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The Effect of Diabetes Self-Management Education Using Audiovisual Media on Self-Efficacy Among Patients with Type 2 Diabetes Mellitus: A Quasi-Experimental Study at an Indonesian Puskesmas

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ABSTRACT

Background: Self-efficacy is a critical determinant of dietary adherence and self-care among patients with type 2 diabetes mellitus (T2DM). In Indonesian primary care, the pandemic disrupted face-to-face Posbindu (Integrated Health Development Post) services, limiting opportunities for structured diabetes education and leaving many patients with suboptimal self-management capacity. **Purpose:** To examine the effect of Diabetes Self-Management Education (DSME) delivered through audiovisual media on self-efficacy among patients with T2DM at a community health centre (Puskesmas) in Bandung, Indonesia. **Methods:** A quasi-experimental pre-test-post-test with non-equivalent control group design design was used. Sixty-six patients with T2DM enrolled in the Prolanis programme at a Puskesmas in Bandung were recruited through total sampling and allocated equally to an intervention group (n=33) receiving DSME via a 20-minute audiovisual programme covering the four pillars of diabetes management, and a control group (n=33) receiving usual care. Self-efficacy was measured using the Diabetes Management Self-Efficacy Scale (DMSES). Within-group changes were analysed using the Wilcoxon signed-rank test, and change scores (post-test minus pre-test) were compared between groups using the Mann-Whitney U test, with effect sizes and 95% confidence intervals reported for all primary outcomes. **Results:** Mean self-efficacy in the intervention group rose from 61.79 (SD=15.68) to 76.64 (SD=7.98) post-intervention (mean change +14.85; p<0.001), with 66.7% reaching the high category. The control group showed no significant change (65.03 to 66.55; p=0.366). The proportion with low self-efficacy in the intervention group fell from 18.2% to 0%. The improvement was significantly greater in the intervention group than in the control group (Mann-Whitney U=761.5, p=0.005, r=0.34; Cohen's d=0.77, 95% CI 0.27 to 1.27). **Conclusions:** Audiovisual DSME was associated with a significant within-group increase in self-efficacy among patients with T2DM in an Indonesian primary-care setting, and the improvement was significantly larger than under usual care. Given the quasi-experimental, single-site, urban, and short-term design, the intervention should be considered potentially adaptable, rather than directly transferable, to rural and peri-urban community health settings, and it warrants formal evaluation in those settings before wider adoption.

KEYWORDS

Audiovisual media, Diabetes mellitus, Health education, Self-efficacy, Self-care

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1. BACKGROUND

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder that has become a major global public-health priority. The International Diabetes Federation (IDF) Diabetes Atlas (11th edition) estimated 589 million adults living with diabetes worldwide in 2024, projected to rise to 853 million by 2050, with more than 90% of cases attributable to T2DM (Genitsaridi et al., 2025). The corresponding global burden of premature mortality, complications, and health-system cost has prompted renewed calls for structured, equitable, and primary-care-deliverable diabetes interventions (Ceriello & Colagiuri, 2025). In Indonesia, the 2023 Indonesian Health Survey estimated diabetes prevalence at 11.7%, and the Provincial Health Office of West Java recorded 156,977 cases (1.7%) in the province in 2022, including 45,430 cases and 507 diabetes-related deaths in Bandung City alone (West Java Provincial Health Service, 2023). These figures underscore the urgency of strengthening community-based diabetes education, particularly in primary-care settings that serve both urban and rural populations.

Effective diabetes management depends on four pillars endorsed by the Indonesian Endocrinology Society (PERKENI, 2021): structured education, medical nutrition therapy, physical activity, and pharmacological therapy. Among these, education forms the foundation of all other behaviours because patient knowledge, skills, and confidence directly determine adherence to dietary, activity, and pharmacological regimens (Alharbi et al., 2023; Sayuti et al., 2024). Within this framework, Diabetes Self-Management Education and Support (DSMES) is a structured, evidence-based process that equips people living with diabetes with the abilities required to perform daily self-care, prevent complications, and improve quality of life (Powers et al., 2020; Wilmoth et al., 2024).

