

The effect of handwashing education given to children with intellectual disabilities on handwashing skills

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Abstract

Objective: Children with intellectual disabilities may experience poor motor development, communication difficulties and memory problems. This study aimed to determine the effect of handwashing education using coloured hand paint on handwashing skills in children with intellectual disabilities.

Method: This study was undertaken using a controlled semi experimental research design. Children in the intervention group received handwashing education using coloured hand paint, while children in the control group received handwashing education with liquid soap and water. Data were collected using a demographic information form, a Social Handwashing Attitude Questionnaire and a handwashing checklist.

Results: A significant difference was found between the pre-test and post-test mean scores for the intervention group that received handwashing education with coloured hand paint ($p < .05$). Furthermore, it was found that the correct handwashing practices of students in both groups increased compared to pre-training levels.

Conclusion: Education about handwashing has a role to play in improving the handwashing skills of children. Handwashing education using coloured hand paint has a useful role to play in improving the handwashing attitudes and skills of children with intellectual disabilities.

Keywords

Children, coloured hand paint, education, handwashing, intellectual disabilities

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Introduction

Proper hand hygiene is a key element of infection control activities (Falus et al., 2020). Microorganisms on the skin acquired during daily activities can be completely removed by washing hands with soap and water. Social handwashing is defined as maintaining hand hygiene with water and non-antimicrobial soap as part of daily life (Erdoğan et al., 2016). Handwashing is an activity that should be performed automatically when necessary. Therefore, internalising the habit of handwashing is crucial (Cai et al., 2019; Oppong et al., 2019).

However, the importance of handwashing is not well understood by both adults and children. For example, the handwashing rate after using the toilet among children has been reported to be between 22% and 65%, in countries such as India and Türkiye (Kavitha et al., 2019; Öncü and Vayısoğlu, 2021; Pratinidhi et al., 2020). Hand hygiene through effective handwashing plays a significant role in protecting children, particularly in schools, from outbreaks of infectious diseases in developing countries (Mbakaya et al., 2017). Repeated soap handwashing training for school-aged children has an key role to play in encouraging the development of lifelong behavioural habits in future adults (Khan et al., 2021).

Intellectual disability often involves lifelong impairments as well as limitations in adaptive functioning (Lee et al., 2015). Individuals with intellectual disabilities require a phased process to learn certain personal care skills such as handwashing, due to challenges including insufficient and weak motor development, communication difficulties and poor memory (Kang and Chang, 2019). Children with intellectual disabilities are a particularly important target for hand hygiene interventions for three reasons

1. The presence of other students in close proximity;
2. The need for students to learn how to effectively practise handwashing behaviours;
3. A weakened immune system in some children and an increased tendency for hand-to-mouth contact.

Training through demonstration can facilitate the learning process for children with intellectual disabilities. However, when using demonstration, it is important to provide individualised alternative support in order to foster handwashing habits among members of this special group of children (Dahlan et al., 2022; Joseph and Machalicek, 2022; Karhula et al., 2023; Purba and Gusar, 2020). The literature identifies different methods used for handwashing education in children with intellectual disabilities. Purba and Gusar (2020) conducted a study with four boys and four girls with intellectual disabilities using demonstration technique, and observed that this method was effective for handwashing education among children with intellectual disabilities over a 5-week period (Purba and Gusar, 2020).

Aktaş and Öncü (2023) provided handwashing training as part of menstrual hygiene education to 22 intellectually disabled girls aged 10–19. This educational programme involved modelling handwashing with dolls and personal practice over an 8-week period. Evaluations conducted on days 1, 15, 30 and 60 of the study showed a significant increase in hygiene practices among the children (Aktaş and Öncü, 2023). Lee et al. (2022) used a multimedia visualisation teaching strategy to develop a simplified five-step handwashing programme for students as part of a 4-week randomised controlled trial, reporting that for children aged 6–16 with intellectual disabilities the technique used was more effective than the World Health Organization's seven-step handwashing programme (Lee et al., 2022). Konuk Sener et al. (2019) developed a hygiene education programme based on social learning theory for adolescents with intellectual disabilities, which included handwashing hygiene. Results showed significant improvement in personal hygiene

habits both at the end of the 10-week training programme and 3 months later, compared to pre-training levels (Konuk Sener et al., 2019).

