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Effectiveness of Pictorial Text Instruction and Demonstration Towards Hand Washing Technique: A Randomized Controlled Trial

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Abstract

Background: With the efforts by the government to promote hand washing technique and importance of hand hygiene among the health care members, only a moderate compliance towards hand hygiene practices were observed. The purpose of this study is to determine the effectiveness of pictorial text instruction and demonstration towards hand washing technique among pre-university students in a private medical college. *Methods*: This randomized controlled trial was conducted among 54 pre-university health science students in private medical college in Malaysia, from March to May 2018. They were divided into three groups with 18 participants respectively and steps of hand washing technique was shown by using demonstration and pictorial text instruction. For control group no intervention was given. Marks on correct hand washing steps were given and students were asked to fill a questionnaire. The data was analysed using software such as Epi Info 7, GraphPad and Microsoft Excel. *Result*: The mean of correct hand washing skills of demonstration group 6.8 (0.5) is highest follow by pictorial text instruction 5.1 (1.6) and control group 2.8 (0.9) with P value is <0.001 which is significant. As for the comparison of marks of hand washing skills among the 3 groups, the mean difference of demonstration vs control group is highest followed by pictorial vs control group then demonstration vs pictorial group, with P value <0.001 which is significant. *Conclusion*: In this study, the participants in demonstration group has significant highest mean marks of hand washing skills compared to pictorial text instruction group and control group. Therefore, the demonstration technique is the most effective method that should be used to teach a skill as well as in improving a person's understanding on a specific skill or technique.

Keywords

Hand Disinfection, Demonstration, Pictorial, Effectiveness

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1. Introduction

As future medical and dental students that will be exposed to a wide range of infections in the hospital, hand hygiene is a renowned cost-saving and effective method in preventing incidence of infection in modern day health care [1]. Studies from the Centres of Disease Control and Prevention have shown that hand washing can prevent 1 in 3 diarrheal-related infections and 1 in 5 respiratory infections. For hand washing, it is essential that we channel the methods to maintain proper hand hygiene. In a recent study that was conducted in India, the percentage of medical students who had received formal training on the hand washing technique was only 14.2% and 14.8% in dental students. As for the knowledge on hand hygiene, less than 50% undergraduate students are aware that the main route of transmission of harmful germs are from the unhygienic hands of the healthcare workers [2] [3]. On the other hand, In Malaysia,

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hand hygiene practices before contact with patient was reported to be 70% among the healthcare workers. In the wards, even though only 60% of the alcohol hand rubs were used, healthcare workers did not follow the hand-washing steps as per WHO guidelines [4].

In this study we are emphasizing on different approaches of teaching hand washing technique. The consideration on focusing on each approach has come to our attention, since the debate on demonstration method has proven more effective than pictorial text learning according to studies. Pictorial text instruction is unlike technical writing as it requires the use of images and text to convey the information. However, a demonstration is a practical exhibition and explanation of how something works or how a technique is performed which is also known as the "hands-on method". In a study conducted by Susan Palmiter and Jay Elkerton in London, animated demonstrations versus written instruction of learning procedural task has claimed that demonstrations provided faster and more accurate learning [5]. Besides that, there was another study that was carried out in India in 2015, which is about the effectiveness of video based-learning and hands-on demonstration for dentistry teaching module which showed that students who were taught by the hands-on demonstration achieved more grade A -26.67% results as compared to students who were taught by the video presentation- 13.3% [6].

With the efforts by the government to promote hand washing technique and importance of hand hygiene among the health care members, only a moderate compliance towards hand hygiene practices were observed. The annual compliance rates were 44.1% among medical students and, 74.4% in intensive care nurses based on a research in Taiwan [7]. Based on the data shown, even with pictorial text illustrations incorporated in hospitals the compliance towards hand hygiene practices are low and therefore a demonstration teaching method will instill proper hand hygiene practice. Thus, a comparison of the effectiveness of demonstration and pictorial text illustration is required to convey the correct hand washing technique which will better improve the awareness and compliance of hand hygiene. From this study we will also be able to identify how the pre-university MMMC students use their visionaries or preferred learning methods from a mediator to attain certain skills. This simultaneously incorporates medical and dental students way of learning. It is evident that the performance in the demonstration group should be better compared to the pictorial text instruction and control groups [8] [9]. The purpose of this study is to determine the effectiveness of pictorial text instruction and demonstration towards hand washing technique among pre-university students in a private medical college in Malaysia.