Self-efficacy, defined by Bandura's Social Cognitive Theory as the individual's belief in their capability to execute the behaviours required to attain a desired outcome, is a robust psychological mediator of diabetes self-care behaviours (Bandura, 1997; Tolasa & Akyol, 2024). Patients with low self-efficacy report higher diabetes distress and poorer glycaemic control (Jiang et al., 2023), while self-efficacy has been shown to mediate the relationship between self-management ability and patient activation in older adults with T2DM (Zhang et al., 2023). Low self-efficacy is also

associated with reduced engagement in recommended self-care activities, including dietary adherence, regular physical activity, blood glucose monitoring, and medication adherence. Conversely, structured interventions that strengthen self-efficacy translate into measurable improvements in self-care behaviour, treatment adherence, and HbA1c levels in adults with T2DM (Rondhianto et al., 2024; Yasa et al., 2025). These findings underscore the importance of incorporating self-efficacy enhancement strategies into community-based diabetes education programmes, particularly in resource-limited settings where patients have limited access to ongoing specialist support.

The mode of delivery is critical. Health education media, whether visual, audio, or audiovisual, differ in their capacity to engage learners. Dale's Cone of Experience is widely used as a heuristic suggesting that information presented through combined auditory and visual channels is better retained than information that is only read or heard (Masters, 2013). Audiovisual modality therefore activates dual coding, in which the brain processes verbal and visual information through complementary channels, supporting working memory and long-term retention (Chittal et al., 2024; Kaynak & Ergun, 2024). For older adults with T2DM, audiovisual delivery also addresses common barriers such as low literacy, visual fatigue, and limited time, and has shown gains in self-efficacy and self-management behaviours (Eroglu & Sabuncu, 2021; Tisna et al., 2025).

Despite this conceptual support, evidence on DSME using audiovisual media in Indonesian primary care remains fragmented. Recent Indonesian studies have explored DSME-related self-efficacy outcomes in hospital and community settings (Fithria et al., 2022; Hapsari, 2025; Tanamas et al., 2025) and tested digital or video formats for foot care, knowledge, and self-management (Feriadianto et al., 2025; Harahap et al., 2025; Tisna et al., 2025). However, four gaps persist. First, few studies have evaluated a structured, theory-anchored audiovisual DSME programme that covers all four PERKENI pillars within a single coherent module. This impression is substantiated rather than assumed: a recent PRISMA-compliant systematic review of DSME interventions published between 2020 and 2024 synthesised evidence on knowledge and self-care outcomes but did not specifically evaluate theory-anchored audiovisual delivery addressing all components of national guidelines within a

single module (Dewi et al., 2025), and recent Indonesian audiovisual studies have instead targeted single outcomes such as knowledge or foot care (Feriadianto et al., 2025; Harahap et al., 2025). Second, research conducted within Indonesian Puskesmas, the principal point of access to diabetes care for the majority of Indonesians, is scarce. Third, the COVID-19 pandemic disrupted face-to-face Posbindu (Integrated Health Development Post) services nationwide, creating an urgent need for delivery formats that can re-establish structured education in the post-pandemic period (Saltar et al., 2025). Fourth, prior Indonesian studies have rarely articulated a dual-theory mechanistic framework integrating Bandura's Social Cognitive Theory and Dale's Cone of Experience to explain why audiovisual DSME should improve self-efficacy (Tolasa & Akyol, 2024).

The relevance of accessible, structured diabetes education is even greater in rural and peri-urban Indonesia, which constitutes the core readership context of community nursing practice. Puskesmas in rural districts face persistent workforce shortages, limited diagnostic and educational infrastructure, and long patient travel distances, all of which constrain the delivery of structured chronic-disease education (Putri et al., 2020). Qualitative evidence from Indonesian health providers shows that the policy shift of diabetes care from hospitals to the primary level has outpaced the capacity of many facilities, particularly in rural districts, to provide structured education and systematic follow-up (Putri et al., 2020). Nurses in low- and middle-income countries similarly identify diabetes education as a core unmet patient need that must be met through feasible, people-centred models embedded in routine community services (Leyns et al., 2023). Comparable access barriers and resource constraints have been documented in rural Sri Lanka, where diabetes self-management was largely unsupported by structured education (Premadasa et al., 2024). Brief, low-cost, nurse-deliverable education formats are therefore needed that can function within these constraints rather than assuming urban levels of staffing and connectivity.

