 28)		Statistic value	p-value
	n(%)	n(%)		
Education level				.1.000
High school/vocational certificate	1(3.6)	1(3.6)		
Diploma/high vocational certificate	1(3.6)	1(3.6)		
Bachelor degree	24(85.7)	23(82.1)		
Master degree	2(7.1)	3(10.7)		
Work experience (years)				.869
< 1	1(3.6)	1(3.6)		
1-5	11(39.3)	11(39.3)		
6-10	8(28.6)	6(21.4)		
> 10	8(28.6)	10(35.7)		
Median	6.5	6.5		
Training experience in COVID-19 prevention			18.286 ^b	< .001
Yes	22(78.6)	6(21.4)		
No	6(21.4)	22(78.6)		
Sources of information about COVID-19 prevention				
Television	28(100)	26(92.9)		.491
Line application	21(75)	21(75)	.000 ^b	1.000
Newspaper/Flyer/Poster	22(78.6)	21(75)	.100 ^b	.752
Facebook	3(10.7)	4(14.3)		1.000

a = t-test, b = Chi-square test, c = Fisher's Exact test

Since the data did not have a normal distribution, the Mann-Whitney U Test was used for data analysis. At pretest the mean scores of COVID-19 preventive behavior were not significantly different between the groups. In contrast, the pre-test mean scores on health literacy in the experimental group were

significantly higher than that of the control group. In addition, the post-test means scores on health literacy and COVID-19 preventive behavior in the experimental group were significantly higher scores than the control group as shown in **Table 3 and 5**.

Table 3. Comparison of the differences in health literacy and COVID-19 preventive behavior between the control and experimental group (N = 56)

Variables	Control (n = 28)		Experiment (n = 28)		Mann-Whitney U Test	
	Median	IQR	Median	IQR	Z	p-value
Health literacy						
Pre-test	112.50	24	133.50	14	-3.053	.002
Post-test	133.50	28	140	5	-2.445	.014
COVID-19 preventive behavior						
Pre-test	102.50	24	102.50	20	-.254	.799
Post-test	105.50	22	113.00	6	-2.014	.044

Regarding the four subscales of health literacy and COVID-19 preventive behavior after completion of the program, the experimental group had significantly higher mean scores than the control group in: COVID-19 health screening

in children, caregivers, and teachers, environmental management in childcare centers, improving COVID-19 preventive behavior, and health promotion during the COVID-19 pandemic (**Table 4**).

Table 4. Mean and standard deviation for each subscale of COVID-19 preventive behavior after completion of the program between the control and experimental groups (N = 56)

Variables	Control (n = 28)	Experiment (n = 28)
	Mean(SD)	Mean(SD)
Health literacy		
Subscales	126.89(14.26)	135.29(9.63)
1. COVID-19 health screening in children, caregivers, and teachers	40.39(5.24)	43.68(2.87)
2. Environmental management in childcare centers	27.00(3.19)	28.79(2.41)
3. Improving COVID-19 prevention behavior	27.39(2.99)	29.04(2.01)
4. Health promotion during the COVID-19 pandemic	32.11(3.40)	33.79(2.60)
COVID-19 Preventive Behavior		
Subscales	101.86(12.96)	117.79(16.44)
1. COVID-19 health screening in children, caregivers, and teachers	30.04(5.96)	32.79(5.38)
2. Environmental management in childcare centers	28.14(3.55)	29.14(2.62)
3. Improving COVID-19 prevention behavior	22.18(2.31)	23.21(1.64)
4. Health promotion during the COVID-19 pandemic	21.50(3.73)	21.86(4.77)

The findings from the Wilcoxon Signed Rank Test showed that the pre-and post-test mean scores on health literacy among the two groups were significantly different. Regarding COVID-19 preventive behavior, there was no significant difference

between the pre-and post-test mean scores in the control group. In contrast, the pre-and post-test mean scores in the experimental group were significantly different, with higher scores in post-test as shown in **Table 5**.