Protecting children from infection and preventing the spread of infection are among the fundamental responsibilities of healthcare workers, especially nurses. It is important for children to develop handwashing habits to promote their own health as well as that of others. Nurses have an important role to play in promoting education about handwashing to the wider community (Kaya and Güvenir, 2020). It is particularly important for nurses to teach proper hand hygiene to children with intellectual disabilities in school health programmes and to practise proper hand hygiene themselves to protect children from disease (Dahlan et al., 2022).

Against this background, this study aimed to determine the effects of handwashing education using coloured hand paint on handwashing skills among children with intellectual disabilities, thereby guiding future research in this area.

Research questions

1. Does handwashing education using coloured hand paint affect the development of handwashing skills in children with intellectual disabilities?
2. Does handwashing education using coloured hand paint affect attitudes towards handwashing among children with intellectual disabilities?

Methods

Study design and sample

This study adopted a controlled semi-experimental research design. Fifty-eight students (20 elementary and 38 middle school students) enrolled in a special education school in Balıkesir, Türkiye, took part on the study which was conducted between February and May 2024. Power analysis (G*Power, 3.1.9.2) was used to determine the sample size. Informed by an existing similar comparative study (Lee and Lee, 2014), to achieve a power of 90% ($1-\beta$), an alpha level of .05, and a Cohen's effect size coefficient $d=0.95$, a total of 50 children with intellectual disabilities (at least 25 per group) needed to be included (Lee and Lee, 2014). The study was eventually undertaken with 36 students from the school, since 22 of the initially included students did not continue with their education.

Inclusion criteria

Participants were required to be enrolled at the school where the study was conducted, to maintain full attendance throughout the 4-week research period, to voluntarily consent to participate in the study, and to provide parental approval through a signed informed consent form. In addition, participants were required to have an IQ score of between 50 and 70. Children needed to have no neurological, orthopaedic, visual or auditory system problems that would prevent them from participating in the educational programme and learning activities provided.

Exclusion criteria

Not being enrolled at the school where the research was conducted, having absences during the 4-week study period, not volunteering to participate in the study, lack of parental approval via a signed informed consent form, and having an IQ score below 50 or above 70.

Procedure

Before the study commenced, families were informed about the research, and their consent was obtained. In addition, children were informed about the study and their assent was also obtained. Data were collected through face-to-face interviews. The study involved two groups. Simple randomisation was used to determine which group students would be assigned to – either an intervention or a control group. This selection process continued until the required number of participants for each group was reached. The assignment of participants to groups was conducted by a faculty member not involved in the research.

The handwashing education was administered by two researchers with doctoral degrees specialising in paediatric health and disease nursing. To provide visual materials for the students, 11-step handwashing posters issued by the Turkish Ministry of Health were displayed in the sinks of the school where the training took place. The handwashing training was carried out using the 11-step handwashing instructions issued by the Turkish Ministry of Health, as follows:

- Wet hands under running water.
- Apply soap to cover all the hand surfaces.
- Rub hands palm to palm to create a lather.
- Rub the back of the left hand with the right palm with fingers interlaced, and repeat with the other hand.
- Rub palm to palm with fingers interlaced.
- Interlock fingers and rub the fingertips against each other in a horizontal motion.
- Clasp the left thumb with the right hand and rotate it; repeat with the other hand.
- Cup the fingers of the right hand and rub the left palm in a circular, back-and-forth motion; repeat with the other hand.
- Rinse hands thoroughly under running water.
- Dry hands completely from the wrist downwards using a disposable paper towel.
- Turn off the tap using a paper towel (Ministry of Health, 2018).

