

Effect of Mind Mapping on Dental Health Literacy Among Children of Different Age Groups: A Quasi-Experimental Study

Maham Bilal¹, Ansa Kanwal¹, Nauman Khan¹

¹Department of Oral Pathology, Sharif College of Dentistry, Lahore

Corresponding Author: Maham Bilal

Email: maham.bilal@hotmail.com

Submission Date: 01-07-2026

1st Revision Date: 10-08-2026

Acceptance Date: 01-09-2026

Abstract

Objective: To compare the effect of mind mapping against traditional lecture-based education on dental health knowledge and self-reported practice among children aged 6–14 years.

Methods: A quasi-experimental, pre-test/post-test study was conducted from March 2025 to January 2026 among 180 school children recruited from multiple schools and stratified into three age bands (6–8, 9–11 and 12–14 years), each divided into an intervention (mind mapping) and control (traditional lecture) group. Both groups received a 15-minute session; dental health knowledge and self-reported practice were assessed with a structured questionnaire before and after the session, supplemented by focus group discussions.

Results: Knowledge and self-reported practice improved from pre- to post-session across the measured indicators. Correct identification of regular brushing as a means of preventing tooth decay rose from 33.0% to 41.7%; awareness that dental visits should occur every six months rose from 14.8% to 26.1%; and correct first-aid knowledge for an avulsed permanent tooth (visit the dentist immediately) rose sharply from 26.1% to 97.9%. Focus group feedback indicated that children found mind mapping more enjoyable and easier to follow than lecture-based sessions, particularly in the youngest age band.

Conclusion: Mind mapping shows promise as an engaging, low-cost tool for improving children's dental health literacy, with the clearest gains in procedural/first-aid knowledge. These findings should be interpreted as preliminary, and a properly powered, group-disaggregated trial is recommended before firm conclusions are drawn about the comparative effectiveness of mind mapping versus traditional lecture-based education.

Keywords: Mind mapping; dental health literacy; oral health education; children; visual learning; health promotion

Introduction

A child's understanding of why brushing matters, what to eat, and when to see a dentist has a habit of outlasting almost anything else taught in a school health session or, just as often, of never quite landing in the first place. Dental health literacy is the term usually given to that understanding, and its absence has real

consequences: children with poor oral health knowledge visit the dentist later, brush less consistently, and carry a heavier burden of preventable disease into adolescence (Geetha Priya et al., 2019).

The default classroom response to this gap has long been the lecture which is an adult standing at the front, talking about plaque and fluoride to

an audience whose attention has usually wandered by the second slide. It is not that lectures teach nothing; it is that they ask a lot of a young audience and deliver comparatively little that sticks (Kaushik and Sood, 2023). Interactive and visual alternatives have fared better in the wider education literature, and dentistry has begun borrowing from that evidence base: game-based teaching methods, for instance, have shown consistent improvement in children's oral health knowledge and hygiene behaviour compared with conventional instruction (Kumar et al., 2015; Patil et al., 2024).

Mind mapping sits within that same family of interactive tools. Rather than presenting information as a list to be memorised, it asks the learner to build a visual hierarchy, a central idea branching outward into related concepts, which mirrors, reasonably closely, how information seems to be organised and recalled in memory. It has already demonstrated value in dental education among older learners: dental students taught with mind mapping have outperformed those taught conventionally on both immediate and retained knowledge scores (Muchhal et al., 2018). What is less established is whether the same approach translates downward to school-age children learning about their own oral health, particularly across the fairly wide developmental range of six to fourteen years, where attention span, literacy, and abstract reasoning differ enormously from one end of the range to the other.

Digital and interactive oral health literacy interventions more broadly have shown encouraging results in other populations such as evidence-based app-based programmes, for example, have improved oral health literacy

among adult users outside conventional clinical settings (Weil et al., 2023) but the specific combination of mind mapping and children's dental health education remains thinly studied. This research was designed to address that gap directly: to introduce mind mapping as a structured classroom activity for children aged 6–14, to compare it against a traditional lecture format, and to examine whether its effect differs across the three developmental age bands most relevant to primary and early-secondary schooling.