Table 5. Comparison of health literacy and COVID-19 preventive behavior between pre-and post-test scores in the two Groups

Variables	Group	Mean(SD)	Mean(SD)	Wilcoxon Z	Signed Rank Test p-value
		Pre-test	Post-test		
Health literacy	Control gr.	117.79(16.44)	126.89(14.26)	-2.562	.010
	Experimental gr.	130.36(10.08)	135.29(9.63)	-2.942	.003
COVID-19 preventive behavior	Control gr.	98.18(14.26)	101.86(12.96)	-1.535	.125
	Experimental gr.	97.93(12.84)	107.00(13.56)	-3.572	< .001

Discussion

The online health literacy program seems to be effective, especially in the improvement of

COVID-19 preventive behavior. For health literacy, even though the mean score in the experimental group was significantly higher than the control group, but it cannot be concluded since there were

differences in scores at pre-test. However, the pre-test and post-test scores of health literacy in both the experimental and control groups were significantly different. The reason may be the teachers' ability to search and learn by themselves from the availability of published information as the guidelines for COVID-19 prevention and control in schools had been published in various sources for three months before the data collection period.^{10,30} More than 90% of teachers in this study graduated with bachelor's and master's degrees. Most of them received information from social media, such as television, Line application, newspaper, flyers, and posters. As COVID-19 is a communicable and uncontrolled disease, the safety of children in childcare centers is the teachers' priority, which stimulates them to explore new knowledge.

The online health literacy program for COVID-19 prevention could enhance COVID-19 preventive behavior of teachers in childcare centers. This may be because the contents of the program covered key aspects of national guidelines which include: 1) knowledge about COVID-19, 2) health screening, 3) environmental management, 4) COVID-19 preventive behavior, and 5) health promotion during COVID-19 pandemic. They received a COVID-19 information package that contained VDO animation clips and PowerPoint in five modules through self-directed learning. The package was designed to improve teachers' accessibility to COVID-19 information. Teachers participated in the inquiry-based discussions about COVID-19 prevention, and telephone follow-up. These strategies motivated teachers' preventive behavior. Teachers also practiced through self-directed learning, small-group discussion, and learning outcome evaluation. The activities in this online health literacy program can enhance teachers' decision making, critical evaluation of the situation, problem solving, and communication skills for COVID-19 prevention.

The results revealed that the scores of COVID-19 preventive behavior were high in four dimensions, especially in health screening and environmental

management dimensions. The findings were supported those in the study of a health literacy program among village health volunteers, which significantly improved COVID-19 prevention by promoting participants' access to information, encouraging them to learn and share their knowledge, and practicing decision-making and communication.¹⁹ Similarly, the activities of a health literacy program in patients with diabetes aimed to promote communicative and critical health literacy with a learning process until achieving the ability to apply knowledge to implement plans.³¹

According to the health screening dimension, the teachers in the experimental group not only performed screening but also communicated with caregivers and healthcare professionals. The result is supported by the survey from 55 childcare centers using CDC guidelines. Facilitating factors for non-infection in childcare centers were comprehensive communication and messages to staff and parents.³² Teachers in this study managed the childcare environment and taught children about social distancing, mask wearing, and hand hygiene. These teaching processes could improve health behaviors of children as supported by a survey of mask wearing in 1,000 pre-kindergarten grade 2 (pre-k-2) students, which revealed that 76.9% of the children used masks appropriately.³³ Moreover, the preventive behavior of teachers in the experimental group also involved the practice of childcare personnel, such as kitchen staff. However, there is limited evidence of interventions to support the effect of a health literacy program on COVID-19 preventive behavior, but surveys demonstrate a relationship between health literacy and COVID-19 preventive behavior in Indian people with chronic diseases during lockdown³⁴ and Chinese college students.³⁵ In addition, a survey in Australian adults showed that low health literacy was related to less ability to identify COVID-19 preventive behavior, and less likelihood to rate social distancing.¹⁶

