

STARSMILE: AN APPLICATION TO IMPROVE THE ORAL HEALTH KNOWLEDGE AND TOOTH BRUSHING BEHAVIOUR

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ABSTRACT

Introduction: Poor oral hygiene is a common problem among preschool children and is influenced by parental guidance and socioeconomic factors. **Aim:** This study aimed to evaluate the effectiveness of the StarSMILE App, a game-based educational tool, in improving tooth brushing knowledge and behaviour among preschool children and their parents. **Methods:** This study utilized a Level 3 Research and Development (R&D) methodology following the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) framework and conducted in Padang city. The StarSMILE App was systematically validated by experts in content, educational methodology, and multimedia design to ensure its quality and appropriateness. User-level validation was subsequently conducted with five parent-child dyads to assess the application's usability, acceptability, and overall functionality. **Results:** The assessment details showed 89% approval from media experts, 85% approval from subject matter experts, and 84% approval from learning experts. Positive feedback was also received from users, with a very high feasibility rate of 91.2%. **Conclusion:** These results indicate that StarSMILEApp is valid and suitable as a medium for dental and oral health education.

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INTRODUCTION

Oral and dental health issues continue to be a major public health concern in Indonesia. According to the 2023 Indonesian Health Survey¹, more than half of the population experiences oral health problems, with preschool-aged children identified as one of the most vulnerable groups. This vulnerability is

closely related to the formation of health-related habits from an early age, especially tooth brushing behaviour. However, the proportion of children aged 3-4 years who practice correct tooth brushing techniques is still very low.²

Early childhood is a critical period for maintaining dental health, as habits formed at this stage tend to persist into adulthood.³ Effective oral hygiene depends not only on the frequency of brushing but also on proper brushing technique, including brushing direction, pressure, duration, and the selection of an appropriate toothbrush and toothpaste. Lack of understanding of these aspects may contribute to the high

prevalence of dental problems among young children.

The preschool period is often described as a “golden age” of development, marked by rapid growth in physical, cognitive, and motor skills.⁴ This phase offers an ideal opportunity to introduce self-care behaviours, such as tooth brushing, while fostering a sense of personal responsibility for hygiene.⁵ However, preschoolers generally have limited knowledge and independence in maintaining oral hygiene, so parental guidance is essential.⁶

Parents act as role models and primary supervisors in shaping children's oral hygiene habits.⁷ Consistent instruction, monitoring, and reinforcement by parents play a crucial role in encouraging responsible and independent tooth brushing behaviour.⁸ Educational strategies that use interactive and engaging media, such as educational games, have been shown to increase the effectiveness of health promotion efforts.⁹

Health education is intended not only to convey information but also to increase understanding and encourage positive behavioural changes.¹⁰ In this situation, game-based learning media is a promising approach to dental health education for preschool children, because it increases motivation, engagement, and understanding.

The *StarSMILE App* is an innovative educational app designed as an interactive game to promote proper toothbrushing behaviour among preschoolers with active parental involvement. The app features daily toothbrushing tracking through photo uploads and visually engaging dental health information

cards. These features encourage consistent brushing routines while strengthening parental supervision.

METHOD

R&D approach uses, which is a type of research method used to create a specific product and check how well it works¹¹, with the ADDIE model, which focuses on product validation. In the development process, the product is initially evaluated through a validity assessment to determine its feasibility and overall quality.

The population in this study consisted of lecturers from the Faculty of Dentistry, Baiturrahmah University, as media, materials, and learning experts. Parents from Assyofa Kindergarten in Padang acted as validators for the user's part. The sample in this study consisted of four lecturers from the Faculty of Dentistry, Baiturrahmah University, and five parents as application users.

The instruments in this study include the *StarSMILE App*, a questionnaire sheet containing an assessment of the *StarSMILE App*. The sample criteria in this study consisted of inclusion and exclusion criteria. The inclusion criteria were permanent lecturers teaching at the Baiturrahmah Faculty of Dentistry, willing to be respondents by signing an informed consent, and being in Padang during the study. The exclusion criteria included lecturers on extended leave and lecturers pursuing further study assignments outside the city or abroad.