A preliminary survey conducted in April 2021 at a Puskesmas in Bandung confirmed these gaps: Posbindu meetings had been suspended due to COVID-19, and structured DSME had not yet resumed. Health workers reported that diabetes education was provided only opportunistically during patient consultations. This service gap represents both a clinical risk and an

opportunity to evaluate audiovisual DSME as a feasible, scalable solution for Indonesian community-based primary care, with potential applicability to rural and peri-urban settings where access to specialist diabetes services is limited (Premadasa et al., 2024).

This study aimed to examine the effect of DSME delivered through audiovisual media on the self-efficacy of patients with type 2 diabetes mellitus at a Puskesmas in Bandung, Indonesia. Specifically, the study compared self-efficacy before and after the intervention in an experimental group with that of a control group receiving usual care. We hypothesised that, compared with usual care, audiovisual DSME would produce a significant increase in patients' self-efficacy.

2. METHODS

Design

This research employed a quantitative, quasi-experimental pre-test-post-test with non-equivalent control group design.

Sample and Setting

The study was conducted at a Puskesmas (primary community health centre) in Bandung City, West Java, Indonesia, which is classified as an urban Puskesmas. The centre serves a catchment population of 23,631 residents across three kelurahan (Burangrang, Malabar, and Lengkong) and is staffed by four general practitioners and four nurses. At the time of reporting, 66 patients with diabetes mellitus were enrolled in the centre's Prolanis (chronic disease management programme) caseload. Puskesmas serve as the principal point of access to health care for the majority of Indonesians, including those in rural and peri-urban communities. Eligible participants were adults clinically diagnosed with type 2 diabetes mellitus and registered in the centre's Prolanis (chronic disease management programme). Inclusion criteria were: (i) age at least 18 years; (ii) confirmed T2DM diagnosis; (iii) able to read and communicate in Bahasa Indonesia; and (iv) willing to participate and provide informed consent. Exclusion criteria were: (i) severe visual or hearing impairment that would preclude engagement with audiovisual media; (ii) significant cognitive impairment; and (iii) acute medical decompensation requiring hospitalisation during the study period.

A total of 66 patients meeting the inclusion criteria were recruited via total sampling of the entire eligible population during the study window. To balance baseline characteristics, participants were listed in ascending order of their Prolanis

registration number and allocated alternately to the intervention group (n=33) and the control group (n=33). Consequently, all 66 eligible patients were allocated and analysed with no attrition. Because this alternation-based sequence was deterministic and fully predictable, allocation concealment was not possible, and the allocator could not be blinded to upcoming assignments; this is acknowledged as a limitation of the study.

Variable

The primary study variable was self-efficacy, defined as the patient's perceived confidence in performing diabetes self-management behaviours, including dietary management, blood glucose monitoring, physical activity, foot care, and medication adherence. The independent variable was the DSME intervention delivered through audiovisual media, and the dependent variable was the post-intervention self-efficacy score measured by the Diabetes Management Self-Efficacy Scale (DMSES).

Instruments

Self-efficacy was measured using the Diabetes Management Self-Efficacy Scale (DMSES), originally developed by van der Bijl, van Poelgeest-Eeltink, and Shortridge-Baggett (1999) and validated in Indonesian translation by Marlina et al. (2024). The version administered in the present study contains 20 items, each rated on a five-point Likert scale (1 = cannot do at all to 5 = certainly can do), assessing perceived ability to perform diabetes self-care behaviours including dietary management, blood glucose monitoring, exercise, foot care, and medication adherence. Total scores range from 20 to 100, with higher scores indicating greater self-efficacy. Total scores were classified as low (<46.8), moderate (46.8 to 73.2), or high (>73.2) based on the cut-off values established in the Indonesian validation study by Marlina et al. (2024). In line with the operational categorisation applied in the study instrument, total scores were classified as low (<46.8), moderate (46.8 to 73.2), or high (>73.2), expressed as proportions of the maximum possible score. In the present sample, the DMSES demonstrated excellent internal consistency at baseline (Cronbach's alpha = 0.93 for the total sample; 0.95 in the intervention group and 0.90 in the control group).