2. Methodology

We conducted a randomized controlled trial to determine the effectiveness of pictorial text instruction and demonstration towards hand washing techniques among pre-university students in a private medical college in Malaysia.

2.1. Study Setting, Study Time, Study Population

The study was conducted in private medical college in Melaka, Malaysia where the population of students comprises Bachelor of Medicine and Bachelor of Surgery (MBBS), Bachelor of Dental Surgery (BDS) and pre-university health science which are the Foundation in Science (FIS) students. The study was held from March to May 2018. The study was conducted among pre-university health science students of our college. Our inclusion criteria was pre-university health science students who were not exposed to hand washing techniques whereas our exclusion criteria was MBBS and BDS students who were exposed to hand washing techniques and students who were not willing to give an informed consent.

2.2. Sample Size, Sampling

Our sample size was generated from the values of the previous literature from Research Gate, titled Effectiveness of video based presentation (VBT) versus conventional "hands on" practical demonstration (HPD) for dentistry teaching module [10]. The sample size was calculated using the formula by comparing 2 independent proportions with:

P1 (outcome|treatment)= 0.5997 (There was 59.97% of good response for the "hands on" group)

P2 (outcome|control)= 0.133 (There was 13.3% good response for the no teaching group)

Ratio= 1

Alpha= 0.05

Power = 80%

Results obtained were 16 participants required for each group.

However, by calculating the 10% dropout rate, our research needed 18 participants for each group.

n calculated / (1- dropout rate) = 16/ (1-0.10)

= 16/ 0.9

= 18

We used simple randomisation sampling method to select 54 participants among the pre-university health science students and they were further divided into demonstration group, pictorial text illustration group and control group with each

has 18 participants by using the software Research Randomiser. *(http://www.randomizer.org)*

2.3. Procedure and Data Collection

First, two assessors were allocated to the demonstration group, pictorial text instruction group and control group each respectively. In the demonstration group, the assessors each demonstrated the hand washing technique twice to each student individually. The student was then asked to demonstrate hand washing technique to the assessor for assessment. Next, in the pictorial text instruction group, a pictorial text hand-out was given to each student individually for three minutes and was immediately asked to demonstrate hand washing technique without referring to the hand-out for assessment. In the control group the students were asked to demonstrate hand washing techniques without demonstration and pictorial text intervention. Before approaching the students, all assessors will be trained about the standardized marking scheme and correct steps in sequence to avoid assessor bias.

According to World Health Organisation (WHO) hand washing guidelines [11], there are seven steps of hand washing as shown in Figure 1 below and students will be given 1 mark for each step correctly performed (Step 8 was excluded from the marking scheme of our study). The maximum marks that can be obtained by the student is 7 marks while the minimum mark that can be obtained by the student is 0 mark.

Figure 1. World Health Organisation (WHO) hand washing guidelines.

Immediately after each student was asked to demonstrate hand washing technique individually to assessor both in demonstration group and pictorial text instruction group, they were asked to fill up a questionnaire and a feedback form.

In the questionnaire, the students were asked to rearrange the pictures of the hand washing steps according to the correct sequence to assess the understanding of the student about the hand washing technique. Then, in the feedback form, few questions were asked to the students regarding their opinion about the intervention which was given to them respectively

and they had to grade them into five point Likert scale which are strongly disagree (score 1), disagree (score 2), neutral (score 3), agree (score 4) or strongly agree (score 5). Examples of the questions are:

1. Do you prefer demonstration / pictorial text instruction teaching method?
2. Is the time allocated for the intervention is sufficient?
3. The content was organized and easy to follow?

2.4. Data Processing and Data Analysis

The data was analysed using software such as Epi Info 7, GraphPad and Microsoft Excel. The mean and standard deviation of the age and final score of the correct hand washing steps from each group were calculated. On the other hand, we also calculated the frequency and percentage of gender, ethnicities and awareness towards hand washing. We used the ANOVA method to calculate the marks of hand washing skills as it is a one-way analysis of variance and we have three independent groups with one measurement. The comparison of marks of hand washing skills between the three groups were calculated using independent t-test method after adjusting the type 1 error. Bonferroni adjustment was made where the pairwise comparison was alone (where P value <0.017 was considered as significant).

