



Original Article

Culturally Integrated Behavior-Centered Educational Media Using a Visual-Auditory-Kinesthetic Approach for Adolescent Engagement in Stunting Prevention in South Kalimantan

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ABSTRACT

Background: Stunting prevalence in South Kalimantan is 24.6%, exceeding the national average and indicating a persistent public health challenge. Despite various educational interventions, the stunting cases remain high. This study aimed to develop and evaluate a Behavior-Centered Design educational medium that integrates *Banjar* cultural values, *Maasi* (obedience), *Mahe* (positive habituation), and *Manuntung* (commitment to completion), using a visual-auditory-kinesthetic learning approach to enhance adolescent engagement in stunting prevention. **Methods:** A level-3 Research and Development design with a controlled pretest-posttest method was applied to 76 adolescents equally assigned to intervention and control groups. The intervention consisted of four culturally contextualized educational games (comprehensive-card, factor-cards, *shame*-blocks, and true-false cards) each emphasizing anemia, nutrient balance, healthy behavior, and stunting prevention. Data were collected using a validated questionnaire assessing cognitive, attitude, and motivation toward stunting prevention. **Results:** Statistical analyses (paired t-tests, independent t-tests, ANOVA, post hoc) showed significant improvements in all domains ($p < 0.05$), cognitive increasing by 25.7%, attitude by 30.8%, and motivation by 17.1%. The games demonstrated strong cultural strong resonance, with representation of *Maasi* (97.36%), *Mahe* (92.10%), and *Manuntung* (97.36%) values. **Conclusion:** In conclusion, the culturally integrated Behavior-Centered Design educational medium effectively enhances adolescent engagement and behavioral readiness for stunting prevention, offering a promising culturally grounded model for public health promotion in South Kalimantan.



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INTRODUCTION

Stunting is a chronic nutritional problem that remains a major global health challenge, with approximately 149.2 million children worldwide experiencing stunting. Although Indonesia's stunting prevalence is projected to decline to 19.8% by 2024, the rate still exceeds the 20% threshold recommended by the World Health Organization (WHO). At the regional level, South Kalimantan Province ranks 14th nationally, with a stunting prevalence of 24.6%, exceeding the national average (Nasional, 2024).

Demographically, South Kalimantan is predominantly by the *Banjar* ethnic group, comprising 76.34% of the region's total population (Selvia & Sunarso, 2020), with over 1,547,081 children

(Akbar, 2023). Multiple factors contribute to persistence of stunting, including malnutrition during pregnancy, early cessation of breastfeeding, suboptimal parenting practices, limited antenatal care, and limited access to nutritious food, clean water, and sanitation. Social, economic, and cultural contexts further exacerbate these challenges (Gusriani, Noviyanti, Wahidah, Octamelia, & Ruqaiyah, 2023).

Stunting prevention should ideally begin during adolescence, a critical developmental phase marked by increased nutritional demands and the formation of long-term health behaviors (Moore Heslin & McNulty, 2023). Various educational media, such as booklets (Listyarini & Fatmawati, 2020), audiovisuals, and e-leaflets (Kurniasari, Wardani, Putri, & Jannah, 2023), have been widely implemented in health promotion. However, their impact has been inconsistent. Prior studies report limited engagement, low message retention, and minimal behavioral change, as most of these media rely on one-way information transfer without opportunities for interactive learning or contextual adaptation (Moin et al., 2024). Moreover, the absence of cultural alignment has reduced adolescents' emotional connection to the messages, resulting in low motivation to internalize preventive behaviors (Mendonça, Carvalho, Aljafari, Hosey, & Costa, 2024). Consequently, these conventional media have shown limited effectiveness in translating knowledge into sustained behavioral change.

This gap highlights the need for a more participatory, culturally grounded, and behavior-oriented educational approach. To address this, the present study adopts the Behavior-Centered Design (BCD) framework to develop an innovative educational medium that integrates *Banjar* cultural values as behavioural anchors, they are *Maasi* (obedience), *Maher* (positive habituation), and *Manuntung* (commitment to completion). These values are contextualized within a series of interactive learning games designed to strengthen adolescents' role as agents of change in promoting stunting prevention (Qomariah, Sugianto, & Sulistiyana, 2024). To date, no study has combined Behavior-Centered Design with local cultural wisdom and multimodal learning strategies for adolescent engagement in stunting prevention.