Intervention

The intervention group received a structured DSME programme delivered through a 20-minute audiovisual module. The module, developed by the research

team and reviewed by two diabetes nurse specialists and one endocrinologist for content validity, covered the four PERKENI pillars: (1) general diabetes education (definition, types, complications), (2) medical nutrition therapy with the 3-J principle (Jadwal/schedule, Jenis/type, Jumlah/amount), (3) recommended physical activity adapted to age and comorbidity, and (4) pharmacological therapy adherence. The audiovisual content was presented in Bahasa Indonesia, using culturally appropriate examples and simple language to maximise comprehension among patients with varying literacy levels. Cultural tailoring was deliberate and concrete: dietary guidance was illustrated with foods familiar to the Sundanese population of Bandung and West Java, including portion measurement for rice-based meals, lalapan (raw vegetable side dishes), and strategies to reduce locally common sweetened beverages such as sweet tea, while the physical activity segment drew on locally familiar routines such as brisk walking (jalan pagi), household activities, and gardening. The visual components included demonstrations of foot inspection, meal portion measurement, and proper medication timing. The programme was implemented over two weeks, with one supervised viewing session per participant, facilitated by a trained community nurse who had received orientation on the module and study procedures, and accompanied by a printed booklet for reference. The control group received usual care only, that is, standard consultations and any incidental advice given by Puskesmas staff during the same period.

Data Collection

Pre-test data were collected immediately before the audiovisual intervention; post-test data were collected two weeks later (i.e., 14 days after the single supervised viewing session for the intervention group, and 14 days after the pre-test for the control group). During the interval, participants in the intervention group could review the printed booklet, but no additional supervised viewing session was conducted. Data were collected by trained research assistants under the supervision of the principal investigator, with strict adherence to transmissible disease prevention protocols (mask, distancing, and hand hygiene).

Data Analysis

Data were analysed using IBM SPSS version 25. Descriptive statistics (frequencies, percentages, means, standard

deviations) summarised participant characteristics and self-efficacy scores. Normality was assessed with the Shapiro-Wilk test; the post-test distribution in the intervention group and the change-score distributions in both groups deviated from normality, supporting a non-parametric analytical strategy. The Wilcoxon signed-rank test was used for within-group comparisons of pre- and post-intervention self-efficacy, with the effect size r computed as r = z / sqrt(N), where N is the number of non-zero change pairs. To directly compare changes between groups, individual change scores (post-test minus pre-test) were computed and compared between the intervention and control groups. Given the non-normal distribution of the change scores, the Mann-Whitney U test served as the primary between-group test, with the independent-samples t-test on change scores and an analysis of covariance (ANCOVA) with the baseline self-efficacy score as covariate performed as sensitivity analyses. Effect sizes were reported for all primary analyses (r for the Mann-Whitney U test and the Wilcoxon signed-rank test; Cohen's d with 95% confidence intervals for the t-test; partial eta-squared for the ANCOVA), together with 95% confidence intervals for the between-group difference in change scores. Baseline comparability of self-efficacy scores between groups was examined with the Mann-Whitney U test. Statistical significance was set at $p < 0.05$ (two-tailed).

Ethical Consideration

Ethical approval was granted by Research Ethics Committee of Universitas 'Aisyiyah Bandung (approval number: 25/KEP.01/UNISA-BANDUNG/VI/2021, dated June 12, 2021) prior to the commencement of the study. All participants provided written informed consent before enrolment, were informed of their right to withdraw at any time without consequence, and were assured of data confidentiality and anonymity. The study adhered to the principles of the Declaration of Helsinki (as revised in 2024).

3. RESULTS

Participant Characteristics

Sixty-six patients with type 2 diabetes mellitus completed the study, with no attrition. Sociodemographic and clinical characteristics are presented in Table 1. The two groups showed similar distributions for sex and education level. The most frequent age band was 46–55 years (45.5% intervention; 33.3% control), women slightly outnumbered men in both groups, and most

participants had completed senior high school education. Baseline self-efficacy was formally tested and found to be comparable between groups (U = 484.5, p = 0.445).