1. Demonstration group vs. pictorial text instruction group
2. Demonstration group vs. control group
3. Pictorial text instruction vs. control group

We also used the Mann Whitney U Test to calculate the median and Quartile 1, Quartile 3 for the feedback from participants in demonstration and pictorial text instruction group. The level of significance was set at 95% CI (P value <0.05) for all results except for comparison of marks of hand washing skills among demonstration, pictorial text instruction and control groups which use the Bonferroni adjustment P value.

2.5. Ethical Consideration

All students were voluntary and only allowed to participate in the research after giving informed consent. Students were informed that their academies will not be affected if they do not volunteer for the study. Student who participated in the research were assured all the information obtained will be kept private and confidential. They were assured their information will not be used in future studies without informed consent. This research studies was approved by the Research Ethics Committee of our college.

3. Results

The mean age of participants in the demonstration group was 18.8 (1.0), the pictorial text instruction group was 18.9 (0.8) and in the control group was 18.6 (0.6). The participants of this study comprised of 16 males (29.6%) and 38 females (70.4%). In the demonstration group there were majority of Indian (55.6%) followed by Chinese (38.9%) and other ethnicities (5.6%). In the pictorial text instruction group there were majority of Indian (55.6%) followed by Chinese (22.2%) and Malay (22.2%). Meanwhile in the control group majority were Chinese (38.9%) followed by Malay (33.3%) and Indian (27.8%). There were 66.7% of the participants in the demonstration group were aware of hand washing technique, while only 61.1% participants in the pictorial text instruction group and 55.6% of participants in the control group were aware of the hand washing technique. (Table 1)

Table 1. Baseline characteristics of participant.

Variables	Control group (n=18) n (%)	Demonstration group (n = 18) n (%)	Pictorial group (n = 18) n (%)
Age			
Mean (SD)	18.6 (0.6)	18.8 (1.0)	18.9 (0.8)
Range	18.0 – 20.0	17.0 – 21.0	18.0 – 21.0
Gender			
Male	5 (27.8)	8 (44.4)	3 (16.7)
Female	13 (72.2)	10 (55.6)	15 (83.3)
Ethnicity			
Malay	6 (33.3)	0 (0.0)	4 (22.2)
Chinese	7 (38.9)	7 (38.9)	4 (22.2)
Indian	5 (27.8)	10 (55.6)	10 (55.6)
Others	0 (0.0)	1 (5.6)	0 (0.0)
Awareness			
Yes	10 (55.6)	12 (66.7)	11 (61.1)
No	8 (44.4)	6 (37.3)	7 (38.9)

Based on the marks of hand washing skills between the 3 groups calculated using ANOVA, the mean of demonstration group is 6.8 (0.5), pictorial text instruction group is 5.1 (1.6) and the control group is 2.8 (0.9). The P value is <0.001 which is significant. As for the mean of the marks of understanding hand washing sequence calculated using the

independent t-test, comparison between the demonstration group 7.0 (0) and the pictorial text instruction group 6.7 (1.4) giving P value of 0.324 which is not significant. (Table 2).

Table 2. Marks of hand washing skills and hand washing sequence between demonstration, pictorial text instruction and control group.

Outcome	Control group Mean (SD)	Demonstration group Mean (SD)	Pictorial group Mean (SD)	F (df_1, df_2) / t (df)	P value
Hand washing skills (marks) [a]	2.8 (0.9)	6.8 (0.5)	5.1 (1.6)	61. 3 (2, 51)	< 0.001
Hand washing sequence (marks) [b]	-	7.0 (0)	6.7 (1.4)	1.0 (34)	0.324

[a] ANOVA, [b] Independent t-test

As for the comparison of marks of hand-washing skills among the 3 groups, the mean difference of demonstration vs control group is 3.94 with P value of <0.001. For the pictorial text instruction vs control group the mean difference is 2.22 with P value of <0.001. For demonstration vs pictorial text instruction group, the mean difference is 1.72 with P value <0.001. Based on Bonferroni correction (P value <0.017 is significant), the P value of all three groups are significant. (Table 3)

Table 3. Comparison of marks of hand washing skills among demonstration, pictorial text instruction and control groups.