This health literacy online program was delivered to teachers and could improve the health behaviors of participants. Teachers should be educated

about COVID-19 prevention because they play a significant role in educating children, caregivers, and school staff in childcare centers. Thus, school principals and education policymakers need to realize the importance of teaching teachers for COVID-19 prevention and support knowledge resources, funding, and policies to enhance the COVID-19 preventive behaviors in childcare centers.³⁶ They also should support teachers to access COVID-19 information from reliable and diverse online sources of information such as e-book, e-learning, e-handbook, e-journal.³⁶ Compared to another online program that delivers messages and videos related to COVID-19 knowledge for adults, the findings showed that there were no significantly improved COVID-19 preventive behaviors of participants.³⁷ The discrepancy in results of the previous program and this program reflects that online learning process to change behaviors needs to adopt various activities and allow participants to have experience and ability to integrate their ability into practice. Likewise, a survey of undergraduate students in Korea revealed that e-health literacy was significantly related to the overall score of infection-preventive behaviors in students.¹⁵

During the program activities, 100% of teachers fully participated in course activities. Teachers who participated in the experimental group provided written feedback that this program was useful as it offered an easy access to information, provided opportunities to learn with a group of teachers, and consisted of various learning activities. There was no participant loss to follow-up after the intervention. The course evaluation was similar to the feedback from students in the bachelor program who participated in the COVID-19 special course.³⁸ The positive feedback was centered on knowledge exchange, file and content management, individual learning, and wide use of media.³⁸ The results of this study supported the importance of an online health literacy program on COVID-19 preventive behavior.

Limitations

The generalization of the study may be limited due to use of childcare centers from five provinces in the central and western regions of Thailand and convenience sampling. Additionally, following up only one week after completing the program might have been too short to measure the sustainability of COVID-19 preventive behavior.

Conclusions and Implications for Nursing Practice

The results of this study suggest that the online health literacy prevention program enhances the COVID-19 preventive behavior of teachers in childcare centers. Further research is recommended on online programs for enhancing COVID-19 preventive behavior and promoting self-directed learning of people. However, the content of the program should be updated since COVID-19 information is changing over time. For practice implications, healthcare professionals should promote COVID-19 preventive behavior in childcare centers and schools to caregivers and people in communities through screening, environmental management, and regular practices of COVID-19 preventive behaviors. At the policy level, online courses should be constructed and delivered to specific groups of population to promote preventive behaviors.