Table 1. Sociodemographic and Clinical Characteristics of Participants (N = 66)

Characteristics	Intervention f (%)	Control f (%)
Age (years)		
26–35	3 (9.1)	6 (18.2)
36–45	6 (18.2)	8 (24.2)
46–55	15 (45.5)	11 (33.3)
56–65	9 (27.3)	6 (18.2)
>65	0 (0.0)	2 (6.1)
Sex		
Male	15 (45.5)	16 (48.5)
Female	18 (54.5)	17 (51.5)
Education		
Junior high school	3 (9.1)	3 (9.1)
Senior high school	20 (60.6)	22 (66.7)
Diploma/Bachelor/Postgraduate	10 (30.3)	8 (24.2)
Occupation		
Unemployed	6 (18.2)	2 (6.1)
Civil servant	4 (12.1)	7 (21.2)
Self-employed	7 (21.2)	8 (24.2)
Farmer	2 (6.1)	2 (6.1)
Retired	2 (6.1)	4 (12.1)
Other	12 (36.4)	10 (30.3)
Duration of T2DM		
< 5 years	20 (60.6)	22 (66.7)
≥5 years	13 (39.4)	11 (33.3)
Family history of DM		
Yes	18 (54.5)	15 (45.5)
No	15 (45.5)	18 (54.5)
Owns glucometer		
Yes	17 (51.5)	13 (39.4)
No	16 (48.5)	20 (60.6)

Note. f = frequency; values in % are within-group percentages.

Distribution of Self-Efficacy Categories

Table 2 shows the distribution of self-efficacy categories before and after the intervention. In the intervention group, the proportion of patients with low self-efficacy decreased from 18.2% at baseline to 0.0% post-intervention, while the proportion with high self-efficacy increased from 27.3% to 66.7%. In the control group, only modest shifts were observed: low self-efficacy decreased from 12.1% to 9.1%, moderate decreased from 63.6% to 57.6%, and high self-efficacy increased from 24.2% to 33.3%.

Table 2. Distribution of Self-Efficacy Categories Before and After the Intervention

Self-efficacy category	Intervention Pre-test f (%)	Intervention Post-test f (%)	Control Pre-test f (%)	Control Post-test f (%)
Low (<46.8)	6 (18.2)	0 (0.0)	4 (12.1)	3 (9.1)
Moderate (46.8-73.2)	18 (54.5)	11 (33.3)	21 (63.6)	19 (57.6)
High (>73.2)	9 (27.3)	22 (66.7)	8 (24.2)	11 (33.3)

Note. f = frequency; categories defined by the operational cut-offs applied to the DMSES total score: low (<46.8), moderate (46.8-73.2), high (>73.2)

Mean Self-Efficacy Scores

Mean DMSES scores in the intervention group rose from 61.79 (SD = 15.68) at pre-test to 76.64 (SD = 7.98) at post-test, while the control group changed only from 65.03 (SD = 13.75) to 66.55 (SD = 14.36) (Table 3). The reduction in standard deviation in the intervention group post-test (from 15.68 to 7.98) suggests a more homogeneous improvement across participants.

Table 3. Mean Self-Efficacy Scores by Group and Time-Point

Group / Time-point	Mean	n	SD
Intervention - Pre-test	61.79	33	15.68
Intervention - Post-test	76.64	33	7.98
Control - Pre-test	65.03	33	13.75
Control - Post-test	66.55	33	14.36

Note. SD = standard deviation; n = number of participants per group.

Within-Group Comparisons

Wilcoxon signed-rank tests demonstrated a statistically significant pre- to post-intervention increase in self-efficacy in the intervention group (mean change = +14.85, SD = 18.66; W = 37.0; z = -3.78; p < 0.001; r = 0.71) and no statistically significant change in the control group (mean change = +1.52, SD = 16.00; W = 89.5; z = -0.90; p = 0.366; r = 0.20) (Table 4).

Table 4. Within-Group Comparison of Self-Efficacy Before and After the Intervention (Wilcoxon Signed-Rank Test)

Comparison	Mean change (post minus pre)	SD	W	z	p	r
Intervention - Pre vs Post	+14.85	18.66	37.0	-3.78	< 0.001	0.71
Control - Pre vs Post	+1.52	16.00	89.5	-0.90	0.366	0.20

Note. Mean change is computed as post-test score minus pre-test score; positive values indicate improvement. W = the smaller Wilcoxon signed-rank sum; z and r are based on the number of non-zero change pairs (intervention n = 28; control n = 21); r = |z| / sqrt(N).