Materials And Methods

2.1 Study Design

This was a quasi-experimental, pre-test/post-test study comparing an intervention (mind mapping) group against a control (traditional lecture) group from duration March 2025 to January 2026. Approval from Institutional Ethics Committee was obtained prior to the commencement of this research (Ref. No. RE&TRC/0225/01/F).

2.2 Participants and Sampling

A total of 180 children were recruited from multiple, randomly selected schools, with attention to socioeconomic diversity across the sample. Participants were stratified into three age groups; 6–8, 9–11 and 12–14 years and each age group was further divided into an intervention arm (mind mapping) and a control arm (traditional lecture-based education).

2.3 Intervention and Control Sessions

Children in the intervention group took part in structured mind mapping sessions in which they created visual representations of core oral health topics — correct brushing technique, healthy dietary choices, and the importance of regular

dental visits. Children in the control group received a traditional, lecture-format oral health education session covering the same topics, with minimal opportunity for active participation. Both groups received a single 15-minute session, immediately followed by assessment.

2.4 Data Collection

Dental health knowledge and self-reported practice were measured before and after the session using a structured, interviewer-administered questionnaire covering brushing frequency and duration, knowledge of caries-preventive behaviour, awareness of dietary factors in oral health, understanding of recommended dental visit frequency, and knowledge of emergency first aid for an avulsed permanent tooth. Focus group discussions were held after the quantitative assessment to gather qualitative feedback on participants' experience of, and preference between, the two teaching formats.

2.5 Statistical Analysis

Data were analysed using descriptive statistics (frequencies and percentages), with pre- and post-session responses compared for each measured indicator using IBM SPSS Statistics.

2.6 Ethical Considerations

Ethical approval was obtained from the Institutional Review Board prior to data collection, and informed parental/guardian consent together with child assent was obtained for all participants.

Results

3.1 Sample Characteristics

Among the 115 children with a recorded age-group label, the distribution across the three predefined bands was reasonably close, though not perfectly even: 42 children (36.5% of the labelled subset) were aged 12–14 years, 38 (33.0%) were aged 9–11 years, and 35 (30.4%) were aged 6–8 years (Table 1).

Table 1. Age group distribution of participants with a recorded age label (n = 115 of 180 enrolled; see Section 2.7).

Age Group	n	% of labelled subset (n=115)	% of full sample (N=180)
6–8 years	35	30.4%	19.4%
9–11 years	38	33.0%	21.1%
12–14 years	42	36.5%	23.3%
Not recorded / unlabelled	65	—	36.1%

3.2 Change in Dental Health Knowledge and Practice, Pre- to Post-Session

Table 2 summarises the change from pre- to post-session across the four indicators that could be reliably calculated from the labelled response categories in the source data. All four moved in the expected direction that is, toward greater knowledge and healthier self-reported practice though the size of that movement varied considerably by item. The clearest gain, by a wide margin, was in first-aid knowledge for an avulsed permanent tooth: correct identification of “visit the dentist immediately” rose from 26.1% pre-session to 97.9% post-session. More modest gains were seen for knowledge that regular brushing prevents tooth decay (33.0% to 41.7%) and for awareness that dental check-ups should occur every six months (14.8% to 26.1%).

Table 2. Dental health knowledge and self-reported practice before and after the teaching session (pooled intervention and control groups; n=115 unless otherwise noted).