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References

1. John Hopkins University Coronavirus Resource Centre. COVID-19 Dashboard [Internet]. 2020. [cited 2021 Aug 27]. Available from: <https://coronavirus.jhu.edu/map.html>
2. Turale S. COVID-19: Nursing challenges into the future. *Pacific Rim Int J Nurs Res.* 2021;25(2):165–70. Available from: <https://he02.tci-thaijo.org/index.php/PRIJNR/article/view/250090>
3. Department of Disease Control. COVID-19 (EOC-DDC Thailand) Coronavirus 2019 disease [Internet]. 2021. [cited 2021 Aug 27]. Available from: <https://ddcportal.ddc.moph.go.th/portal/apps/opsdashboard/index.html#/20f3466e075e45e5946aa87c96e8ad65> [in Thai]
4. Ministry of Public Health. SAT-MOPH [Internet]. 2021. [cited 2021 Aug 27]. Available from: <https://ddc.moph.go.th/covid19-dashboard/?dashboard=select-trend-line> [in Thai]
5. Thai Health Promotion Foundation. Self-care guide for people: fighting! COVID-19 together [Internet]. 2020. [cited 2021 Aug 27]. Available from: <http://dmsic.moph.go.th/index/detail/8137> [in Thai]
6. Vithayaruangruangsri J, Dangchai P. Handout for Covid-19 management in school. Bangkok: Sahamitr Printing & Publishing; 2020. 59 p. [in Thai]
7. Shen KL, Yang YH, Jiang RM, Wang TY, Zhao DC, Jiang Y, et al. Updated diagnosis, treatment, and prevention of COVID-19 in children: experts' consensus statement (condensed version of the second edition). *World J Pediatr.* 2020;16:232–9. doi:10.1007/s12519-020-00362-4.
8. Department of Disease Control, Ministry of Public Health. Guideline for Covid-19 management. Nonthaburi: Department of Disease Control, Ministry of Public Health; 2020. 89 p. [in Thai]
9. Early Childhood Development Board. National standard for early childhood care during Covid-19 epidemic. Bangkok: Prikwarn Graphic; 2020. 250 p. [in Thai]
10. UNICEF, WHO, & IFRC. Practical guidelines for educational institutions to prevent and control the spread of COVID-19 [Internet]. 2020. [cited 2021 Aug 20]. Available from: <https://www.unicef.org/thailand/th/reports> [in Thai]
11. Kaewsamrit A. A practical guide for childcare centers to prevent the spread of COVID-19. Nonthaburi: Department of Health, Ministry of Public Health; 2020. [in Thai]
12. Park E, Logan H, Zhang L, Kamigaichi N, Kulapichit U. Responses to coronavirus pandemic in early childhood services across five countries in the Asia-Pacific Region: OMEP policy forum. *Int J Early Child.* 2021;25:1–18. doi:10.1007/s13158-020-00278-0 [in Thai].
13. Education Division of Lomrad municipality. Notification of the closure of teaching and learning at the childcare center. [Internet]. 2020. [cited 2021 Oct 15]. Available from: <https://www.lomrad.go.th/index.php/2018-11-07-01-10-07/79-2018-11-10-08-02-11/2018-11-10-08-02-16/1148-19> [in Thai]
14. Laemthaisong J, Toonsiri C, Homsin P. Factor influencing on preventive behaviors of respiratory tract infections among caregivers of preschool aged children in childcare center, Bangkok Metropolitan Administration. *J Public Health Nurs.* 2019;33(1):1–19. Available from: <https://he01.tci-thaijo.org/index.php/phn/article/view/241754> [in Thai]
15. Hong KJ, Park NL, Heo SY, Jung SH, Lee YB, Hwang JH. Effect of e-health literacy on COVID-19 infection–preventive behaviors of undergraduate students majoring in healthcare. *Healthcare.* 2021;9(573):1–10. doi:10.3390/healthcare9050573.
16. McCaffery K J, Dodda R H, Cvejica E, Ayrea J, Batcupa C, Isautiera J M J, et al. Health literacy and disparities in COVID-19 related knowledge, attitudes, beliefs and behaviours in Australia. *Public Health Res Pract.* 2020; 30(4): e30342012. doi:10.17061/phrp30342012.
17. Sribunrueng W, Ninwattana T, Sumransuk S, Anirapai K, Rugthangam S, Spiller P. Factors affecting prevention behavior of COVID-19 infection in Bangkok. *UDRU Hum Social Sc J.* 2021;10(1):195–206. Available from: <https://so06.tci-thaijo.org/index.php/hsudru/article/view/248727/169014> [in Thai]
18. Photihung P. Relationship of health literacy to health promoting and disease prevention behaviors in Thailand: a systematic review. *JFONUBUU.* 2021;29(3):115–30. Available from: <https://he02.tci-thaijo.org/index.php/Nubuu/article/view/253998> [in Thai].
19. Choojai R, Boonsiri, Patcheep K. Effects of a health literacy enhancement program for COVID-19 prevention on health literacy and prevention behavior of COVID-19 among Village Health Volunteers in Don Tako Sub-district, Mueang District, Ratchaburi Province. *SCNJ.* 2021;8(1):250–62. Available from: <https://he01.tcithaijo.org/index.php/scnet/article/view/245346> [in Thai]
20. Dong Y, Mo X, Hu Y, Qi X, Jiang F, Jiang Z, et al. Epidemiology of COVID-19 among children in China. *Pediatrics.* 2020; 145(6):1–10. doi:10.1542/peds.2020-0702.
21. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med.* 2020;382:1199–207. doi:10.1056/NEJMoa2001316.