This study utilized a Level 3 Research and Development (R&D) methodology following the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) framework.

The StarSMILE App was systematically validated by experts in content, educational methodology, and multimedia design to ensure its quality and appropriateness.¹² Based on suggestions, input, and comments obtained from media experts, material experts, and learning experts, design revisions were made to improve the product. The revised product was then re-evaluated through a second expert validation test to ensure that all suggested improvements had been implemented correctly. After passing the expert review stage, the product was trialed involving parents at Assyofa Kindergarten, Padang City. The research process concluded with the final results, which reflect the effectiveness of the *StarSMILE App* as an educational tool.

The data analysis used in this study uses Research and Development (R&D) analysis techniques. Research and Development is research conducted systematically and aims to improve existing products or develop new products through a testing process, so that the product can be accounted for.¹³

Analysis of the development process of the *StarSMILE App* learning media based on educational games. Data from expert critics and suggestions were analyzed descriptively and qualitatively. The information obtained was logically organized to produce general conclusions that were used in revising the product.

The feasibility assessment is carried out by experts using the following calculation formula¹⁴:

$$NP = \frac{R}{SM} \times 100\%$$

Description:

NP: Expected feasibility score percentage

R: Raw score obtained from experts

SM: Ideal maximum score

RESULTS

The results of the calculations show that the average product validation by Media Experts was 82%. According to the conversion table, 82% falls into the acceptable category.

Table 1. Results of the first test media expert review

No.	Evaluation	Respondent				
		expert 1	expert 2	expert 3	expert 4	average
1	The design of the <i>StarSMILE Application</i> is presented in an attractive manner.	4	3	4	5	4
2	The graphics and animations in the <i>StarSMILE Application</i> are in accordance with the theme and purpose of the application.	4	4	5	5	4.5
3	The sounds and music in the <i>StarSMILE App</i> match the theme of the app.	4	4	4	5	4.25
4	Navigation within the <i>StarSMILE App</i> is easy and intuitive.	4	4	4	5	4.25
5	<i>StarSMILE Application</i> has good technical quality	3	3	4	4	3.5
Total						20.5

The application was refined based on input, suggestions, and comments from experts. The next step was to conduct a revalidation test.

The purpose of this test was to evaluate whether StarSMILE App met the eligibility criteria for testing.

Table 2. Results of the second test media expert review

No.	Evaluation	Respondent				
		expert 1	expert 2	expert 3	expert 4	average
1	The design of the <i>StarSMILE</i> Application is presented in an attractive manner	4	5	4	5	4.5
2	The graphics and animations in the <i>StarSMILE</i> Application are in accordance with the theme and purpose of the application.	4	5	5	5	4.75
3	The sounds and music in the <i>StarSMILE</i> App match the theme of the app.	4	4	4	5	4.25
4	Navigation within the <i>StarSMILE</i> App is easy and intuitive.	4	5	4	5	4.5
5	<i>StarSMILE</i> Application has good technical quality	4	4	4	5	4.25
Total						22.25

The results of the calculations above, the average product validation by media experts is 89%, according to the 89% scale convection table, which is included in the feasible category.

Table 3. Results of the first test material expert review

No	Evaluation	Respondent				
		expert 1	expert 2	expert 3	expert 4	Average
1	Dental and oral health information in the <i>StarSMILE</i> Application is accurate and complies with standards.	3	2	4	5	3.5
2	<i>StarSMILE</i> Application materials are relevant to children's needs.	3	4	4	4	3.75
3	Learning objectives are formulated clearly	3	3	4	3	3.25
4	The material is packaged in an attractive manner	3	3	4	3	3.25
5	Statements using easy to understand language	3	3	4	1	2.75
Total						16.5

Based on this calculation, the average product validation by material experts is 66%, adjusted to the convection table scale, of which 66% is included in the fairly good category.