The medium also applies a Visual-Auditory-Kinesthetic (VAK) approach, stimulating multiple learning modalities through visual cues, sound, and physical interaction to foster deeper understanding and sustained engagement. The VAK approach has been proven effective in increasing participant interest, understanding, and engagement in the learning process (Maryanti, Hendriana, Suwanto, & Permulaan, 2023). Integrating BCD, VAK, and local cultural wisdom is expected to create a more engaging, meaningful, and culturally grounded learning experience for adolescents.

Accordingly, this study aims to develop and evaluate a BCD-based educational medium employing a VAK approach that embodies *Banjar* cultural values and to analyze its effectiveness in enhancing adolescent behavior related to stunting prevention. The findings are expected to contribute to stunting reduction efforts through culturally responsive health education that reinforces the local wisdom of the *Banjar* community.

METHODS

This research employed a developmental design using the Level-3 Research and Development (R&D) model, consisting of media modification, development, and new media effectiveness testing. The quantitative quasi-experimental design with a pretest-posttest control group was conducted offline in Tamban District, South Kalimantan.

Participants and Sampling

The study involved 76 adolescents aged 14–17 years from the Bina Husada Mandiri adolescent health group, equally divided into intervention and control groups ($n = 38$ each). A total population sampling technique was used, considering the relatively small and well-defined population in the research area, ensuring full coverage and minimizing sampling bias. This method also allowed for maximizing the representativeness of adolescent health behaviors within the community.

Workflow of Research

The overall workflow followed five stages, beginning with a preliminary study, followed by media design and development, expert validation, field implementation, and data analysis. A schematic representation of these stages is shown in the workflow diagram (Figure 1).

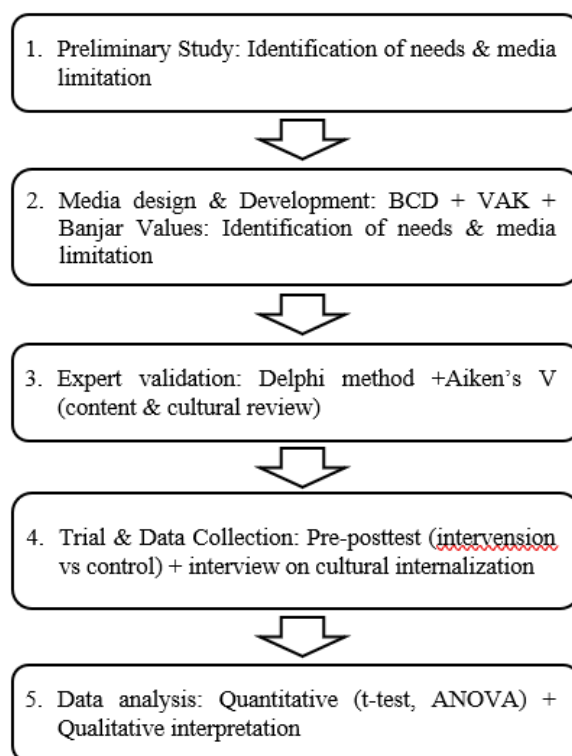


Figure 1. Workflow of the research

1. Preliminary study

A preliminary study was carried out to identify the needs and limitations of existing educational media for stunting prevention among adolescents. These findings formed the basis for developing the new BCD-based educational media.

2. Media Design and Development

The ABCD-stunting media was developed in the form of a culturally integrated educational game combining the Behavior Centered Design (BCD) approach, Visual-Auditory-Kinesthetic (VAK) learning strategy, and *Banjar* cultural values: *Maasi* (obedience), *Maher* (positive habituation), and *Manuntung* (commitment to completion), and *maher* (habit). The medium consisted of four sessions, each focusing on a key behavioral message about stunting prevention:

- 1) Comprehensive-Card Game: identifying stunting and anemia risk factors.
- 2) Factor-Card Game: matching balanced nutrition components.
- 3) Shame-Blocks Game: recognizing clean and healthy living behaviors.
- 4) True-False Cards Game: distinguishing myths and facts about stunting prevention.

Each game was designed with colorful visual cards, illustrated wooden blocks, and simple game boards to facilitate active participation and discussion. The *Banjar* values were integrated through storytelling, character names, and rule systems emphasizing *Maasi*, *Maher*, and *Manuntung*. All game materials were developed in a bilingual format (Indonesian–*Banjar* language) to increase cultural resonance.