Between-Group Comparisons

Baseline self-efficacy scores did not differ significantly between the intervention and control groups (61.79 vs 65.03; U = 484.5, p = 0.445). The mean change score (post-test minus pre-test) was +14.85 (SD = 18.66) in the intervention group and +1.52 (SD = 16.00) in the control group. The Mann-

Whitney U test indicated that the improvement in self-efficacy was significantly greater in the intervention group than in the control group (U = 761.5, z = 2.78, p = 0.005, r = 0.34). This finding was confirmed by the independent-samples t-test on change scores (t = 3.12, df = 64, p = 0.003; mean difference = 13.33, 95% CI 4.79 to 21.88; Cohen's d = 0.77, 95% CI 0.27 to 1.27) and by ANCOVA controlling for baseline self-efficacy (F = 13.31, df = 1, 63, p < 0.001, partial eta-squared = 0.17). All three approaches converged on a significantly larger improvement in the intervention group, with a medium-to-large between-group effect size (Table 5).

Table 5. Between-Group Comparison of Self-Efficacy Change Scores (Post-Test Minus Pre-Test)

Analysis	Test statistic	p	Effect size (95% CI)
Mann-Whitney U (primary)	U = 761.5; z = 2.78	0.005	r = 0.34
Independent-samples t-test on change scores	t = 3.12; df = 64	0.003	d = 0.77 (95% CI 0.27 to 1.27)
ANCOVA (baseline-adjusted)	F = 13.31; df = 1, 63	< 0.001	partial eta-squared = 0.17

Note. Change scores computed as post-test minus pre-test for each participant; positive between-group differences favour the intervention group. Mean difference in change scores = 13.33 (95% CI 4.79 to 21.88). The Mann-Whitney U test was the primary analysis because the change scores were not normally distributed (Shapiro-Wilk p = 0.006 intervention; p = 0.002 control); the t-test and ANCOVA are sensitivity analyses.

4. DISCUSSION

This quasi-experimental study found that DSME delivered through audiovisual media was associated with a statistically and clinically meaningful increase in self-efficacy among patients with T2DM at an urban Indonesian Puskesmas, while patients receiving usual care showed no significant change, and the between-group comparison of change scores confirmed a significantly larger improvement in the intervention group (Table 5). The findings advance the evidence base on diabetes self-management in three ways: they document a robust effect in a real-world primary-care setting, they re-establish a structured education pathway after pandemic-related disruption of Posbindu services, and they articulate a dual-theory mechanistic explanation for why audiovisual delivery is well suited to this population.

Magnitude and Clinical Relevance of the Effect

The 14.85-point mean increase in DMSES scores in the intervention group, accompanied by a marked tightening of variance (SD 15.68 to 7.98), indicates not only an average improvement but also more uniform gains across participants. The between-group comparison of change scores showed that this improvement was significantly greater than in the control

group, with a medium-to-large effect size (Mann-Whitney U = 761.5, p = 0.005, r = 0.34; Cohen's d = 0.77, 95% CI 0.27 to 1.27; ANCOVA partial eta-squared = 0.17) (Table 5). The proportional shift from low (18.2% to 0%) to high (27.3% to 66.7%) self-efficacy is consistent with a categorical change that has been associated, in previous Indonesian and international studies, with measurable improvements in dietary adherence, physical-activity engagement, and glycaemic control (Tanamas et al., 2025; Wilmoth et al., 2024). The absence of meaningful change in the control group, where 66.7% remained in the low-to-moderate range at follow-up, underscores that exposure to routine Puskesmas care alone, particularly during the post-COVID-19 disruption period, is insufficient to build self-efficacy (Sayuti et al., 2024; Yasa et al., 2025).

