

ORIGINAL ARTICLE

The Development and Evaluation of a Hand Hygiene Educational Module for Preschool Children

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ABSTRACT

Introduction: The world has been badly affected by the spread of a novel virus known as Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) that was first reported in Wuhan, China back in December 2019. As the virus is transmitted through aerosol, respiratory droplets and close contact, hand hygiene and wearing mask are the most important preventive measures for COVID-19. Studies showed hand hygiene intervention improved compliances. This paper discussed the development of a hand hygiene intervention module, validation, usability and effectiveness reports. **Methods:** This study involved 5 stages; need analysis, module development, validation, usability and effectiveness studies. Need analysis and module development were carried out through brainstorming and literature search. The content was evaluated by three experts, whereas the usability was screened by four preschool teachers. The effectiveness of knowledge transfer was evaluated via pre and post intervention surveys. **Results:** The hand hygiene educational module received valuable comments from the content expert and the end-users (teachers). Knowledge score related to COVID-19 transmission, prevention and hand hygiene moments among pre-school children were significantly increased after the intervention. **Conclusion:** This module can be used to improve teaching method related to COVID-19 and hand hygiene. The 'learn and play' approach may increase excitement, thus make learning process enjoyable and memorable.

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INTRODUCTION

Coronavirus disease 2019 or COVID-19 was first recognized in December 2019, in Wuhan China. The disease spread rapidly throughout the world resulting in the declaration of pandemic on the 11th March 2020 (1). As of 10th June 2021, COVID-19 had affected more than 175 million people and caused more than 3.7 million deaths (2). The disease is transmitted primarily via respiratory droplets either directly through contaminated air and hands or indirectly through contaminated surfaces.

Since mid of December 2020, COVID-19 vaccine has already been rolled out in certain countries and many other companies are racing up to produce their own vaccine. Even though the vaccines were proven highly effective and safe, most trials had only been done in adult and teenagers more than 16 years old (3). It seems that children will get vaccination much later than the

adults, subjected to the result of trials among children age group. While waiting for immunity via vaccination, preventive measures such as regular hand washing, cough etiquette, physical distancing and mask wearing must be persistently practiced. Hand hygiene with soap and water or hand sanitizer is regarded as the most important preventive measures for COVID-19 (4).

Apart from COVID-19, hand hygiene is also important in the prevention of other infectious diseases particularly respiratory and gastrointestinal infections that commonly affect young children (5,6). Studies have shown that hand hygiene intervention among pre-school children resulted in reduction of absenteeism due to illness (7). Therefore, good hand hygiene habit should be taught at the early age. Children learn more with playing or interaction. Playing not only brings pleasure to the child, but there are many benefits children can get through playing activities (8).

We embarked on this project aimed to create an interactive hand hygiene learning module by using learn-and-play approach. We also evaluated the usability and effectiveness through feedback from pre-school teachers and children.

MATERIALS AND METHODS

This study involved 5 stages; need analysis, module development, validation, usability and effectiveness studies. During the first stage, analysis of the needs of children was carried out through brainstorming and literature search by all the researchers.

Development of Hand Hygiene Module

The module was carefully developed through series of face to face meeting with committee members that comprised of a clinical microbiologist, a public health physician, an internal medicine physician and a module expert. A consultation with Dr Z (an expert in children educational games) was also done, to get opinion related to suitable experiments and interactive games as the supplementary materials for the module. Designing step involved consolidation of basic ideas, preparation of the tools, constructing module and activities. The module that targeted teachers or parents as the users, was written in Malay language, using layman's terms.

Content Validation

The module was validated by a panel of three experts which were a clinical microbiologist, a pediatrician and a module specialist. Content validation was done independently using a content validation form. Four major aspects were evaluated: content, teaching and learning method, time duration and language.

Usability

This was done among preschool teachers (the target user). Four teachers were given the module for them to perform the activities independently with their own students. They were asked to read the module and to indicate any difficult words or sentences. During the activities, they were also asked to note comments and recommendations.

Effectiveness

Pre-school students from a primary school in Ampang involved in this study. The students were selected via random sampling using students' name list. The inclusion criteria were: students aged 5 and 6 years old, able to comprehend simple instructions. Whereas those who did not consented by their parents were excluded from this study. Written consent was obtained from their parents prior to the study.

Preschool students were interviewed face to face before and after the intervention, using similar questionnaires. The questionnaire consisted of questions regarding COVID-19 transmission, prevention, hand hygiene steps and hand hygiene moments. The intervention was done using the Hand Hygiene Module.

Ethical Clearance

This study received ethical clearance from the Human Medical Research and Ethics Committee of Universiti

Sains Islam Malaysia, USIM/JKEP/2017-20) and permission to conduct the study from the Ministry of Education Malaysia.