Group	Final score of the hand washing skills Mean difference (95% CI)	P value
Demonstration vs Control	3.94 (3.46, 4.43)	<0.001[a]
Pictorial vs Control	2.22 (1.37, 3.07)	<0.001[a]
Demonstration vs Pictorial	1.72 (0.93, 2.51)	<0.001[a]

[a] Post hoc analysis with Bonferroni correction (P value < 0.017 is significant)

The number of participant who answered correctly in step 1 is (100%) for all 3 groups. In step 2, for demonstration and pictorial text instruction group 94.4% answered correctly and 100% in control group. In step 3, there were 100% participant in the demonstration group, 83.3% in pictorial text instruction group and 61.1% in control group who answered correctly. In step 4, 83.3% of participants in demonstration group, 44.4% in pictorial text instruction group and 16.7% in control group who answered correctly. In step 5, 100% of participants in demonstration group, 50.0% in pictorial text instruction group and 5.5% in control group who answered correctly. As for in step 6, 100% of participants in demonstration group, 66.7% in pictorial text instruction and 0% in control group answered correctly. For step 7, a total of 100% in demonstration group answered correctly, 66.7% in pictorial text instruction group answered correctly and none 0% in control group. The P value of step 1 to step 3 gives non-significant results meanwhile in step 4 to step 7, the results are significant. (Table 4)

Table 4. Correct steps of hand washing between demonstration, pictorial text instruction and control groups.

Outcome	Control Frequency (%)	Demonstration Frequency (%)	Pictorial Frequency (%)	Chi-square (X^2)	P value
Step 1					
Correct	18 (100%)	18 (100%)	18 (100%)	0.00	0.999
Wrong	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Step 2					
Correct	18 (100%)	17 (94.4%)	17 (94.4%)	1.04	0.595
Wrong	0 (0.0%)	1 (5.5%)	1 (5.5%)		
Step 3					
Correct	11 (61.1%)	18 (100%)	15 (83.3%)	9.08	0.011
Wrong	7 (38.9%)	0 (0.0%)	3 (16.7%)		
Step 4					
Correct	3 (16.7%)	15 (83.3%)	8 (44.4%)	16.17	0.003
Wrong	15 (83.3%)	3 (16.7%)	10 (55.6%)		
Step 5					
Correct	1 (5.5%)	18 (100%)	9 (50.0%)	32.19	<0.001
Wrong	17 (94.4%)	0 (0.0%)	9 (50.0%)		
Step 6					
Correct	0 (0.0%)	18 (100%)	12 (66.7%)	37.80	<0.001
Wrong	18 (100%)	0 (0.0%)	6 (83.3%)		
Step 7					
Correct	0 (0.0%)	18 (100%)	12 (66.7%)	37.80	<0.001
Wrong	18 (100%)	0 (0.0%)	6 (33.3%)		

Based on the feedback from participants in the demonstration group and pictorial text instruction group, the median of those who preferred demonstration method is 5.0 and 4.0 in those who preferred the pictorial text instruction method. The

median of those who agreed that the time allotted was sufficient is 5.0 in demonstration group and 4.5 in pictorial text instruction group. In the demonstration group, a median of 5.0 and 4.5 in pictorial text instruction group agreed that the content was organized and easy to follow. A median of 5.0 in both demonstration and pictorial text instruction group agreed that they had a better understanding of the hand washing technique after the interventions. A median of 5.0 in both the groups agreed to practice the hand washing technique in clinical setting and to recommend this to others. (Table 5)

Table 5. Feedback from participants in demonstration and pictorial text instruction group.

Feedback questions[a]	Median (Q1, Q3)		P-value
	Demonstration	Pictorial	
Preference of teaching method	5.0 (4.0, 5.0)	4.0 (3.0, 5.0)	0.191
Time allotted for demonstration/pictorial text reading	5.0 (4.0, 5.0)	4.5 (4.0, 5.0)	0.193
Arrangement of content	5.0 (5.0, 5.0)	4.5 (4.0, 5.0)	0.026
Apprehension of hand-washing technique after demonstration/ pictorial text	5.0 (5.0, 5.0)	4.0 (4.0, 5.0)	0.004
Future practice of hand-washing technique in clinical setting	5.0 (4.0, 5.0)	5.0 (4.0, 5.0)	0.169
Recommendation of hand-washing technique to others	5.0 (4.0, 5.0)	5.0 (4.0, 5.0)	0.641