Mechanisms: Dual-Coding and Bandura's Four Sources of Self-Efficacy

The observed effect can be explained by two complementary theoretical lenses. First, audiovisual modality engages dual-coding: verbal information is processed through the auditory channel, while accompanying visual demonstrations are processed through the visual channel, producing complementary memory traces that improve retention (Chittal et al., 2024; Kaynak & Ergun, 2024). Dale's Cone of Experience predicts that audiovisual content can yield up to 50% retention compared with 10-30% for reading or hearing alone (Masters, 2013), a pattern recently corroborated in studies of video-based health education (Eroglu & Sabuncu, 2021; Tisna et al., 2025).

Second, the intervention was designed to activate all four sources of self-efficacy described by Bandura (1997): (i) mastery experiences, by demonstrating step-by-step self-care actions (e.g., calculating the 3-J meal plan, performing foot inspection) that participants could replicate; (ii) vicarious learning, by showing peer-similar patients successfully managing diabetes; (iii) verbal persuasion, through encouraging narration delivered by a trusted nurse-educator voice; and (iv) physiological feedback, by reframing common somatic experiences such as transient fatigue or thirst as actionable signals rather than threats. The theoretical framework suggests that the convergence of these four mechanisms within a single 20-minute module, a configuration recently applied in social-cognitive-theory-based foot-care education (Tolasa & Akyol, 2024) and primary-care DSME programmes (Yunis et al., 2024), is a

plausible explanation for the magnitude of the effect. Because the study did not include a process evaluation, mediator analysis, or qualitative participant feedback, the activation of these four sources remains a theoretically grounded interpretation rather than an empirically demonstrated mechanism.

Comparison with Previous Studies

Our findings align with Tisna et al. (2025), who reported significant gains in self-care and self-efficacy after online DSME educational videos in a Tasikmalaya Puskesmas, and with Harahap et al. (2025) and Feriadianto et al. (2025), who documented increases in diabetes knowledge and foot-care self-efficacy after video-based and digital DSME interventions in Indonesia. Eroglu and Sabuncu (2021) and Chittal et al. (2024) demonstrated comparable benefits in randomised controlled trials of education interventions for self-efficacy outcomes. At the international level, Wilmoth et al. (2024) reported significant within-group increases in self-efficacy and self-care among Hispanic adults in a cluster RCT, while the ADA/ADCES consensus (Powers et al., 2020) and the IDF clinical recommendations (Ceriello & Colagiuri, 2025) emphasise structured, theory-informed delivery as a global quality benchmark.

Our study extends this evidence base by providing preliminary evidence of effectiveness in an Indonesian Puskesmas context using total sampling, which captures the heterogeneous real-world population, including older adults, those with limited formal education, and those without personal glucometers, that characterises Indonesian primary care (Premadasa et al., 2024; Rondhianto et al., 2024). This heterogeneity is particularly relevant for community nursing practice in rural and peri-urban areas, where patient populations frequently present with multiple comorbidities, limited health literacy, and constrained access to specialist services. Crucially, the audiovisual module covers all four PERKENI pillars within one session, simplifying delivery during the resumption of Posbindu activities post-COVID-19 and complementing recent Indonesian patient-centred self-management models (Yasa et al., 2025). The brevity of the 20-minute format also makes it suitable for integration into routine Puskesmas consultations and community outreach activities, where time constraints often preclude longer educational sessions.

Implications for Community Nursing Practice and Policy

Three implications follow. First, community and primary-care nurses can adopt the 20-minute audiovisual DSME module as a structured education tool that fits within busy Puskesmas workflows and Posbindu monthly meetings (Tisna et al., 2025). This is particularly relevant for rural and remote community health settings where specialist diabetes services are limited and nurse-led education can bridge access gaps (Premadasa et al., 2024). In rural areas, where patients may travel considerable distances to reach a health centre, a brief, standardised audiovisual module maximises the educational value of each visit and reduces dependence on the availability of specialist educators. Second, the module supports nurse-led task-shifting in diabetes care, particularly important where physician availability is limited (Yunis et al., 2024). Community nurses are well positioned to deliver audiovisual DSME because they already serve as the primary point of contact for Prolanis participants and maintain ongoing relationships with patients and their families. Third, at the policy level, piloting the integration of audiovisual DSME into the national Prolanis package, with wider scale-up contingent on multi-site evaluation, would operationalise PERKENI's education pillar in a standardised and equitable way, and would help local governments meet diabetes control targets included in the National Strategic Plan and West Java Provincial Health priorities (West Java Provincial Health Service, 2023). Because the present evidence comes from a single urban site with two-week follow-up, we recommend that such piloting explicitly include rural Puskesmas, including areas with limited internet connectivity where offline delivery through facility-based equipment (e.g., television or projector units) may be required. Piloting in these settings would also help address disparities in diabetes education access between urban and rural communities, ensuring that evidence-based structured education reaches populations who have historically been underserved.