3. Validation

Validation was conducted using the Delphi method, involving three experts in health promotion and three in language and cultural communication. The feasibility score (NP) was calculated using the following formula:

$$NP = \left(\frac{R}{SM} \right) \times 100$$

interpreted based on the eligibility categories (Hakim, 2021): $NP \leq 20\%$ = Not Eligible; $21\% < NP \leq 40\%$ = Less Eligible; $41\% < NP \leq 60\%$ = Quite Eligible; $81\% < NP \leq 100\%$ = Very Eligible.

4. Trial and Data Collection

Effectiveness testing was conducted in the intervention group using pre- and post-tests based on a validated 24-item questionnaire covering cognitive, attitudinal, and motivational aspects of stunting prevention. The control group received the same questionnaire without the intervention. Additionally, guided interviews were conducted with selected participants to assess their perception and internalization of *Banjar* cultural values embedded in the games.

5. Data Analysis and Interpretation

Data were analyzed quantitatively using normality tests, followed by paired-sample t-tests (within-group differences), independent-sample t-tests (between-group differences), and one-way ANOVA with post hoc analyses (comparisons between game sessions). Qualitative descriptive analysis was used to interpret interview data on cultural internalization. Statistical significance was determined at $p < 0.05$.

Instrument Development, Validity, and Reliability

The research instrument was a 24-item questionnaire assessing cognitive, attitudinal, and motivational domains related to stunting prevention. Content validity was examined by three experts in public health education and three in cultural communication using the Aiken's V index, with all items scoring ≥ 0.86 (indicating strong validity). Reliability testing using Cronbach's Alpha yielded coefficients of 0.860 (cognitive), 0.933 (attitude), and 0.881 (motivation), confirming internal consistency. These results indicate that the instrument demonstrates excellent validity and reliability, making it appropriate for measuring behavioral changes related to stunting prevention among adolescents.

Ethical Clearance

This study obtained ethical approval from the Health Research Ethics Committee, Universitas Sari Mulia, under certificate number 357/KEP-UNISM/V/2024.

RESULTS

Characteristics of Participants

To confirm baseline equivalence and minimize selection bias, the demographic characteristics of participants were examined prior to the intervention. Table 1 provides an overview of the participants' profiles, including gender, age, and educational level, for both the intervention and control groups.

Table 1. Characteristics of participants

Characteristic	n	%
Gender		
Female	60	78.9
Male	16	21.1
Age		
10-14 years	47	61.8
15-19 years	29	38.2
Education level		
Junior high school	45	59.2
Senior high school	31	40.8

Table 1 shows the demographic characteristics of the study participants. The majority were

female (78.9%), while males accounted for 21.1%. Most participants were aged 10–14 years (61.8%), and the remainder were 15–19 years old (38.2%). In terms of education, 59.2% were junior high school students and 40.8% were senior high school students. These characteristics indicate that the sample predominantly represented early to middle adolescence, aligning with the study's target population for preventive health education.

Pretest–Posttest Comparison of Cognitive, Attitudinal, and Motivational Scores

The ABCD-Stunting media is designed to convey stunting prevention messages through four game sessions integrated with the A Behavior Centered Design (ABCD) approach, the Emotional Demonstration (Emo-Demo) method, and the Visual-Auditory-Kinesthetic (VAK) learning style. Expert validation results indicate this media is highly suitable for use, with a feasibility score of 99.12% (media) and 100% (language). This high feasibility level reflects the suitability of the content, presentation, and language to the target audience's needs, in line with Hakim's findings that comprehensively validated educational media are more effective in improving participant understanding (Hakim, 2021).

Table 2 shows that there is a difference between the cognitive, attitude, and motivation of respondents before and after being given ABCD-Stunting media in the intervention group (p -value < 0.05) and there is no difference in the control group (p -value < 0.05).

Table 2. Paired sample t-test of cognitive, attitude, and motivation result

Variables	Mean	Increasing	SD	SE	95% CI	<i>p</i> -value
Cognitive						
Intervention	-12.895	25.7%	12.715	2.063	-17.074 – (-8.716)	<0.001
Control	0.263		19.241	3.121	-6.061 – 6.587	0.933
Attitude						
Intervention	-0.026	30.8%	5.175	0.840	-1.727 – 1.675	0.009
Control	-0.184		4.975	0.807	-1.819 – 1.451	0.821
Motivation						
Intervention	-4.105	17.1%	3.769	0.611	-5.344 – (-2.866)	<0.001
Control	1.474		6.075	0.985	-0.523 – 3.470	0.143

To compare the post-intervention differences between the intervention and control groups, an independent-sample t-test was conducted for cognitive, attitudinal, and motivational variables. The results are presented in Table 3.