The school where the research was conducted

The school in which the study took place was a specialised educational facility offering instruction and training through individualised education plans at both primary and middle school levels. Students enrolled in the institution have moderate intellectual disabilities, with IQ scores ranging between 50 and 70, and an average score of 55. They require limited support to access the educational content and participate in the learning process effectively.

Study groups

Coloured hand paint group. This group received handwashing training using coloured hand paint following the 11-step handwashing instruction detailed above. Handwashing training was provided to students in this group on a one-to-one basis. The trainer applied coloured hand paint to their hands and demonstrated to the students how to wash their hands properly in line with the 11 steps (Figure 1). After demonstrating the technique, the researcher asked the student to repeat the process. Handwashing education was given twice a week for 4 weeks, resulting in a total of eight training sessions per student.

Prior to the study, a demographic information form and a Social Handwashing Attitude Questionnaire (SHAQ) were administered to the students. In addition, a handwashing checklist

was used to assess the student's handwashing skills. At the end of the study, the SHAQ was administered again, and the students' handwashing skills were reassessed using the handwashing checklist. Before washing hands with coloured hand paint, some coloured hand paint was applied to the inside of the forearm of the child followed by a wait for 15 minutes. The researchers did not observe any allergic reaction to the coloured hand paint.



Figure 1. The use of coloured hand paint in handwashing education.

Control group. In this group, students were taught the correct handwashing procedure using liquid soap and water following the 11-step handwashing instruction from the Ministry of Health. The educator individually demonstrated the handwashing procedure to each student and then asked the student to perform the procedure. Handwashing education was given twice a week for 4 weeks, resulting in a total of eight training sessions per student.

Prior to the study, a demographic information form and the SHAQ were administered to the students. In addition, a handwashing checklist was used to assess the student's handwashing skills. At the end of the study, a SHAQ was administered again, and the students' handwashing skills were reassessed using the handwashing checklist.

Outcome measurement

As indicated above, data were collected using a demographic information form, the SHAQ, and a Handwashing Checklist form.

Demographic information form. This form includes six questions about the students' age, gender, family type, place of residence, and parents' education level.

SHAQ. The SHAQ was developed by Üner et al. It consists of 21 items that evaluate participants' attitudes using a 3-point Likert-type scale ('always', 'sometimes', 'never') (Üner et al., 2009). Each correct response is awarded 1 point. An overall SHAQ score is then calculated using the formula presented below:

$$\text{Score} = \frac{\text{Total score obtained from the statements}}{\text{Number of statements}} \times 100$$

Handwashing checklist form. This form was prepared informed by the 11-step handwashing instructions from the Ministry of Health. It includes the statements ‘performed’ and ‘not performed’. Researchers (S.K. and S.E.) observing the students during handwashing completed this form both before and after the training (Figure 2).

Handwashing Checklist Form				
Step for handwashing	Pre-training		Post-training	
	Performed	Not Performed	Performed	Not Performed
1. Wet hands under running water				
2. Apply soap to cover all hand surfaces				
3. Rub hands palm to palm to create lather				
4. Rub the back of the left hand with the right palm with fingers interlaced, and repeat with the other hand				
5. Rub palm to palm with fingers interlaced				
6. Interlock fingers and rub the fingertips against each other in a horizontal motion				
7. Clasp the left thumb with the right hand and rotate it; repeat with the other hand				
8. Cup the fingers of the right hand and rub the left palm in a circular, back-and-forth motion; repeat with the other hand				
9. Rinse hands thoroughly under running water				
10. Dry hands completely from the wrist down using a disposable paper towel				
11. Turn off the tap with a paper towel				

Figure 2. Handwashing checklist form.

Data analysis

Data were analysed using SPSS (Statistical Package for Social Sciences) for Windows version 21. To determine the tests (parametric/non-parametric) that should be applied, the Shapiro–Wilk test was used to assess the normality of distribution of scores. Skewness and kurtosis values were also calculated. All revealed that parametric analysis was appropriate. Descriptive statistics, such as frequencies, percentages and means, were calculated. Independent sample *t*-tests and Fisher’s exact test were used to determine of differences in demographic variables between groups. A paired sample *t*-test was used to determine pre- and post-test score differences, while an independent sample *t*-test was used to determine score differences between groups. A significance level of .05 was set for determining whether the values obtained were statistically significant.