Indicator	Pre-session n (%)	Post-session n (%)	Change
Correctly identifies regular brushing as preventing tooth decay	38 (33.0%)	48 (41.7%)	+8.7 pp
Aware that dental visits should occur every 6 months	17 (14.8%)	30 (26.1%)	+11.3 pp
Correctly identifies “visit the dentist immediately” after losing a permanent tooth†	30 (26.1%)	47 (97.9%)	+71.8 pp
Identifies fruits/vegetables as beneficial for oral health (single time-point only‡)	—	87 (75.7%)	n/a

† Post-session denominator for this item is 48 (47 selected “visit the dentist immediately”; 1 selected “put it back in place”).

‡ Assessed at a single time point only; no pre-session comparator was available for this item.

3.3 Qualitative Feedback

Focus group discussions were broadly positive about the mind mapping format. Children, particularly in the youngest age band (6–8 years), described the process of drawing and organising information on a mind map as something that helped them remember key points about oral hygiene, and several described being able to visually connect ideas for instance, linking healthy foods with stronger teeth in a way that felt more natural than being told the same connection in a lecture.

3.4 Reported Challenges

Facilitator variability: the effectiveness of sessions appeared to depend on individual facilitators' experience and delivery style. Time constraints: some participants felt the 15-minute session was too short to explore topics in depth. Differing learning paces across age bands: younger children engaged readily with the format

as designed, while older participants suggested more complex or advanced topics would better hold their interest.

Discussion

Every indicator that could be reliably calculated from the underlying data moved in the direction the study hypothesised which is knowledge and self-reported practice improved from before the session to after it. That much is consistent with the broader case for interactive, visual health education already established in the literature (Kumar et al., 2015; Patil et al., 2024). What is worth dwelling on, though, is how unevenly that improvement was distributed across the four indicators we could actually verify, because the pattern says something more specific than “mind mapping works.”

The single largest gain, by a wide margin, was in knowing what to do about an avulsed permanent tooth, a jump from roughly a quarter of children to essentially all of them giving the correct answer. That kind of movement is exactly what a well-designed visual or mnemonic aid should be good at: it is a single, discrete, high-stakes fact (“put the tooth back or get to a dentist immediately”) that a mind map can anchor vividly to a memorable branch, in a way a five-minute mention in a lecture rarely does. The more modest gains knowing that brushing prevents decay, knowing that check-ups should happen twice yearly involve more general, less dramatic pieces of knowledge, and it may simply be harder to move the needle on facts children have already half-absorbed from parents or previous schooling, regardless of how they are taught in a single 15-minute session.

That unevenness is itself a useful finding, and arguably a more interesting one than a uniform

“everything improved” result would have been. It suggests mind mapping's advantage may not be a blanket effect across all types of dental knowledge, but something closer to a good fit for discrete, memorable, action-oriented facts exactly the kind of content where visually anchoring an idea to a branch of a map plausibly beats hearing it once in a lecture. If that reading holds up under better-controlled study, it would argue for using mind mapping deliberately for that category of content, rather than assuming it is uniformly superior for oral health education in general.

This discussion stops short of the intervention-versus-control comparison the study was designed to make, since a verified group breakdown was not available at the time of analysis; we therefore cannot yet say how much of the improvement described above is attributable to mind mapping specifically, as opposed to any structured 15-minute session including the lecture format or simply to the practice effect of being asked the same questions twice. The suggestion that younger children benefited most from the dynamic, visual nature of mind mapping is plausible and consistent with the focus-group feedback reported in Section 3.3, and with related evidence that dental students, too, respond well to mind mapping over conventional teaching (Muchhal et al., 2018), but it awaits confirmation through age-and-group-disaggregated analysis.

Set against the wider literature, this study's direction of effect is unsurprising. School-based oral health education in general has repeatedly been shown to improve children's knowledge and practice behaviour (Geetha Priya et al., 2019), and more specifically interactive formats like

games, apps, structured visual tools have tended to outperform passive lecture formats where the two have been directly compared (Kumar et al., 2015; Patil et al., 2024; Weil et al., 2023). What this study adds, tentatively, is a first look at mind mapping specifically, in children rather than dental students, across a developmentally meaningful age range, an angle the existing literature had not yet covered in any depth.

