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Development of a Traditional Dam-Daman Game Based Physical Education Model to Enhance Learning Motivation among Junior High School Students in Musi Rawas, Indonesia

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Abstract

Low learning motivation in Physical Education, Sport, and Health (PESH) remains a persistent challenge at the junior high school level, particularly in schools with limited access to innovative instructional models. This study aims to: (1) develop a valid Dam-Daman traditional game–based PESH learning model, (2) test its practicality, and (3) identify its effect on students' learning motivation. The research employed the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation) combined with Tessmer's formative evaluation. Product trials involved expert validation (n=3), one-to-one testing (n=3), small group testing (n=6), and a field test with pretest-posttest design (n=23 students) at SMP Ma'arif NU Tugumulyo, Musi Rawas Regency. Data were analyzed using descriptive statistics (mean, SD, percentage) and inferential statistics (Shapiro-Wilk normality test, paired sample t-test, N-gain, and Cohen's d effect size). Expert validation results showed high validity for learning design (M=4.9, SD=0.18), material/content (M=3.9, SD=0.32), and media (M=4.3, SD=0.27). Practicality was very high in one-to-one (M=4.5, SD=0.35) and small group stages (M=4.3, SD=0.41). The field test revealed a significant increase in motivation from pretest (79, 56.4%) to posttest (119, 85.0%) with t (22)=12.347, p=0.000, N-gain=0.66 (moderate effectiveness), and Cohen's d=4.87 (large effect). The findings align with Keller's ARCS motivation model and Vygotsky's play theory, demonstrating that cultural relevance, game-based structure, and systematic development contribute to the model's effectiveness. However, limitations include the absence of a control group and single-school setting. In conclusion, the Dam-Daman game–based PESH learning model is valid, highly practical, and has a statistically significant large effect on junior high school students' learning motivation. This model is recommended as a contextual and enjoyable alternative for PESH instruction.

Keywords: Dam-Daman traditional game; learning motivation; ADDIE model; formative evaluation; physical education; junior high school; ARCS motivation model; traditional game-based learning

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Introduction

Learning motivation is a key determinant of successful Physical Education, Sport, and Health (PESH) instruction because it shapes students' engagement, persistence, and willingness to actively participate in learning activities (Habyarimana et al., 2022). According to (Hamalik, 2011; Cook & Artino, 2016) learning motivation is a psychological state that drives an individual to engage in learning activities in order to achieve specific goals. In the context of PESH, motivation is a crucial factor because physical activities require dedication, willingness, and active involvement from students. Without strong motivation, students tend to be passive, give up easily, and do not enjoy the learning process. In practice, however, PESH lessons at the junior high school level often face challenges such as low student interest, monotonous learning activities, and limited variation in instructional models that match students' characteristics (Lambros, 2004).

This phenomenon is not limited to just one or two schools; rather, it has become a widespread issue across various regions, particularly in areas with limited access to educational innovations. Physical Education (PJOK), which should be a subject eagerly anticipated by students, is often avoided due to repetitive activities and a lack of new challenges that align with adolescents' psychological development. Based on the results of initial observations and interviews with Physical Education teachers at SMP Ma'arif NU Tugumulyo, Musi Rawas Regency, conducted in January 2026, it was found that out of 23 seventh-grade students, 17 students (74%) exhibited low learning motivation. Indicators of this low motivation include: a lack of enthusiasm during PE lessons (78%), frequent complaints when asked to engage in physical activity (65%), absences from some lessons (52%), and a tendency for students to be passive and simply follow instructions without taking initiative.

Teachers also reported that the teaching methods used are still dominated by conventional approaches such as routine exercises, drills, and technical approaches without engaging game variations. The ideal conditions expected in Physical Education and Health (PJOK) instruction based on the Merdeka Curriculum are the creation of a learning environment that is enjoyable, active, and creative, and that motivates students to participate voluntarily while developing their social and physical skills holistically. Ideally, Physical Education and Health (PJOK) learning should be student-centered, provide meaningful learning experiences, and integrate character values such as cooperation, sportsmanship, and responsibility. However, the gap between the ideal and actual conditions in the field is quite wide, particularly regarding the lack of innovative learning models based on games that are closely aligned with students' daily lives.