Table 4. Results of the expert review of the second test material

No	Evaluation	Respondent				
		expert 1	expert 2	expert 3	expert 4	Average
1	Dental and oral health information in the <i>StarSMILE</i> Application is accurate and complies with standards.	4	4	4	4	4
2	<i>StarSMILE</i> Application materials are relevant to children's needs.	4	5	4	5	4.5
3	Learning objectives are formulated clearly	5	4	4	4	4.25
4	The material is packaged in an attractive manner	4	4	4	5	4.25
5	Statements using easy to understand language	4	4	4	5	4.25
Total						21,25

The average value of product validation by material experts reached 85% based on the calculation results, which according to the scale conversion table is included in the very feasible category.

Table 5. Results of the first test learning expert review

No	Evaluation	Respondent				
		expert 1	expert 2	expert 3	expert 4	average
1	The <i>StarSMILE App</i> has clear learning objectives and is tailored to children's needs.	3	3	4	5	3.75
2	The learning strategies in the <i>StarSMILE Application</i> are effective and appropriate to children's needs.	4	3	4	4	3.75
3	The <i>StarSMILE Application</i> has interactive features that can increase knowledge.	3	3	4	3	3.25
4	The <i>StarSMILE App</i> can adapt to children's needs.	3	3	4	4	3.5
5	The <i>StarSMILE App</i> has an evaluation feature that can help children monitor their progress.	3	3	4	5	3.75
Total						18

The average value of product validation by material experts was 72%, which according to the scale conversion table is included in the fairly adequate category.

Table 6. Results of the second test learning expert review

No	Evaluation	Respondent				
		expert 1	expert 2	expert 3	expert 4	average
1	The <i>StarSMILE App</i> has clear learning objectives and is tailored to children's needs.	4	5	4	5	4.5
2	The learning strategies in the <i>StarSMILE Application</i> are effective and appropriate to children's needs.	4	4	4	4	4
3	The <i>StarSMILE Application</i> has interactive features that can increase knowledge.	4	4	4	5	4.25
4	The <i>StarSMILE App</i> can adapt to children's needs.	4	5	4	4	4.25
5	The <i>StarSMILE App</i> has an evaluation feature that can help children monitor their progress.	3	4	4	5	4
Total						21

The average validation of learning experts is 84%, adjusted to the 84% scale convection table, which is included in the feasible category.

Table 7. User review results

No.	Evaluation	Respondent				
		L	N	MS	NF	SAR
1	The design of the <i>StarSMILE Application</i> is presented in an attractive manner.	4	4	4	5	5
2	The graphics and animations in the <i>StarSMILE Application</i> are in accordance with the theme and purpose of the application.	4	4	5	5	5
3	The sounds and music in the <i>StarSMILE App</i> match the theme of the app.	4	4	5	5	5
4	Navigation within the <i>StarSMILE App</i> is easy and intuitive.	4	4	5	5	5
5	StarSmile app has good technical quality	4	4	5	5	5
Total						22,8

Based on the calculation below, the average product validation by users is 91.2%, adjusted to the scale convection table, 91.2% is in the very suitable category.

DISCUSSION

This research was conducted on preschool children and parents at Assyofa Kindergarten, Padang. The development of this media was carried out using the ADDIE development model, which consists of five development stages, namely: (1) analysis stage, (2) design stage, (3) development stage, (4) implementation stage, and (5) evaluation stage.



Figure 1. *StarSMILE App* initial view

In the analysis phase, researchers conducted observations at Assyofa Kindergarten in Padang, interviewing the principal to determine how the UKGS program was implemented at the school. Based on these

interviews, researchers identified existing problems. Therefore, they developed the *StarSMILE App*.

In the Design phase, researchers designed the components that would be used in the *StarSMILE App*. The design included determining the app name, creating a logo, selecting colors, designing a gamification feature with a toothbrush puzzle system where parents and children had to upload photos of their toothbrushes in the morning and evening to receive puzzle pieces, creating a dental information card containing information about dental and oral health, creating a dubbing feature for the dental information card, and creating a reward feature.

During the development phase, the researchers created the *StarSMILE App* according to the design phase. The existing dental information card design facilitated the development of the *StarSMILE App*. This process didn't encounter any significant challenges, except for the relatively lengthy technical aspects of the application's camera.

During the implementation phase, the researchers conducted a validity test for the *StarSMILE App*. This validation was conducted by subject matter experts, media experts, and learning experts, involving four lecturers from the Faculty of Dentistry, Baiturrahmah University.