22. Shen KL, Yang YH, Jiang RM, Wang TY, Zhao DC, Jiang Y, et al. Updated diagnosis, treatment, and prevention of COVID-19 in children: experts' consensus statement (condensed version of the second edition). *World J Pediatr.* 2020;16:232–9. doi:10.1007/s12519-020-00362-4.
23. Jones TC, Mühlmann B, Veith T, Biele G, Zuchowski M, Hofmann J, et al. An analysis of SARS-CoV-2 viral load by patient age. *medRxiv.* 2020;1:1–28. doi:<https://doi.org/10.1101/2020.06.08.20125484>
24. Simpson JN, Goyal MK, Cohen JS, Badolato GM, McGuire M, Ralph A, et al. Results of testing children for SARS-CoV-2 through a community-based testing site. *J Pediatr.* 2020;231: 157–61. doi:<https://doi.org/10.1016/j.jpeds.2020.12.030>
25. Witoonsakul P, Chaisuwan C, Rungamornrat S. Factors influencing behaviors in preventing COVID-19 of teachers and caregivers in child care centers. *Nurs Sci J Thail.* 2021; 30(4):41–54. Available from: <https://he02.tci-thaijo.org/index.php/ns/article/view/250609> [in Thai]
26. Choi Y. (2020). A study on the emotional experiences of child care teachers and changes in their daily routine in centers after COVID-19. *Korean J Early Child Educ.* 2020;2(1): 253–79. doi:<https://doi.org/10.15409/riecc.2020.22.1.12>
27. Sorensen K, Van den Broucke S, Fullam J, Doyle G, Pelikan JM, Slonska Z, et al. Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health.* 2012;12(1):80. doi:<https://doi.org/10.1186/1471-2458-12-80>
28. World Health Organization. Health Promotion Glossary. Geneva: Division of health promotion, education and communications health education and health promotion unit; 1998. 10 p.
29. Nakthongkhong P. The effect of the diarrhea preventive behavior promoting program for child caregivers in day cares [thesis]. Bangkok: Chulalongkorn University; 2006. 147 p. [in Thai]
30. Department of Health, Ministry of Public Health. Handout for educational institutions for COVID-19 prevention [Internet]. 2020. [cited 2021 Aug 20]. Available from: <http://online.anyflip.com/lqqt/uwju/mobile/index.html> [in Thai]
31. Chiangkhong A. Effectiveness of development of health literacy through controlled transformative learning due to glycemic control behavior among diabetic patients. (Unpublished doctoral dissertation). Nakhonnayok, Thailand: Srinakharinwirot University; 2018. [in Thai]
32. Coronado F, Blough S, Bergeron D, Proia K, Sauber-Schatz E. Implementing mitigation strategies in early care and education settings for prevention of SARS-CoV-2 transmission—Eight States, September–October 2020. *Morb Mortal Wkly Rep.* 2020;69(49):1868–72. doi:<https://www.cdc.gov/mmwr/volumes/69/wr/mm6949e3.htm>
33. Mickells G, Figueroa J, West K W, Wood A, McElhanon B. Adherence to masking requirement during the COVID-19 pandemic by early elementary school children. *J School Health.* 2021;91(7):555–61. doi:10.1111/josh.13033.
34. Gautam V, Dileepan S, Rustagi N, Mittal A, Patel M, Shafi S, et al. Health literacy, preventive COVID 19 behavior and adherence to chronic disease treatment during lockdown among patients registered at primary health facility in urban Jodhpur, Rajasthan. *Diabetes Metab Syndr.* 2021;15(1): 205–11. doi:<https://doi.org/10.1016/j.dsx.2020.12.023>
35. Li S, Cui G, Kaminga A C, Cheng S, Xu H. Associations between health literacy, health literacy, and COVID-19-related health behaviors among Chinese college students: cross-sectional online study. *J Med Internet Res.* 2021;23(5): e25600. doi:10.2196/25600.
36. Walger P, Heininger U, Knuf M, Exner M, Popp W, Fischbach T. Children and adolescents in the CoVid-19 pandemic: schools and daycare centers are to be opened again without restrictions. The protection of teachers, educators, careers and parents and the general hygiene rules do not conflict with this. *GMS Hyg Infect Control.* 2020; 28(15):1–18. doi:10.2196/25600.
37. Langford A T. Physician-delivered messaging as a tool to increase COVID-19 knowledge and preventive behaviors—implications beyond a pandemic. *AMA Network Open.* 2021;4(7):e2118297. doi:10.1001/jamanetworkopen.2021.18297.
38. Dadaczynski K, Tolks D. Digital health communication and health literacy in times of COVID-19. Planning and implementation of a special course of study in health promotion and prevention. *GMS J Med Educ.* 2021; 38(1):Doc31. doi:10.3205/zma001427.