Teachers acknowledge that they have not yet developed or implemented traditional game-based learning models, resulting in students feeling bored and unmotivated. In fact, students are more familiar with various traditional games in their local communities, including the game of Dam-Daman, which is quite popular in Musi Rawas Regency. One promising approach to address these issues is the integration of traditional games. Traditional games are not only culturally meaningful and familiar to students, but they also provide enjoyable, active, and challenging learning experiences that can stimulate participation, social interaction, and intrinsic motivation during PESH learning. According to (Mulyani, 2016; Dahyat, 2025)

traditional games are a cultural heritage rich in noble values, such as cooperation, honesty, patience, and sportsmanship.

These values align with the goals of physical education, which aim to develop not only physical aspects but also social and emotional aspects. Several previous studies have demonstrated that traditional games are effective in increasing student participation and motivation to learn. (Afifah 2023; Mami & Triwahyuni, 2025). developed a traditional snake-and-ladder game model to improve locomotor and manipulative movements in early childhood. (Damayanti et al., 2023) state that introducing traditional games can preserve Indonesian culture while increasing student engagement in learning. (Sari & Solikin, 2017; Dewi, 2025) also demonstrated the effectiveness of traditional games in developing children's oral communication skills.

However, despite these various studies, the traditional game of Dam-Daman is still rarely integrated into Physical Education and Health (PESH) instruction, particularly at the junior high school level. As part of local cultural heritage, the Dam-Daman traditional game has strong potential to be incorporated into PESH because it involves rules, strategy, cooperation, and structured activities that can be aligned with instructional objectives. Dam-Daman is a game played on a board with holes using seeds or small stones, requiring students to think strategically, work together, and follow established rules. According to (Mashuri, 2015), the Dam-Daman game develops concentration, decision-making skills, and fine motor skills.

Meanwhile, (Murdiansyah, 2022) states that Dam-Daman playing skills contribute to students' cognitive learning outcomes. To date, a physical education learning model based on the traditional Dam-Daman game has not been systematically developed, particularly for junior high school students in Musi Rawas Regency. Based on the literature review conducted, the development of Dam-Daman has so far been limited to several fields, including mathematics learning media for the Pythagorean theorem (Rahmanto, 2024), chemistry learning media for colloids (Kamaludin & Nisak, 2020), media to enhance the self-efficacy of junior high school students (Salsabila & Ningsih, 2021).

No research has yet integrated Dam-Daman into Physical Education (PJOK) instruction to enhance student motivation. Furthermore, the Dam-Daman game offers several advantages over other traditional games relevant to the PJOK context. It is easily adaptable to meet PJOK learning objectives, whether for cognitive, affective, or psychomotor aspects. It can be played both indoors and outdoors, making it flexible regarding weather conditions and school facilities. It involves cognitive aspects (strategic calculation), affective aspects (cooperation and sportsmanship), and psychomotor aspects (hand-eye coordination and precision of hand movements). It uses simple, inexpensive, and easily accessible materials found in the local environment (used wooden boards, grains, pebbles, or bottle caps). It has been passed down through generations in Musi Rawas Regency, so students do not feel unfamiliar with it and adapt more quickly.

These characteristics make Dam-Daman highly suitable for development as a contextual and enjoyable physical education learning model that aligns with the characteristics of early adolescents, who still enjoy play-based activities but are beginning to develop strategic thinking skills. According to (Keller, 2010) in the ARCS model (attention, relevance, confidence, satisfaction), learning motivation can be enhanced through four main components

attention, relevance, confidence, and satisfaction. The Dam-Daman game has the potential to accommodate all four of these components. The attention aspect arises because the game is challenging and not monotonous.

