# INTERACTIVE ORAL HEALTH EDUCATION FOR ADOLESCENTS: A SCHOOL-BASED COMMUNITY EMPOWERMENT PROGRAM IN TANGERANG SELATAN, INDONESIA

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## ABSTRACT

Adolescence is an important period for reinforcing preventive oral-health practices, particularly in relation to erosive dietary exposures, electronic-cigarette use, and effective toothbrushing. This community service program aimed to deliver interactive oral-health education to students at SMAN 4 Tangerang Selatan and to describe immediate changes in knowledge after the activity. The program used a one-group pre-test-post-test descriptive evaluation involving 290 students. Educational content covered dental erosion, the oral-health implications of electronic cigarettes, and the Bass toothbrushing technique. Delivery combined presentations, posters, interactive discussion, demonstration videos, ice-breaking activities, and direct toothbrushing practice. The mean knowledge score increased from 92.80 before education to 96.51 after education. The proportion of students in the good-knowledge category increased from 96.5% to 97.9%, while the fair category decreased from 2.8% to 1.4%. Participants also demonstrated the brushing technique during the practice session, although skills were not quantitatively scored. The program was associated with a modest immediate improvement in already-high baseline knowledge. Future implementation should use paired individual data, validated instruments, structured skill assessment, and follow-up evaluation to determine retention and behavioral change.

**Keywords:** Adolescent Oral Health, Community Empowerment, School-Based Education, Dental Erosion, Electronic Cigarettes

## 1. INTRODUCTION

Oral health is an integral component of general health and quality of life, and adolescence is a strategic period for strengthening preventive behaviors that may persist into adulthood. Schools provide a practical setting for oral-health promotion because education can reach a large group of young people in a structured environment and can combine knowledge development with opportunities for skill practice. Systematic reviews have generally reported favorable effects of school-based oral-health promotion on knowledge, behavior, and oral-health outcomes, although the magnitude and durability of effects vary according to program design, educator involvement, and follow-up period (Bramantoro et al., 2021; Dadipoor et al., 2023).

For adolescents, prevention messages need to address contemporary risk exposures rather than focus only on dental caries. Dental erosion is the chemical loss of dental hard tissue caused by non-bacterial acids. Dietary acids, particularly acidic and carbonated beverages, are consistently identified among modifiable risk factors for erosive tooth wear in adolescents (Chan et al., 2020; Inchingolo et al., 2023). Prevention therefore includes recognizing acidic exposures, reducing frequency of exposure, and applying appropriate oral-hygiene practices rather than responding only after visible tooth-surface loss has occurred.

Electronic-cigarette use is another relevant health topic for adolescents and young adults. Evidence from Southeast Asia indicates that e-cigarette use among adolescents is a public-health concern and is influenced by multiple individual and social factors (Ling et al., 2023). Current oral-health literature also describes associations between e-cigarette exposure and changes involving oral tissues, salivary function, periodontal parameters, and other oral conditions, while emphasizing that long-term evidence continues to develop (Cichońska et al., 2024). Including e-cigarette content in oral-health education can therefore connect preventive dentistry with a health behavior that adolescents may encounter in their social environment.

Knowledge alone, however, does not necessarily translate into correct self-care behavior. Observational evidence has demonstrated a gap between what children and adolescents know about oral hygiene and how effectively they perform toothbrushing in practice (Gund et al., 2022). For this reason, school-based education may be strengthened when conventional explanation is combined with visual media, demonstration, and hands-on practice. Meta-analytic evidence suggests that educational approaches using multiple aids, including audio-visual presentations and practical learning tools, can support oral-health promotion in schoolchildren (Gurav et al., 2022). A six-month school-based program in adolescents likewise showed that education combined with practical toothbrushing activities can influence knowledge and behavior (Nguyen et al., 2021).

The community service activity at SMAN 4 Tangerang Selatan was designed around these principles. The target community comprised 290 senior high-school students. Rather than assuming that the students had uniformly low baseline knowledge, the program sought to reinforce existing knowledge, address risk-related misconceptions, and provide practical exposure to correct toothbrushing. The educational topics were dental erosion, the oral-health implications of electronic cigarettes, and the Bass toothbrushing technique. The objective of this paper is to describe the implementation of the interactive school-based program and to evaluate the immediate pre-test-post-test change in students' oral-health knowledge using the aggregate data generated during the activity.