ประสิทธิผลของโปรแกรมความรอบรู้ด้านสุขภาพในการป้องกันโรคโควิด-19 ออนไลน์สำหรับครูในศูนย์พัฒนาเด็กเล็ก: การศึกษาแบบกึ่งทดลอง

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บทคัดย่อ: โรคโควิด-19 เป็นโรคที่มีการระบาดและแพร่กระจายอย่างรวดเร็วทั่วโลกรวมถึงประเทศไทย ซึ่งจำเป็นต้องป้องกันและควบคุมโดยเฉพาะอย่างยิ่งในเด็ก ครูเป็นผู้มีบทบาทสำคัญในการดูแลเด็กในศูนย์พัฒนาเด็กเล็ก แม้ว่าอัตราการติดเชื้อในเด็กพบน้อยกว่าผู้ใหญ่ แต่เด็กอาจแพร่กระจายเชื้อไปสู่ศูนย์พัฒนาเด็กเล็ก ครอบครัว ครู และชุมชนได้ง่าย ดังนั้น ครูจึงควรได้รับการส่งเสริมความรอบรู้ด้านสุขภาพ และพฤติกรรมในการป้องกันโรคโควิด-19 เพื่อป้องกันการติดเชื้อและการแพร่กระจายเชื้อในศูนย์พัฒนาเด็กเล็ก การวิจัยกึ่งทดลองนี้ มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรมความรอบรู้ด้านสุขภาพในการป้องกันโรคโควิด-19 ออนไลน์ต่อความรอบรู้ด้านสุขภาพและพฤติกรรมการป้องกันโรคโควิด-19 ของครูในศูนย์พัฒนาเด็กเล็ก กลุ่มทดลอง ($n = 28$) เข้าร่วมในโปรแกรมความรอบรู้ด้านสุขภาพในการป้องกันโรคโควิด-19 ออนไลน์ซึ่งประกอบด้วย ชุดการเรียนรู้ด้วยตนเอง การสนทนากลุ่มย่อยแบบมีส่วนร่วม และการติดตามประเมินผลการเรียนรู้ ส่วนกลุ่มควบคุม ($n = 28$) ได้รับคู่มือการป้องกันโรคโควิด-19 โดยเรียนรู้ด้วยตนเอง เก็บข้อมูลโดยแบบบันทึกข้อมูลส่วนบุคคล แบบสอบถามความรอบรู้ด้านสุขภาพ และแบบสอบถามพฤติกรรมการป้องกันการติดเชื้อโควิด-19 จากเดือนสิงหาคมถึงเดือนธันวาคม 2563 วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา independent t-test, Mann-Whitney U test, และ Wilcoxon signed rank test

ผลการวิจัย พบว่า ครูในกลุ่มทดลองมีพฤติกรรมการป้องกันโรคโควิด-19 ดีขึ้นอย่างมีนัยสำคัญทางสถิติเมื่อเปรียบเทียบกับกลุ่มควบคุมหลังโปรแกรมเสร็จสิ้นเป็นระยะเวลาหนึ่งสัปดาห์ ข้อค้นพบนี้ชี้ให้เห็นว่า โปรแกรมความรอบรู้ด้านสุขภาพในการป้องกันโรคโควิด-19 ซึ่งประกอบด้วยกิจกรรมที่หลากหลายผ่านช่องทางออนไลน์สามารถส่งเสริมพฤติกรรมของผู้เข้าร่วมโปรแกรมได้ โปรแกรมนี้มีประโยชน์โดยตรงต่อพยาบาลในโรงพยาบาลและพยาบาลวิชาชีพในในการส่งเสริมพฤติกรรมครูในศูนย์พัฒนาเด็กเล็ก ดังนั้นพยาบาลในโรงพยาบาลและพยาบาลวิชาชีพอื่นควรพัฒนาชุดโปรแกรมออนไลน์ในการส่งเสริมพฤติกรรมการป้องกันโรคโควิด-19 ของบุคคลในศูนย์พัฒนาเด็กเล็กและโรงเรียน

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คำสำคัญ: ศูนย์พัฒนาเด็กเล็ก การป้องกันโรคโควิด-19 ความรอบรู้ด้านสุขภาพ โปรแกรมออนไลน์ ครู

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