Table 3. Independent sample t-test result

Variable	SD	95% CI	<i>p</i> -value
Cognitive	3.157	6.342 – 18.921	<0.001
Attitude	1.126	-2.033 – 2.454	0.028
Motivation	1.134	0.373 – 4.890	0.023

Based on the table 3, the p -value for cognitive is <0.001 , for attitude the p -value is 0.028, and for motivation the p -value is 0.023. Based on these results, it can be concluded that all p -values at each level are <0.05 , meaning there is a significant difference between the intervention and control groups.

Analysis by Game Type

To further examine the differences in effectiveness among the four game sessions of the ABCD media, a one-way ANOVA test was performed on cognitive, attitudinal, and motivational outcomes. The results are summarized in Table 4. One-way ANOVA followed by post hoc analysis revealed significant differences in the effectiveness of the four game types ($p < 0.05$). As shown in Table 4, the Comprehensive-Card Game and Shame-Blocks Game generated the highest cognitive and motivational gains, respectively, while all games contributed to overall behavioral enhancement.

Table 4. One-way ANOVA test result

Games 1, 2, 3, & 4	Mean	F	p-value
Cognitive	2.175	6.920	<0.001
Attitude	11.026	2.777	0.043
Motivation	5.798	22.997	<0.001

Based on Table 4, the p-value for the cognitive variable is <0.001 (<0.05). This value indicates a significant cognitive difference between the comprehensive card game (session 1), factor cards (session 2), shame blocks (session 3), and true-false cards (session 4). Similarly, the attitude variable (p-value = 0.043 <0.05) and the motivation variable (p-value = <0.001) are similar.

To identify which specific game sessions contributed to the significant differences found in the ANOVA test, a post hoc analysis was conducted using the Tukey HSD method. The detailed comparison results are presented in Table 5.

Table 5. Post Hoc test result

Comparison Game	Rating Game	SE	Sig.	95% CI
Cognitive				
Game 1	Game 2	0.129	<0.001	0.32 – 0.83
	Game 3	0.129	0.005	0.11 – 0.62
	Game 4	0.129	0.015	0.06 – 0.57
Game 2	Game 1	0.129	<0.001	-0.83 – (-0.32)
	Game 3	0.129	0.014	-0.46 – 0.04
	Game 4	0.129	0.043	-0.52 – (-0.01)
Game 3	Game 1	0.129	0.005	-0.62 – (-0.11)
	Game 2	0.129	0.014	-0.04 – (0.46)
	Game 4	0.129	0.038	-0.31 – 0.20
Game 4	Game 1	0.129	0.015	-0.57 – 0.06
	Game 2	0.129	0.043	0.01 – 0.52
	Game 3	0.129	0.038	-0.20 – 0.31
Attitude				
Game 1	Game 2	0.457	0.005	-1.14 – 0.67
	Game 3	0.457	0.006	-0.27 – 1.54
	Game 4	0.457	0.046	0.02 – 1.82
Game 2	Game 1	0.457	0.005	-0.67 – 1.14
	Game 3	0.457	0.049	-0.04 – 1.77
	Game 4	0.457	0.012	0.25 – 2.06
Game 3	Game 1	0.457	0.006	-1.54 – 0.27
	Game 2	0.457	0.049	-1.77 – 0.04
	Game 4	0.457	0.028	-0.61 – 1.19
Game 4	Game 1	0.457	0.046	-1.82 – (-0.02)
	Game 2	0.457	0.012	-2.06 – (-0.25)
	Game 3	0.457	0.028	-1.19 – 0.61
Motivation				
Game 1	Game 2	0.115	<0.001	-0.89 – (-0.43)
	Game 3	0.115	<0.001	-1.12 – (-0.67)
	Game 4	0.115	<0.001	-0.94 – (-0.48)
Game 2	Game 1	0.115	<0.001	0.43 – 0.89
	Game 3	0.115	0.042	-0.46 – (-0.01)
	Game 4	0.115	0.048	-0.28 – 0.18
Game 3	Game 1	0.115	<0.001	0.67 – 1.12
	Game 2	0.115	0.042	0.01 – 0.46
	Game 4	0.115	0.012	-0.04 – 0.41
Game 4	Game 1	0.115	<0.001	0.48 – 0.94
	Game 2	0.115	0.048	-0.18 – 0.28
	Game 3	0.115	0.012	-0.41 – 0.04

Based on the results of the Post Hoc test above, it was found that all games differed significantly in terms of cognitive, attitude, and motivation, where the p -value was <0.05 .