During the evaluation phase, the researchers made improvements to the *StarSMILE App* based on the suggestions, input, and comments of the experts and users. The assessment from the media, materials, and learning experts collectively concluded that this

educational app was feasible, although several improvements were suggested. The parent trial at Assyofa Kindergarten, Padang, yielded a very positive response, categorizing it as very feasible.

The R&D methodology ensured that the *StarSMILE App* underwent a systematic validation process by experts in the fields of materials, media, and learning, confirming its suitability and effectiveness as an educational tool. Validation results show that the application content, gamification elements, and instructional design are appropriate for the developmental characteristics of preschoolers.¹⁵

Puzzle-based activities and visually engaging dental information cards provide a stimulating and interactive learning experience, encouraging children to adopt regular brushing practices. Furthermore, the app successfully positions parents as active facilitators, reinforcing consistent monitoring and guidance at home, which aligns with the Stimulus–Organism–Response (S–O–R) theory that emphasizes behavioural responses through repeated interactions with environmental stimuli.¹⁶

The effectiveness of the *StarSMILE App* can be attributed to three key factors: its interactive and developmentally appropriate design, the integration of parental involvement as part of the learning process, and alignment with behavioural learning theory.¹⁶

In the first media validity test, a score of 82% was obtained, categorized as adequate. Several suggestions, input, and comments from experts are provided in Table 8.

Table 8. Media expert suggestions, input, and comments

Respondents	Suggestions, Input, and Comments
Expert 1	Give a hint on which part to press
Expert 2	1. Limited game selection 2. There are typos on the dental information card.
Expert 3	-
Expert 4	The application can detect that the uploaded photo is not an old photo.

After revisions were made based on suggestions, input, and comments from experts, a re-validity test was carried out by media experts, resulting in a score of 89%, categorized as suitable for testing.

In the first stage of the material validity test, a score of 66% was obtained, categorized as quite adequate. Several suggestions, input, and comments from experts were provided in Table 9.

Table 9. Suggestions, input and comments from subject matter experts

Respondents	Comments from Subject Matters
Expert 1	Improve the language on the dental information cards
Expert 2	1. The card's content needs to be reviewed 2. Include details of the photos to be uploaded
Expert 3	Add audio reading for the material
Expert 4	Learning materials need to be made more detailed and informative.

After revisions were made based on suggestions, input and comments from experts, a re-validation test was carried out by material experts so that it received a score of 85% with a category suitable for trial testing. In the first learning validity test, a score of 72% was obtained, categorized as quite adequate. Several suggestions, input, and comments from experts are provided in the Table 10.

Table 10. Suggestions, input, and comments from learning experts

Respondents	Suggestions, input, and comments
Expert 1	Add application references and introductions
Expert 2	1. The learning objectives are quite clear, but the cards contain too many sentences, which may reduce children's interest in reading. 2. The features are less interactive, as they only upload photos, without any feedback. 3. The cards could be made simpler.
Expert 3	-
Expert 4	Learning materials are made more interactive

After revisions based on expert suggestions, input, and comments, a re-validation test was conducted by learning experts, resulting in a score of 84%, categorizing it as suitable for testing. The user validity test achieved a score of 91.2%, categorizing it as very suitable. Several suggestions, input, and comments from users are presented in the Table 11.

Table 11. User suggestions, feedback, and comments

Respondent	Suggestions, Feedback, and Comments
L	Worth learning for children
N	-
MS	This application is very interesting and good for children
NF	-
SAR	-

CONCLUSION

Based on the results of the development research that has been conducted, it can be concluded that the *StarSMILE App* educational media based on educational games developed using the ADDIE model has met the standards of suitability for use. The suitability of this product is proven through validation results by experts, where media experts gave an assessment of 89% with a category of feasible, material experts gave an assessment of 85% with a category of feasible,

and learning experts gave an assessment of 84% with a category of feasible. In addition, user responses during the trial phase also showed very positive results with a feasibility percentage reaching 91.2%. This confirms that the developed application is valid and suitable for implementation as a medium for dental and oral health education.

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