Data Analysis

The knowledge scores were analyzed analytically using IBM Statistical Package for Social Sciences (SPSS) Version 23. The scores for each component in a domain were calculated for both before and after intervention and compared by paired t test. Subsequently, the knowledge scores were totaled according to the domains and compared using paired t test as well. A p-value of less than 0.05 ($p < 0.05$) was considered to be statistically significant.

RESULTS

Hand Hygiene Module

A comprehensive module and 3 types of educational boxes were developed; Magic Germs, Germ-germ Go Away and Germs Spread Easily. The module comprised of three units that covered three main components i.e. the basic of infectious diseases, disease transmission and prevention, the importance of hand hygiene steps and the importance of soap in hand washing. The module was meant for teachers or parents who guide children's activities using the 3 boxes. Each unit consisted of list of activities that required the usage of an educational box.

Magic Germs aimed to teach children the correct technique of hand washing by using GloGerm® that acts as artificial germs. The children were asked to play a game called 'Detective COVID-19'. GloGerm® was randomly applied to hands and faces of three students, the other students act as detectives by looking for those with glowing face and hands, using ultraviolet torch lights. Once captured, the 'criminals' were asked to wash their hands with water and soap. They were released only when their hands were free from germs.

'Germ-Germ Go Away' box teaches children to build various shape of bacteria and viruses, and the importance of soap in hand washing. After building own germs using plasticine, few drops of cooking oil was applied to children's hands. Then they were asked to observe the effect of hand washing with and without soap on their oily hands. Next, a bowl of water powdered with finely ground black pepper was prepared. Children were asked to dip their index finger into the bowl before and after applying little amount of liquid soap on the index finger. Changes were observed.

'Germs Spread Easily' box was developed to demonstrate how germs spread while playing and sharing toys. Children played two traditional games: Musical Box and Fox & Chicken. Colourful glitter powder was applied randomly on children's hands. At the end of the games, they were asked to observe presence of glitters on their hands and their toys. Table I showed the content of the

Table I: The Content of the Module

UNIT	TOPIC	LEARNING OUTCOMES	CONTENT	ACTIVITIES	LEARNING TIME
1	Transmission of Germs	<ul style="list-style-type: none"> Children will be able to explain how germs being transmitted 	<ul style="list-style-type: none"> Definition of infectious disease Chain of infection Common infections in children Prevention of infectious diseases 	<ul style="list-style-type: none"> Game: Fox and Chicken Game: Poisonous Ball Game: Hand ball 	3 hours
2	Germs Go Away	<ul style="list-style-type: none"> Children will be able to explain the importance of soap in hand washing 	<ul style="list-style-type: none"> Various shapes of germs Soap structure Functions of soap Type of soap 	<ul style="list-style-type: none"> Germs decoration Oily germs Experiment: Pepper and Soap Singing: Germs Go Away 	3 hours
3	Magic Germs	<ul style="list-style-type: none"> Children we be able to apply hand washing properly Children will be able to memorize hand hygiene moment 	<ul style="list-style-type: none"> Hand hygiene steps Frequently missed areas Hand hygiene moments Drying hands 	<ul style="list-style-type: none"> Role play: COVID-19 detective Hands-on: Hand washing steps Singing: Hand washing steps 	3 hours

module according to units.

Content Validation

Three experts were asked to rate the module as listed in Table II. Maximum rating was 5. All three experts gave good scores.

All the experts panel said that the module was good and comprehensive:

*'A creative idea with efficient methods in educating the target group
Interesting and enjoyable activities, help to increase understanding effectively'*

Expert A suggested that all activities should begin with singing.

'Start activity with singing as it will induce good mood'

Expert B recommended that the hand hygiene technique should be at the early part of the module.

'Hand hygiene should be put in activity 1 so that it can be practised in activities 2 and 3.'

Usability Test

Four preschool teachers involved in this study. Generally, they were satisfied with this module. Table III showed the mean rating.

They also wrote comments for improvement as shown below.

Activity 1

- Children understand virus transmission
- Replace ball with commonly used items such as books, pencils

Activity 2

- To involve all students in all activities
- Activity is suitable for 5 to 6 years old children

Activity 3

- To provide simulation video
- To use more catchy songs

Effectiveness

Thirty-six out of 40 (90%) selected children involved in this study. About two third (69%) were female and majority (89%) were 6 years old. Table IV showed the knowledge score on COVID-19 transmission and prevention before and after intervention. For transmission, the results

Table II: Assessment by The Experts

Assessment	Mean rate
Objectives are clear	5
Good coverage on hand hygiene education for children	4.7
Teaching and learning methods are suitable for targeted age group.	5
The content is suitable for targeted age group.	5
The content is carefully done	4.7
The language is simple and easy to understand	5
The suggested time duration is adequate for running of the activities	5
The content is able to increase children's knowledge on hand hygiene.	5
User guide for teacher/ facilitators is adequate	4.7
Activities are adequate to achieve the objectives	5