Ethical considerations

Ethical approval for the study was received from the Balıkesir University Non-Interventional Research Ethics Committee (Approval no: 2023/108, Approval date: 11 August 2023).

Results

The average age of the students in the group that washed their hands using coloured hand paint was 10.22 ± 1.16 , while the average age in the group that washed their hands with liquid soap and water was 10.72 ± 1.96 . In all, 66.7% of the students in the coloured hand paint group were boys, and 55.6% of the students in the normal handwashing group were the same. In all, 77.8% of the students in the coloured hand paint group came from households with a nuclear family structure, as 72.2% of the students in the liquid soap and water handwashing group. In all, 72.2% of the students in the coloured hand paint group and 66.7% of those in the normal handwashing group lived in the city centre.

Of the mothers of the students, 55.6% of the coloured hand paint group had elementary-level education, while 55.6% of the mothers in the liquid soap and water handwashing group had middle-school-level education. In all, 55.6% of the fathers in the coloured hand paint group had middle-school-level education, while 50.0% of the fathers in the liquid soap and water handwashing group had high-school-level education.

Overall, there were no statistically significant differences between the two groups in terms of age, gender, family structure, place of residence or parental education ($p > .05$) (Table 1).

Table 1. Findings regarding the comparison of demographic variables between groups.

Variables	Group				t	p	
	Coloured hand paint		Control				
	Mean ± SD		Mean ± SD				
Age	10.22 ± 1.16		10.72 ± 1.96		-0.929	.360	
Variables	Group	Group				X ²	p
		Coloured hand paint		Control			
		n	%	n	%		
Gender	Female	6	33.3	8	44.4	0.450	.638
	Male	12	66.7	10	55.6		
Family type	Nuclear	14	77.8	13	72.2	1.978	.278
	Extended	4	22.2	5	27.8		
Place of residence	Urban	13	72.2	12	66.7	0.554	.615
	Village	5	27.8	6	33.3		
Mother's education	Elementary school	10	55.6	8	44.4	0.281	.664
	Middle school	8	44.4	10	55.6		
Father's education	Middle school	10	55.6	9	50.0	3.600	.153
	High school	8	44.4	9	50.0		

n = number, % = percentage, t = independent sample t-test, X² = Fisher's exact test, Mean = average, SD = standard deviation, $p < .05$.

The pre-test and post-test scores of responses to the SHAQ for both groups were assessed for normal distribution using the Shapiro–Wilk test, examining the skewness and kurtosis coefficients. The Shapiro–Wilk test revealed no significant differences in the variables ($p > .05$), and the skewness and kurtosis values were within ± 2.0 , allowing for parametric analysis (Table 2).

Table 2. Findings related to normality assumptions.

Variables	Group	Shapiro–Wilk			Skewness	Kurtosis
		Statistics	SD	<i>p</i>		
Social Handwashing Attitude Questionnaire Pre-test	Coloured hand paint	0.93	18.00	.22	-0.40	-0.18
	Control	0.94	18.00	.31	-0.06	-0.68
Social Handwashing Attitude Questionnaire Post-test	Coloured hand paint	0.90	18.00	.06	0.66	-0.76
	Control	0.94	18.00	.32	-0.19	-1.02

n = number, SD = standard deviation, *p* < .05.

There was a statistically significant difference in the pre-test mean scores of the SHAQ between the coloured hand paint group and the liquid soap and water handwashing group (*p* < .05). The pre-test mean score for the coloured hand paint group was 30.37 ± 9.24 , while the pre-test mean score for the liquid soap and water handwashing group was 38.07 ± 12.15 , with this latter group having a higher mean score. There was no statistically significant difference between the post-test mean scores of the SHAQ for the coloured hand paint group and the liquid soap and water handwashing group (*p* > .05). The post-test mean score for the coloured hand paint group was 38.59 ± 17.92 , while the post-test mean score for the liquid soap and water handwashing group was 38.87 ± 15.72 (Table 3).