## 2. METHOD

### Program design and setting

This activity was a school-based community service program with a descriptive one-group pre-test-post-test evaluation. It was conducted at SMAN 4 Tangerang Selatan and involved 290 students who participated in both the pre-test and post-test. The available program report did not provide participant-level demographic variables; consequently, no age- or sex-stratified analysis is presented in this paper. The program design emphasized interactive education and practical participation, consistent with school-based oral-health promotion approaches that combine classroom learning and hands-on activities (Nguyen et al., 2021; Gurav et al., 2022). The implementation process consisted of four operational stages: needs identification, preparation, educational delivery, and evaluation. Initial problem identification was conducted through field observation and simple communication with the school community to determine topics that were relevant to the target students. The program team then prepared educational material, visual media, and evaluation instruments. This structure retained the participatory intent of the original community-service activity while avoiding the stronger methodological claim that the program constituted a full Participatory Action Research cycle.

### Educational content and delivery

The educational material addressed three main areas. First, students were introduced to dental erosion as a non-bacterial chemical loss of tooth structure and to common intrinsic and extrinsic acid exposures. Preventive messages included reducing the frequency of acidic food and beverage exposure, using fluoride-containing toothpaste, avoiding immediate brushing after a major acidic challenge, and applying practical strategies to reduce direct contact between acidic drinks and tooth surfaces. The emphasis on modifiable exposure was consistent with evidence linking acidic dietary habits and erosive tooth wear in adolescents (Chan et al., 2020; Inchingolo et al., 2023). Second, the program discussed electronic cigarettes and their potential implications for oral health, including dry-mouth symptoms, plaque accumulation, gingival inflammation, and other oral effects described in the contemporary literature (Cichońska et al., 2024). The topic was presented as preventive health education rather than as a diagnostic or therapeutic intervention. Third, the students received instruction in effective toothbrushing, including the Bass technique. The education was delivered in classroom groups using PowerPoint presentations, posters, interactive discussion, and a demonstration video. Ice-breaking activities were inserted to maintain engagement. After the educational session, students participated in direct toothbrushing practice and were asked to reproduce the demonstrated technique. Practical demonstration was included because oral-hygiene knowledge may not reliably predict actual brushing performance (Gund et al., 2022).

### Evaluation and data analysis

Knowledge was evaluated using a pre-test administered before the educational session and a post-test administered after completion of the educational activities. The program report summarized the number of participants, mean score, highest score, lowest score, and the distribution of students across three knowledge categories: good, fair, and poor. The same number of students (n = 290) was reported for both measurements. Data were analyzed descriptively by comparing the aggregate pre-test and post-test summaries. No inferential statistical test, confidence interval, or effect size was calculated because the original program report used descriptive analysis. Observations during the practical session were used only to describe participation and the ability of students to demonstrate the brushing steps; no numerical psychomotor score or validated skills rubric was available. Accordingly, this manuscript does not claim a

statistically significant effect or a quantitatively measured improvement in toothbrushing skill. Only aggregate program-evaluation results are presented.

## 3. RESULTS AND DISCUSSION

All 290 students were included in the aggregate pre-test and post-test summaries. The mean score increased from 92.80 before the intervention to 96.51 after the intervention, an absolute increase of 3.71 points. The highest score was 100 in both measurements. The lowest score was 27 in the pre-test and 13 in the post-test. Thus, although the overall mean shifted upward, the aggregate distribution does not indicate that every student improved. Table 1 summarizes the reported test scores.

Table 1. Summary of pre-test and post-test scores

| Test | N | Mean | Highest score | Lowest score |
|---|---|---|---|---|
| Pre-test | 290 | 92.80 | 100 | 27 |
| Post-test | 290 | 96.51 | 100 | 13 |

The distribution by knowledge category also showed only a small shift because baseline scores were already high. The number of students in the good category increased from 280 (96.5%) to 284 (97.9%). The fair category decreased from 8 students (2.8%) to 4 students (1.4%), while the poor category remained at 2 students, with the percentages reported as 0.6% in the pre-test and 0.7% in the post-test. Table 2 reproduces the category data from the original program report without altering the reported values.