Table III: Assessment by The Pre school Teachers

Assessment	Mean rate
Objectives are clear	5
Good coverage on hand hygiene education for children	4.5
Teaching and learning methods are suitable for targeted age group.	4.5
The content is suitable for targeted age group.	5
The content is carefully done	4.5
The language is simple and easy to understand	5
The suggested time duration is adequate for running of the activities	5
The content is able to increase children's knowledge on hand hygiene.	4
User guide for teacher/ facilitators is adequate	4.5
Activities are adequate to achieve the objectives	4

show statistically significant difference in mean score for "toys" ($p < 0.001$), "stationaries" ($p < 0.001$) and airborne ($p = 0.006$). Whereas, for preventive measures for COVID-19 "cough etiquette" ($p < 0.001$) shows statistically significant mean difference before and after

Table IV: Knowledge scores on COVID-19 Transmission and Prevention (N=36)

Variables	Mean (SD) Before Intervention	Mean (SD) After Intervention	Mean difference (95% CI)	p-value
COVID-19 spreads via:				
Toys	.36 (.487)	.81 (.401)	-.444 (-.274, -5.292)	.000
Stationeries	.36 (.487)	.81 (.401)	-.444 (-.274, -5.292)	.000
Hands	.78 (.422)	.81 (.401)	-.028 (-.084, .029)	.324
Droplets	.50 (.507)	.69 (.467)	-.194 (-.330, -.059)	.006
COVID-19 is prevented by:				
Cough etiquette	.31 (.467)	.78 (.422)	-.472 (-.644, -.301)	.000
Face mask	.92 (.280)	.97 (.167)	-.056 (-.134, .023)	.160
Physical distancing	.81 (.401)	.89 (.319)	-.083 (-.178, .012)	.083

intervention.

Meanwhile, there were no statistically significant differences between the mean scores for all steps of hand hygiene before and after intervention. The mean score for hand hygiene moments was shown in Table V. All moments showed significant differences.

Table V: Knowledge on Hand Hygiene Moments(N=36)

Variable	Mean (SD) Before Intervention	Mean (SD) After Intervention	Mean difference (95% CI)	p-value
When to wash hands:				
• After going to the toilet	.50 (.507)	1.00 (.000)	-.500 (-.672, -.328)	.000
• Before and after eating	.50 (.507)	1.00 (.000)	-.500 (-.672, -.328)	.000
• After playing outdoor	.50 (.507)	1.00 (.000)	-.500 (-.672, -.328)	.000
• After coughing and sneezing	.50 (.507)	1.00 (.000)	-.500 (-.672, -.328)	.000
• After in contact with pets	.50 (.507)	.72 (.454)	-.222 (-.365, -.080)	.003

DISCUSSION

This study successfully developed and evaluated a hand hygiene educational module for pre-school children. The module integrates play and learn approach in instilling good hand hygiene habit among pre-school children. For children, learning should be done both indoors and outdoors. Outdoor activities provide primary experiences, help them to convert theoretical knowledge into practice, record in the long-term memory, and find solutions to problem they encounter in daily life, based on what they have learned (9). In the pre-school setting, teaching and learning activities should involve all students as suggested by one of the teachers. A study among adult showed that, even though

observing simulation training was adequate, the students preferred hands-on participation and learning by doing (10).

The knowledge score related to COVID-19 transmission, prevention and hand hygiene moments were significantly increased after the intervention. While most posters or videos mentioned that COVID-19 is transmitted via contaminated object (11), we believe that children could not relate it with their daily activities. It is very important to highlight that COVID-19 may transmit through toys, surfaces and stationeries, particularly at school. The use of glitter as the germs substitute in this module had clearly demonstrated virus transmission through the toys. Children are able to simulate parents' behaviour, but are not well-equipped with a true understanding of why they are being asked to make changes, potentially resulting in confusion, fear or gaps in hygiene (12). Understanding the route of transmission may result in better prevention practices among children.

Even though hand hygiene had been recognized as the most effective and cheapest measure to prevent infectious diseases (13), it was not widely practised until the beginning of COVID-19 pandemic. People now are more aware on the importance of hand hygiene due to continuous reminder from the authorities including the World Health Organization. Posters and videos on correct hand hygiene technique are widely distributed in the social and mass media. Therefore, it was not surprising that the knowledge of hand hygiene steps was already high even before the intervention. Glo Germ™ was used to assess the completeness of hand hygiene steps in this study. Studies have shown that the Glo Germ™ promoted handwashing compliance more effectively than instructions and modelling in preschool children (14,15).

The effectiveness study of this intervention module might have some limitations due to the small sample size. This is due to the fact that schools were closed during Movement Control Order (MCO) thus the study could not be continued.

CONCLUSION

The development of the hand hygiene module and the innovation of interactive games could attract children to learn while playing. The "learn & play" approach may increase excitement and enable children to understand the why, the how, and the when of hand hygiene to help prevent illnesses and support their own health and well-being.

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