Table 3. Intra-group and inter-group comparison of students' social handwashing questionnaire.

	Group					Inter-group ^a	Min–Max
	Coloured hand paint		Control				
	Mean	SD	Min–Max	Mean	SD		
Social Handwashing Attitude Questionnaire Pre-test	30.37	9.24	09.50–42.80	38.07	12.15	<i>t</i> : -2.140; <i>p</i> : .04	19.00–61.90
Social Handwashing Attitude Questionnaire Post-test	38.59	17.92	14.20–76.10	38.87	15.72	<i>t</i> : -0.05; <i>p</i> : .96	09.30–61.90
Longitudinal measurements ^b	<i>t</i> : -2.298; <i>p</i> : .03			<i>t</i> : -0.216; <i>p</i> : .831			

n = number, SD = standard deviation. *p* < .05.

^aIndependent sample *t*-test.

^bPaired sample *t*-test.

For the students in the coloured hand paint group, a statistically significant difference was found between pre-test and post-test scores on the SHAQ (*p* < .05). The mean pre-test score (30.37 ± 9.24) was lower than the mean post-test score (38.59 ± 17.92) (Table 3).

For the students in the liquid soap and water handwashing group, no statistically significant difference was found between the pre-test and post-test scores on the SHAQ (*p* > 0.05). The mean pre-test score (38.07 ± 12.15) and the mean post-test score (38.87 ± 15.72) were similar (Table 3).

Table 4 shows the pre- and post-training practice results for handwashing practice by step for each group. The post-education practice results for the coloured hand paint handwashing training group were better than those of the pre-training group. The post-training results for the liquid soap and water handwashing training were also better than the pre-training results (Table 4).

Table 4. Distribution of students across handwashing steps by group.

Handwashing steps	Coloured hand paint group						Control group									
	Performed			Not performed			Performed			Not performed						
	Pre-training	Post-training		Pre-training	Post-training		Pre-training	Post-training		Pre-training	Post-training					
n	%	n	%	n	%	n	%	n	%	n	%	n	%			
Wet hands	12	66.7	18	100.0	6	33.3	-	-	8	44.4	17	94.4	10	55.6	1	5.6
Applied soap	17	94.4	18	100.0	1	5.6	-	-	18	100.0	18	100.0	-	-	-	-
Rubbed palms together	17	95.4	18	100.0	1	5.6	-	-	14	77.8	18	100.0	4	22.2	-	-
Rubbed the back of each hand in turn	11	61.1	18	100.0	7	38.9	-	-	12	66.7	16	88.9	6	33.3	2	11.1
Interlaced fingers and cleaned between fingers of both hands	12	66.7	17	94.4	6	33.3	1	5.6	11	61.1	16	88.9	7	38.9	2	11.1
Cleaned nails	7	38.9	16	88.9	11	61.1	2	11.1	11	61.1	11	61.1	7	38.9	7	38.9
Rubbed thumbs	14	77.8	16	88.9	4	22.2	2	11.1	11	61.1	12	66.7	7	38.9	6	33.3
Cleaned fingertips	12	66.7	16	88.9	6	33.3	2	11.1	14	77.8	16	88.9	4	22.2	2	11.1
Rinsed hands	16	88.9	17	94.4	2	11.1	1	5.6	18	100.0	18	100.0	-	-	-	-
Dried hands with a paper towel	8	44.4	16	88.9	10	55.6	2	11.1	13	72.2	15	83.3	5	27.8	3	16.7
Turned off the tap using a paper towel	5	27.8	16	88.9	13	72.2	2	11.1	3	16.7	8	44.4	15	83.3	10	55.6

n= number, %=percent.