Table 2. Distribution of knowledge categories before and after education

| Knowledge category | Pre-test n | Pre-test % | Post-test n | Post-test % |
|---|---|---|---|---|
| Good | 280 | 96.5% | 284 | 97.9% |
| Fair | 8 | 2.8% | 4 | 1.4% |
| Poor | 2 | 0.6% | 2 | 0.7% |
| Total | 290 | 100% | 290 | 100% |

During the educational session, students participated in discussion and practice. Following the demonstration, students were able to reproduce the Bass toothbrushing steps during the activity. This observation indicates immediate task engagement and practical exposure; however, because no structured skills checklist or pre-intervention psychomotor assessment was recorded, the observation should not be interpreted as a quantified improvement in toothbrushing competence.

The principal finding was a modest immediate increase in the aggregate mean knowledge score from 92.80 to 96.51 following the interactive educational program. The proportion of students categorized as having good knowledge also increased slightly. These changes occurred in a group with a very high baseline mean and with 96.5% of participants already classified in the good category. The baseline distribution therefore created a clear ceiling effect: there was limited numerical room for a large post-test increase even if the educational session successfully reinforced understanding. For this reason, the program is better interpreted as knowledge reinforcement than as remediation of a major knowledge deficit.

The direction of the observed change is consistent with the broader school-based oral-health education literature. Systematic reviews have found that school-based interventions can improve knowledge, attitudes, behaviors, and selected oral-health outcomes, while also noting substantial variation among program designs and study quality (Bramantoro et al., 2021; Dadipoor et al., 2023). The current program combined verbal explanation, posters, audio-visual material, interactive discussion, and practical demonstration. Such multimodal delivery is consistent with evidence that oral-health education using varied instructional aids can be more engaging than information-only approaches (Gurav et al., 2022).

The content selection also supported the community-development objective by connecting basic oral hygiene with risk factors relevant to adolescence. Dental erosion is particularly suitable for preventive education because acidic dietary exposures are modifiable and may occur repeatedly before obvious symptoms become apparent. A systematic review of adolescents identified acidic dietary habits, especially carbonated and other acidic beverages, among the most consistent risk factors for dental erosion (Chan et al., 2020). A later systematic review similarly documented the

damaging potential of carbonated soft drinks on enamel (Inchingolo et al., 2023). Translating these concepts into practical prevention messages may help students make more informed everyday choices.

Electronic cigarettes were included because vaping is increasingly relevant to adolescent health education. A systematic review from Southeast Asia identified e-cigarette use among adolescents as an important regional public-health issue (Ling et al., 2023). Oral-health evidence indicates that e-cigarette exposure may be associated with multiple changes in the oral environment, although causal pathways and long-term clinical effects remain under investigation (Cichońska et al., 2024). Framing vaping within oral-health education can make risk communication more immediate for students by connecting a contemporary behavior with symptoms and conditions that they can understand in the context of the mouth.

The direct toothbrushing component represents another important feature of the program. Knowledge acquisition is not equivalent to psychomotor competence. Oral-hygiene knowledge and actual toothbrushing performance may diverge, supporting the use of demonstration and practice rather than lecture alone (Gund et al., 2022). School-based interventions that include practical activities have also reported favorable changes in oral-health knowledge and behavior over longer follow-up periods (Nguyen et al., 2021). In the present program, students demonstrated the Bass technique after instruction, but the absence of a formal skill score means that this outcome must remain descriptive.
From a community-empowerment perspective, the program had several strengths. It reached 290 students in their school environment, addressed both established and emerging oral-health risks, used several educational media, and incorporated active participation rather than passive information transfer alone. The intervention can therefore be viewed as an initial capacity-strengthening activity for adolescent self-care. School-based oral-health promotion also aligns with broader community models in which students, teachers, and peers can serve as reinforcement agents beyond a single educational session. Reviews of school-based and peer-led approaches suggest potential value in involving the wider school community when programs are sustained over time (Bramantoro et al., 2021; Elsadek et al., 2023).

Important limitations must be acknowledged. First, the program used a one-group pre-test-post-test evaluation without a comparison group, so the observed change cannot establish causality. Second, the evaluation was immediate and did not determine whether knowledge was retained or translated into sustained behavior. Third, the analysis was descriptive and based on aggregate summaries; no paired individual-level analysis, significance test, or effect size was reported. Fourth, baseline knowledge was already high, creating a ceiling effect. Fifth, participant-level demographic data were not available in the program report, limiting subgroup interpretation. Sixth, the available manuscript did not report the psychometric properties of the knowledge instrument, and toothbrushing skill was not evaluated using a quantitative rubric. Finally, the lower minimum score in the post-test than in the pre-test illustrates that improvement in the overall mean should not be generalized to every individual participant.