[a]Mann Whitney U Test

4. Discussion

The main objective of this study is to determine the effectiveness of pictorial text instruction and demonstration towards hand washing technique among pre-university health science students. The pictorial text instruction group and demonstration group was compared with a control group. Based on the total marks of hand washing skills, the demonstration group obtained the highest mean score among the three groups which is 6.8 and a Standard Deviation (SD) of 0.5, while the pictorial text instruction group obtained a mean score of 5.1 and SD (1.6) and the control group obtained a mean score of 2.8 and SD (0.9). In reference to the results of this study, it is proven that the demonstration approach is more effective compared to the pictorial text instruction approach as the participants in the demonstration group obtained the highest score out of the 3 groups [12] [13]. Therefore, the demonstration approach is a more favourable method that should be implemented on teaching a procedural task which in our context is the hand washing technique. The understanding of hand washing sequence was also tested during this study where the mean marks of the demonstration group was 7.0 with a SD of 0 while the pictorial text instruction group obtained mean marks of 6.7 with SD of 1.4. The demonstration group managed to obtain the full score which indicates that they fully understood the sequence of the hand washing technique compared to pictorial text instruction group [14] [15]. Based on study, A Comparison of Demonstration and Tutorials in Photo Editing instruction conducted by Cenk Akbiyik, which compared the effectiveness between demonstration and tutorial on performance which proved that the demonstration group performed significantly better than the tutorial group as students from the tutorial group made more mistakes than other groups [16].

The positive mean difference value of the comparison between the demonstration group and control group indicates that the demonstration method is more effective in implementing the hand washing technique compared to the control group in this study. Based on a previous research by Muhammad Husnu, demonstration technique was used to improve the vocabulary and grammar element in teaching speaking at EFL learners which proved that the demonstration method was most effective in learning concepts in economics among secondary school students in Borneo [17]. However, the positive mean difference value of the comparison between the pictorial text instruction group and control group indicates that the pictorial text instruction is more effective in implementing the hand washing skill when it is compared to the control group. Based on the study assessing functional effectiveness of pictorial representations used in the text by Hurt, J. A., the results of the study proves attributes present in an instruction will account for its effectiveness in serving an instructional function [18]. Lastly, the positive mean difference value of the comparison between the demonstration group and pictorial text instruction group indicates that demonstration method is more effective among the 2 interventions in implementing the hand washing technique. Based on a previous study comparing the use of device-specific pamphlet, a verbal instruction and physical demonstration, it shows that participants who receive demonstration intervention has better inhaler device technique compared to the use of device-specific pamphlet [19].

When focused on the correct steps of hand washing between the three groups, there was no significant difference between three groups in Step 1 and Step 2. This is because the participants in all three groups managed to perform Step 1 and Step 2 correctly as it is the most common hand hygiene step practiced daily. The results from the correct steps of hand washing between the 3 groups shows significant results in Step 3, Step 4, Step 5, Step 6 and Step 7. All the participants in the demonstration group was able to perform

step 3 compared to the participants from the other two groups as the participants did not perform this step on both sides of each hand. In all 3 groups, students who did not obtain the marks for step 4 is because they failed to perform this step and skipped to the following step. As for Step 5, Step 6, and Step 7 marks were obtained from all the participants in the demonstration group. This was achieved due to a clear guide that was given to the participants in the demonstration group which made it easier for them to follow the sequence of hand washing technique compared to the control and pictorial instruction group which had to understand the hand washing steps all by themselves. As for the control group, a large number of students were not able to perform Step 5, Step 6 and step 7. This is because these steps required specific skills of hand washing which is not routinely used in daily practice. As for the pictorial instruction group, some students were not able to perform the steps as they failed to perform the steps on both sides of each hand.

This study was focused on the performance of the technique and understanding of hand washing sequence whereas the retention of memory of the technique was not assessed due to time factor. The retention of skills was not able to be assessed as it was time consuming and hard to follow up on the memory of the hand washing skill on the same student. Therefore we suggest for future studies to focus on increasing the duration of the study unlike the time constrain of our study which was 6 weeks. Besides that, we conducted our study among pre-university health science students consisting of participants of 17 to 21 years of age. We were not able to conduct this study among the general population which consists of participants of other age groups and other professions. Hence, future studies should attempt to approach participants of different age groups as it is proven that participants of different age groups have different capability of learning and understanding skills which would make the research more significant and reliable [20]. In addition to that, we were unable to obtain data from different colleges with pre-university health science students. Based on the result of our study, we highly recommend educators to use the demonstration method as a teaching method to students to enable them to learn and understanding a certain skill or technique better.

5. Conclusion

In conclusion, the demonstration method is the most significant method compared to the pictorial text instruction and control group. Besides that, the pictorial text instruction group also had significant mean marks when compared to the control group but the demonstration method had higher mean marks compared to the pictorial text instruction group. This proves that the demonstration technique is not the only method of teaching but it is the most effective method in improving a person's understanding on a specific skill or technique.

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