The study has four notable strengths. (i) Pragmatic primary-care setting and total sampling enhance external validity within comparable urban primary-care populations. (ii) Use of the validated DMSES instrument enables benchmarking against international literature. (iii) The intervention is theoretically anchored in a dual framework, Bandura's Social Cognitive Theory plus Dale's Cone of Experience, that is rarely

articulated in prior Indonesian DSME audiovisual studies. (iv) The study addresses a service-delivery gap created by COVID-19 disruption of Posbindu, providing actionable evidence for post-pandemic diabetes care reconfiguration in community settings.

Limitations

Several limitations must be acknowledged. First, the quasi-experimental design without true randomisation may leave residual confounding by unmeasured variables such as health literacy or family support; in addition, the alternation-based allocation sequence was deterministic and could not be concealed, which may have introduced selection bias. Second, the study was conducted at a single urban Puskesmas in Bandung; therefore, direct transferability to rural or remote community health settings with different resource constraints remains unconfirmed. Third, outcomes were limited to self-reported self-efficacy; we did not measure downstream behavioural or biomedical outcomes (e.g., HbA1c, fasting glucose, or self-care behaviour). Fourth, the post-test was performed only two weeks after the intervention, so the durability of the effect is unknown. Fifth, the intervention fidelity relied on a single supervised viewing; we did not assess viewing time, attention, or comprehension at the individual level, and the module underwent expert content review but was not separately pilot-tested with patients before the study. Sixth, no a priori sample size calculation was performed; the sample comprised all eligible Prolanis participants during the study window, and for the observed between-group effect (d = 0.77) the achieved sample of 66 provided approximately 87% power. Seventh, the study did not include long-term follow-up to assess whether the observed gains in self-efficacy translate into sustained behavioural change or improved glycaemic control. Future research should adopt a cluster-randomised controlled trial across multiple Puskesmas, including rural sites, include 3- and 6-month follow-up, measure HbA1c and self-care behaviour, and triangulate with qualitative data on patient experience. Studies conducted in rural and remote Puskesmas settings, including areas with limited internet connectivity, are particularly needed to confirm the transferability of audiovisual DSME to populations with the greatest access barriers.

5. CONCLUSIONS

Diabetes self-management education delivered through audiovisual media was

associated with a significant within-group increase in the self-efficacy of patients with type 2 diabetes mellitus at an urban Puskesmas in Bandung, with 66.7% reaching the high-efficacy category, and the improvement was significantly greater than in the control group receiving usual care. The intervention is brief (20 minutes), low-cost, and aligned with national guidance, making it a promising option for community and primary-care nurses re-establishing structured diabetes education after COVID-19-related disruption of Posbindu services. Given the quasi-experimental, single-site, urban design and the two-week follow-up, the approach should be regarded as potentially adaptable, rather than directly transferable, to rural and peri-urban community health settings, where it warrants formal evaluation, including in areas with limited internet connectivity. We recommend piloting the integration of audiovisual DSME into the Prolanis programme, accompanied by multi-site cluster-randomised evaluation with longer follow-up and biomedical endpoints, before national scale-up.

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AUTHOR CONTRIBUTIONS

All authors contributed to the conception and design of the study. NJN collected the data and drafted the manuscript and revised the manuscript. ZL and PY performed the statistical analysis and revised the manuscript. DD and FS contributed to the methodology and revised the manuscript. All authors read and approved the final version.

CONFLICT OF INTEREST

The authors declare no actual or potential competing interests that could have appeared to influence this work.

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DATA AVAILABILITY

De-identified data supporting the findings of this study are available from the corresponding author upon reasonable request.

DECLARATION OF USE OF AI

During the preparation of this work, the authors used Grammarly to assist with language and grammar editing. The authors reviewed and edited the content as needed and take full responsibility for the manuscript

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