From the perspective of community development, sustainability requires more than a favorable immediate post-test. A one-time professional visit can initiate awareness, but maintenance is more likely when preventive messages are embedded in the routines of the school community. The school setting offers potential reinforcement through teachers, student leaders, classroom communication, and collaboration with local health services. In this model, dental professionals provide evidence-based content and technical guidance, while members of the school community progressively assume a larger role in repeated reinforcement. This direction is consistent with evidence that school-based programs can benefit from involvement beyond the dental team and with emerging evidence on peer-led oral-health interventions (Bramantoro et al., 2021; Elsadek et al., 2023).

An important implication of the present findings is that future programming should not focus exclusively on raising test scores. Because the students already demonstrated a high baseline mean, the next level of empowerment should target application: recognizing risky acidic exposures, critically evaluating vaping-related health information, performing effective toothbrushing, and sustaining appropriate daily habits. In other words, the program can evolve from knowledge transfer toward supported self-management. This distinction is particularly relevant in adolescents, because practical utilization of oral-hygiene knowledge may differ from stated knowledge (Gund et al., 2022). A program that combines knowledge assessment with observed behavior would therefore provide a more meaningful indicator of community impact.

The original activity already used digital elements in a limited educational role through PowerPoint material and demonstration video, but it did not constitute a digital-health intervention. Future development could add simple and accessible digital reinforcement without replacing face-to-face skill teaching. Examples include QR-linked short videos, interactive quizzes, scheduled school-channel reminders, or student-created prevention messages reviewed by dental educators. Evidence on e-learning for oral-health education suggests that digital modalities can contribute to

knowledge promotion, although their effectiveness depends on design and should be integrated thoughtfully with conventional methods (Kaneyasu et al., 2023). Such additions would also create a clearer connection between community empowerment and the digital-innovation orientation of contemporary community-development programs. Future development should move from a single-session educational activity toward a more structured school oral-health empowerment model. A subsequent program could use a validated questionnaire, anonymous paired identifiers, and pre-specified statistical analysis; add an objective toothbrushing checklist or oral-hygiene indicator; and repeat the assessment after one to three months. Student peer educators and teachers could be trained to reinforce key messages between professional visits, an approach supported by emerging evidence on peer-led oral-health interventions (Elsadek et al., 2023). Digital reinforcement can also be introduced through QR-linked videos, brief interactive modules, or school communication channels, while retaining face-to-face demonstration for psychomotor learning. These additions would strengthen sustainability and provide more robust evidence of behavioral impact without changing the core community-service model.

Table 3. Proposed development pathway for a subsequent school-based oral-health program

| Component | Current program | Recommended next cycle | Purpose |
|---|---|---|---|
| Knowledge evaluation | Aggregate descriptive pre/post scores | Validated instrument with anonymous paired identifiers | Estimate individual change |
| Practical skill | Post-demonstration observation | Structured toothbrushing checklist and/or oral-hygiene indicator | Measure psychomotor outcome |
| Reinforcement | Single educational session | Teacher/peer reinforcement plus brief digital materials | Support retention |
| Follow-up | Immediate post-test | Repeat assessment after 1-3 months | Assess sustainability |
| Community role | Students as participants | Peer educators and student co-created messages | Strengthen ownership |

## 4. CONCLUSION

The interactive school-based oral-health program at SMAN 4 Tangerang Selatan reached 290 students and was associated with an immediate increase in the aggregate mean knowledge score from 92.80 to 96.51. The proportion of students in the good-knowledge category increased from 96.5% to 97.9%, indicating a small positive shift in a group that already had high baseline knowledge. The program's strengths were its large school-based reach, integration of dental erosion and electronic-cigarette risk education, and use of multimodal teaching with direct toothbrushing practice. Its main weaknesses were the absence of a comparison group, inferential paired analysis, long-term follow-up, participant-level demographic analysis, and quantitative assessment of brushing skill. Future implementation should add validated measurement, paired individual data, follow-up evaluation, and peer- or digitally reinforced education. The current findings support interactive oral-health education as a feasible component of adolescent community empowerment while requiring cautious interpretation of effectiveness.

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