

# AR Toothbrushing Machine on Plaque Control, Self-efficacy and Skill of Toothbrushing in School Children

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## Background

Augmented reality (AR) is an interactive experience of real world and virtual environment, which has been used as a learning tool for children in different fields. In this study, a mobile AR toothbrush machine was used to allow school children to operate an optical toothbrush on a dental model to remove simulated dental plaque, and learn the correct method of brushing teeth with a 3-minute brushing song.

## Objective

We aimed to evaluate the effect of AR brushing machine on the dental plaque control and brushing skills in elementary school children in Taiwan.

## Method

**Study design:** Quasi-experimental design

**Participant:** Grade 3-6 students were recruited and assigned to the AR group (EG; n = 290) and the control group (CG; n = 311).

**Outcome variable:** Bass method and Self-Efficacy and Plaque control record.

**Intervention:** All students underwent a 4-week intervention: students in the AR group received instructional interventions using an AR brushing machine; students in the traditional group received a classroom-based Bass method of toothbrushing by a dental hygiene professional.

**Data collection:** Bass brushing method and Self-Efficacy and Plaque control record (PCR) were performed at the baseline, 2 weeks and 4 weeks after the intervention.

**Statistical analysis:** The generalized estimating equations was used to evaluate the outcomes between two groups over time.

## Results

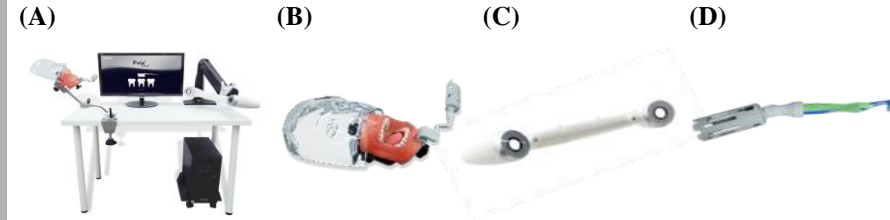
The EG exhibited greater improvement in PCR [ $\beta = -5.17$ , effect size (ES) = 0.24] at the 2-week follow-ups than the CG did. The self-efficacy of toothbrushing in the EG exhibited greater improvement ( $\beta = 0.38$  and  $0.53$ , ES = 0.16 and 0.22) at the 2-week and 4-week follow-up than the CG did. However, the students in the EG had less improvement in Bass toothbrushing technique (odds ratio = 0.44 and 0.49) at 2- and 4-week follow-up than the CG did.

## Conclusion

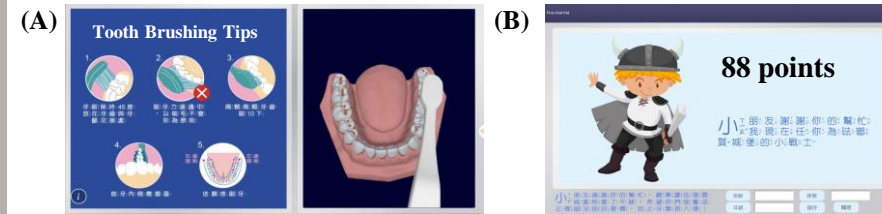
The mobile AR can improve dental plaque control and self-efficacy of toothbrushing in elementary schoolchildren.

## Funding:

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**Fig1.** (A) AR Brushing Machine (B) A 3D training head model (C) An optical tracking unit (D) A wireless toothbrush



**Fig2.** (A) Learn Bass Brushing Method (B) Test score



**Fig3. Intervention (EG)**

(A) Pretest (B) A short instructional story

(C) Learn brushing techniques using a toothbrush machine (D) 2-week and 4-week post-test



**Fig4. Intervention (CG)**

(A) Pretest (B) A short description of the Bass method of tooth brushing

(C) Demonstrate toothbrushing skills (D) 2-week and 4-week post-test

**Table 1.** Bassline information of students at AR and traditional group

	AR group (n=290)		Traditional group (n=311)		p
	N	%	N	%	
Gender (N, %)					0.173
Male	156	53.8	150	48.2	
Female	134	46.2	161	51.8	
Grade					0.307
3 <sup>rd</sup> grade	75	25.9	96	30.9	
4 <sup>th</sup> grade	78	26.9	81	26.1	
5 <sup>th</sup> grade	69	23.8	57	18.3	
6 <sup>th</sup> grade	68	24.5	77	24.8	
Plaque control record (M±SD)	85.2 ± 17.5		85.4 ± 15.7		0.880
Bass brushing method	44	15.2	52	16.7	0.605
Self-efficacy (2-10)(M±SD)	7.4 ± 2.1		7.5 ± 19.7		0.420

Chi-Square Test: analyzed gender and grade

independent samples t-test: analyzed Plaque control record

**Table 2.** Regression-estimated change of tooth brushing skill, self-efficacy, plaque control record between two groups

	OR	$\beta$ (95%CI)	ES	p
<b>Bass brushing method</b>				
Group (AR group) × Time (2 weeks)	0.44	(0.27, 0.73)		0.001
Group (AR group) × Time (4 weeks)	0.49	(0.30, 0.80)		0.005
<b>Self-efficacy</b>				
Group (AR group) × Time (2 weeks) <sup>a</sup>		0.38 (0.74, 0.02)	0.16	0.038
Group (AR group) × Time (4 weeks) <sup>a</sup>		0.53 (0.88, 0.17)	0.22	0.004
<b>Plaque control record</b>				
Group (AR group) × Time (2 weeks) <sup>a</sup>		-5.17 (-8.9, -1.4)	0.24	0.007
Group (AR group) × Time (4 weeks) <sup>a</sup>		1.67 (-2.1, 5.5)	0.07	0.386

Effect size calculated and as the mean difference of change between baseline and 2- and 4-week follow-up measurement between two groups; 0.20 is small, 0.50 is moderate, and 0.80 is large.

<sup>a</sup> Reference group, traditional group × baseline