Cultural Value Integration

The cases and problems used in each ABCD-Stunting game are relevant to everyday life and are presented through internalization of *Banjar* cultural values. The results of interviews with respondents to assess the representation of the values of *maasi*, *maher*, and *manuntung* are presented in Figure 2.

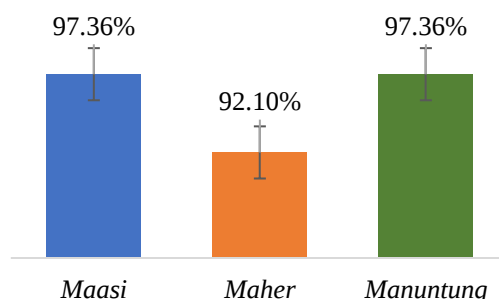


Figure 2. Results of the Representation of *Banjar* Cultural Values in ABCD-Stunting Media

Qualitative analysis from post-intervention interviews indicated strong internalization of *Banjar* cultural values. As shown in Figure 2, participants most strongly identified with *Maasi* (obedience, 97.36%), followed by *Manuntung* (commitment, 97.36%), and *Maher* (positive habituation, 92.10%). Participants expressed that these values enhanced their understanding and emotional connection to the learning material, fostering motivation for sustainable behavior change.

DISCUSSION

Media Validation and Suitability

The development of the ABCD-Stunting media refers to the Emotional Demonstration (Emo-Demo) method. Based on previous research, the success and effectiveness of Emo-Demo implementation have been demonstrated through evaluations in several regions, such as those conducted by Nuraini & Iswati (2021) in anemia counseling using the Emo-Demo method for pregnant women, which resulted in increased knowledge of the signs and symptoms of anemia.

Expert validation of the ABCD-Stunting media yielded feasibility scores of 99.12% (media) and 100% (language), indicating very high suitability. This level of appropriateness reflects the alignment between content, presentation, and language with adolescents' learning needs. The results are consistent with Hakim (2021), who emphasized that comprehensively validated educational media enhances participants' understanding and message retention.

Effectiveness of Media on Behavioral Change

A total of 76 adolescents participated in this study, evenly divided into intervention and control groups. Most respondents were 14 (61.8%) and had a junior high school education or equivalent (59.2%), as shown in Table 1. These characteristics emphasize the importance of interventions in adolescents, as stated by (Moore Heslin & McNulty, 2023), that nutritional deficiencies during adolescence impact the risk of stunting in the next generation.

The results of the paired sample t -test showed a significant increase in the intervention group for cognitive ($p = <0.001$), attitude ($p = 0.009$), and motivation ($p = <0.001$). In contrast, the control group showed no significant difference ($p > 0.05$) (Table 2). The independent sample t -test confirmed significant differences between the intervention and control groups in all variables (cognitive $p = <0.001$; attitude $p = 0.028$; motivation $p = 0.023$) (Table 3).

This effectiveness demonstrates the success of the Emo-Demo approach in building

participants' emotional engagement with educational content, as evidenced in the study by Nuraini & Iswati (2021), which showed an increase in knowledge of pregnant women through a similar method. In addition, the VAK approach has been proven to enrich the learning process by presenting multisensory experiences, supporting Sultan and Paurru's findings that this method increases participants' absorption and active involvement (Asrul Sultan & Putri Paurru, 2021).

Comparison of Effectiveness Between Game Sessions

One-way ANOVA analysis (Table 4) showed that each game session contributed differently to cognitive improvement ($p = <0.001$), attitude ($p = 0.043$), and motivation ($p = <0.001$) (Table 4). These values indicate significant cognitive differences between the comprehensive card game (game 1), factor card (game 2), shame block (game 3), and good-bad card (game 4). Post hoc comparison (Tabel 5) showed that all games differed significantly ($p < 0.05$). This is because each game had a specific topic of information presented, making them distinct yet integrated.