Discussion

This study was conducted to determine the effect of handwashing education using coloured hand paint on the handwashing skills of children with intellectual disabilities. With respect to the sociodemographic characteristics of the children included in the study, no statistically significant difference was found between the two groups. Moreover, the pre-test and post-test scores on the SHAQ were found to follow a normal distribution for both groups, with the Shapiro–Wilk test revealing no significant differences among the variables.

No significant difference was found between the pre-test and post-test mean scores of the SHAQ for the group that received handwashing education with liquid soap and water. However, a significant difference was found between the pre-test and post-test mean scores for the group that received handwashing education with coloured hand paint. Furthermore, it was found that the correct handwashing practices of students in both groups increased compared to pre-training levels. These findings suggest that handwashing education using coloured hand paint was effective in improving handwashing attitudes among children with intellectual disabilities in the study. At the end of the study, it was observed that students' handwashing attitudes and behaviours had improved.

Children with intellectual disabilities often face problems and challenges with intellectual and adaptive skills, as well as difficulties understanding new and complex information. Therefore, activities to facilitate learning are essential (Dahlan et al., 2022). Handwashing education with coloured hand paint makes learning easier for children with intellectual disabilities, allowing them to better understand proper handwashing technique. No study examining the effects of handwashing education with coloured hand paint on the handwashing skills of children with intellectual disabilities was found in the literature, so no direct comparison could be made. However, different methods of handwashing education have been reported for children with intellectual disabilities.

Son and Kwag conducted a study with 14 students with intellectual disabilities with an average age of 10. The handwashing education programme, using visual aid materials over an 8-week period, was reported to increase the frequency of handwashing and improve handwashing techniques among the students (Son and Kwag, 2020). Deochand and colleagues provided handwashing education to three students with intellectual disabilities aged between 9 and 13 using a short handwashing video produced by the World Health Organization and reinforcement by an ultraviolet visual feedback technique. The study reported that two of the students improved their handwashing behaviour (Deochand et al., 2019). Kang and Chang (2019), in their study with four children with intellectual disabilities, used a Kinect-based technological game containing three-dimensional handwashing instructions for 2 weeks, with three sessions per week, and found that the children's handwashing skills improved. In a study by Nazirun and Sari (2023) involving 25 children with intellectual disabilities, the use of visual-auditory media for handwashing education led to improved handwashing skills among the students. Hidayati and colleagues (2019) reported that visual and auditory stimulus-based hygiene education given to 30 children with intellectual disabilities aged 7 and 12 was effective in increasing knowledge levels but was insufficient for attitude, behaviour, and self-efficacy change. The findings from our study contribute to this wider literature, indicating that handwashing education given to children with intellectual disabilities can improve handwashing attitudes and skills in children.

Strengths and limitations

This study is the first in the published literature to provide handwashing training to children with intellectual disabilities using coloured hand paint. As the research findings were limited to one

small group of children in a single centre, they cannot be generalised. The reliability of research data is limited to the accuracy of answers given by participants. It is recommended that school nurses working with intellectually disabled children conduct experimental studies with larger sample sizes to verify the efficacy of such educational methods.

Conclusion

In this study, handwashing education using coloured hand paint was found to improve handwashing attitudes and behaviours among children with intellectual disabilities. Nurses working in child health can use this method to provide handwashing education to children.

It is important for children to develop the habit of handwashing to improve their health and protect against infectious diseases, in particular. Acquiring good hygiene behaviours is easier for children without intellectual disabilities compared to those with intellectual disabilities. Children with intellectual disabilities often benefit from a detailed, stepwise, and attention-grabbing process to acquire personal care skills such as handwashing.

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AI use

During the preparation of this manuscript, support was received from ChatGPT with respect to text translation and language editing. AI assistance was used solely to enhance translation quality and writing style. The scientific content, analyses and conclusions of the study were entirely developed by the authors. The authors take full responsibility for the content and accuracy of the final work.

Data availability

Anonymised data from this study may be made available upon reasonable request to the corresponding author.

Declaration of conflicting interests

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