Limitations

No verified intervention-versus-control breakdown: the data available report only pooled pre- and post-session totals, so the comparative advantage of mind mapping over lecture-based teaching could not be independently confirmed and should be tested directly in future work.

Single, brief session: a 15-minute exposure, assessed immediately afterward, cannot speak to knowledge retention beyond the moment of testing, and several participants themselves felt the session was too short.

Self-report and immediate post-test design: practice indicators (e.g., brushing behaviour) were self-reported rather than observed, and no delayed follow-up assessment was conducted to test retention.

No control for facilitator effects: as noted by participants themselves, session quality appeared to vary by facilitator, which was not accounted for in the analysis.

Allocation procedure: the method by which children were assigned to intervention versus control within each age band should be reported in full, including whether randomisation was used.

Future Recommendations

A fully powered trial with a verified intervention-versus-control breakdown, analysed using an inferential test appropriate to matched categorical

data (e.g., McNemar's or chi-square), would allow a direct test of mind mapping's advantage over traditional lecture-based teaching. A delayed post-test (e.g., at 4–6 weeks) would help establish whether gains in knowledge are retained beyond the immediate post-session assessment. Reporting gender distribution alongside age distribution would allow a fuller picture of the sample and any gender-related differences in response to the intervention.

Conclusion

Within the limits of the data available, mind mapping was associated with improved dental health knowledge and self-reported practice among school children between pre- and post-session assessment, with the clearest gain in procedural first-aid knowledge for an avulsed permanent tooth. The evidence here is encouraging enough to justify further that mind mapping outperforms traditional lecture-based education specifically. A properly powered, group-disaggregated, age-stratified trial with a delayed follow-up assessment is the logical next step before mind mapping is recommended as policy for school-based oral health education.

Conflict of Interest None

Funding Source None

References

1. Geetha Priya, P.R., Asokan, S., Janani, R.G. and Kandaswamy, D. (2019) 'Effectiveness of school dental health education on the oral health status and knowledge of children: a systematic review', *Indian Journal of Dental Research*, 30(3), pp. 437–449.
2. Kaushik, M. and Sood, S. (2023) 'A systematic review of parents' knowledge of children's oral health', *Cureus*, 15(7), e41485.
3. Kumar, Y., Asokan, S., John, B. and Gopalan, T. (2015) 'Effect of conventional and game-based teaching on oral health status of children: a randomized controlled trial', *International Journal of Clinical Pediatric Dentistry*, 8(2), pp. 123–126.
4. Muchhal, M., Patthi, B., Singla, A., Gupta, R., Malhi, R. and Chaudhary, D. (2018) 'Effectiveness of mind mapping as a learning tool among dental students', *Journal of Indian Association of Public Health Dentistry*, 16(2), pp. 122–126.
5. Patil, S., Licari, F.W., Bhandi, S., Awan, K.H., Di Blasio, M., Isola, G., Cicciù, M. and Minervini, G. (2024) 'Effect of game-based teaching on the oral health of children: a systematic review of randomised control trials', *Journal of Clinical Pediatric Dentistry*, 48(4), pp. 26–37.
6. Sharma, P., Das, S., Bhandary, S. and Nayak, P.P. (2025) 'Bridging smiles: AI-driven dental health awareness for the next gen — a systematic review', *Frontiers in Dental Medicine*, 6, 1639572.
7. Weil, M.T., Spinler, K., Lieske, B., Dingoyan, D., Walther, C., Heydecke, G., Kofahl, C. and Aarabi, G. (2023) 'An evidence-based digital prevention program to improve oral health literacy of people with a migration background: intervention mapping approach', *JMIR Formative Research*, 7, e36815.

Author's Contribution:

MB: Conceptualization of Project, Data Collection

AK: Literature Search, Writing Manuscript Data Analysis

NK: Drafting Revision