These results indicate that diversifying game formats impacts the effectiveness of educational message delivery. Contextually structured educational games are more effective in conveying health material, as reported by Lestari (2023), who found that a game-based approach with cognitive and kinesthetic stimulation improved participant comprehension better than conventional print media. This supports the ABCD-Stunting media design, which targets multiple learning pathways simultaneously.

Lack of knowledge contributes to stunting, and education is a preventative measure (Ainiyyah et al., 2026; Lindawati, Susanto, Wahyuni, & Khasanah, 2025). Stunting prevention should begin early through education, starting in adolescence (Hargreaves et al., 2022; Norris et al., 2022). Research by Anggreyenti, Kartini, & Martini (2022) concluded that an educational approach can improve adolescents' knowledge and attitudes toward nutrition.

The ABCD-Stunting media has been statistically proven effective in increasing behavioral changes regarding stunting prevention in adolescents, including cognitive, attitudinal, and motivational levels. It is more engaging, generates curiosity, and provides a hands-on and enjoyable learning experience through visual, auditory, and kinesthetic movements. Furthermore, the cases and problems used in each game are relevant to everyday life.

Using local culture, specifically *Banjar* cultural values, also facilitates understanding and retention of the message. This aligns with Subhan, Rosidawati, & Siti (2024)'s statement that the Emo Demo method is effective in improving knowledge and attitudes compared to other methods. Research by Sultan & Paurru (2021) also proves that the VAK method effectively changes positive behavior because it has many advantages, namely providing direct experience and creating a good and enjoyable learning atmosphere.

Representation of *Banjar* Cultural Values

As shown in Figure 2 that most respondents (97.36%) could represent the values of maasi and manuntung, and 92.10% understood the value of maher. These values were internalized through case simulations in the game that are relevant to everyday life.

Local culture-based approaches have been shown to strengthen the bond between participants and health messages (Cipta et al., 2024; Naderbagi et al., 2024), as conveyed by Lamawuran, Tokan, & Ratumakin (2023), who stated that local wisdom-based approaches help strengthen participants' memories and understanding due to resonance with their personal experiences. A cultural approach can enhance interaction, communication, and emotional growth, encompassing all members of society, regardless of age, experience, physical or cognitive background. Therefore, culture-based health education media has the potential to increase knowledge more progressively (Anisa, Hidayah, Rusilawati, & Yulianti, 2024; Noviana, Hasinuddin, Haris, & Ekawati, 2024)

The research findings confirm that ABCD-Stunting media is appropriate and effective as a culturally based educational tool for stunting prevention. Integrating emotional, multisensory, and culturally contextual approaches significantly increased adolescent understanding and

engagement. These findings add to the growing body of literature, which confirms that the effectiveness of health promotion can be enhanced through media that resonate with local values and participants' personal experiences (Qomariah et al., 2024; Subhan et al., 2024). Therefore, this media has the potential to be widely applied in adolescent health intervention programs at the community and school levels.

CONCLUSIONS

The ABCD-Stunting educational medium, developed through the integration of the Behavior-Centered Design (BCD) framework, the Visual-Auditory-Kinesthetic (VAK) learning approach, and *Banjar* cultural values, demonstrated significant effectiveness in enhancing adolescents' knowledge, attitudes, and motivation related to stunting prevention. The scientific novelty of this study lies in its culturally integrated, multisensory behavioral design that transforms abstract cultural wisdom into interactive learning experiences, bridging behavioral theory and local context in public health education.

This approach offers a replicable model for developing culturally responsive, behavior-oriented educational media across other regions and health topics. Future research should explore the long-term behavioral impacts of such interventions, assess scalability through digital adaptations, and compare cross-cultural applications to strengthen evidence for culturally grounded behavior change strategies.

Author's Contribution Statement: Nurul Hidayah conceived the study, designed the methodology, conducted data collection and analysis, interpreted the findings, and drafted the manuscript; Norliana Ekawati contributed to the study design, supervised the research process, validated the analytical approach, and critically reviewed the manuscript; Nur Ariska Ramadhana assisted with data collection, data interpretation, and manuscript revision; and Amelia Kartika supervised the overall project, provided academic guidance, contributed to the interpretation of results, and critically reviewed and approved the final manuscript. All authors read and approved the final manuscript and agree to be accountable for the content of this work.

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