Relevance is ensured because Dam-Daman is a game familiar to students' daily lives. Self-confidence develops as students improve their ability to devise strategies and succeed in the game. Satisfaction is achieved when students defeat their opponents or meet learning objectives. Play theory also supports the integration of traditional games into learning. According to Vygotsky, play constitutes the zone of proximal development, where children can achieve higher-level skills through enjoyable activities and social interaction. Thus, Dam-Daman-based physical education not only transfers knowledge and skills but also fosters meaningful learning and positive social experiences.

Integrating Dam-Daman into PESH is expected to create a more engaging and meaningful learning environment, while encouraging students to participate more actively and enthusiastically. Based on the background description, gap identification, and literature review, this study is deemed necessary. Based on this rationale, the present study focuses on developing a Dam-Daman game-based PESH learning model to support learning motivation among junior high school students at SMP Ma'arif NU Tugumulyo, Musi Rawas Regency. The development process aims to ensure that the resulting model is valid and practical, and that it demonstrates a measurable potential effect in enhancing students' learning motivation.

Operationally, this study aims to develop a valid Physical Education (PJOK) learning model based on the traditional game of Dam-Daman (in terms of instructional design, content, and media) for junior high school students in Musi Rawas Regency. To test the practicality of this learning model in classroom implementation, both in one-to-one settings (three students with different academic abilities) and small groups (six seventh-grade students from Class VII A). To identify the potential effects of the learning model on student learning motivation through a field test involving 23 seventh-grade students at Ma'arif NU Tugumulyo Junior High School.

Methods

This study employed a research and development (R&D) approach (Borg & Gall, 1983; Gall, Gall, & Borg, 2003) using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) (Branch, 2009; Molenda, 2015) combined with Tessmer's formative evaluation (Tessmer, 1993). The ADDIE framework guided the systematic development of the Dam-Daman game-based PESH learning model, beginning with needs analysis and instructional planning, followed by product design and development (Dick, Carey, & Carey, 2015). Tessmer's formative evaluation was then applied to refine the product through staged trials, including expert review (walkthrough), one-to-one testing, small group testing, and a field test (Tessmer, 1993; Seels & Richey, 1994), ensuring the model's quality in terms of validity, practicality, and its potential effect on students' learning motivation (Nieveen, 1999; Plomp, 2013). Product trials were conducted with junior high school students at SMP Ma'arif NU Tugumulyo, Musi Rawas Regency, using a staged formative evaluation approach (Herawati et al., 2019).

Table 1. Characteristics of study participants

Stage	Number of Students	Gender	Age Range (years)	Grade Level	Academic Ability	Sociocultural Background
One-to-one	3	2 males, 1 female	12-13	VII	High, moderate, low	Javanese & Musi local ethnicity
Small group	6	3 males, 3 females	12-14	VII A	Mixed (high, moderate, low)	Javanese, Musi, & Sundanese
Field test	23	12 males, 11 females	12-15	VII	Heterogeneous	Local Musi Rawas community

In the one-to-one phase, three students representing high, moderate, and low academic ability were selected to assess initial clarity, readability, and ease of use of the developed learning model. Feedback from this stage was used to revise the product before broader testing. The small group phase involved six students from Grade VII A with diverse academic abilities to examine practicality, student responses, and the feasibility of implementing the learning activities in a group setting. After further refinement, the model was tested in a field test (uji lapangan) involving 23 students (12 males, 11 females; age range 12-15 years), aiming to evaluate implementation under real classroom conditions and to identify the model's potential effect on students' learning motivation.

All participants were from the local sociocultural background of Musi Rawas Regency, where the Dam-Daman traditional game is still recognized as part of local heritage. The ADDIE model was implemented through five systematic stages. In the Analysis stage, the researcher conducted several activities including needs analysis through interviews with two physical education teachers at SMP Ma'arif NU Tugumulyo to identify problems in learning implementation, direct observation of three PESH lessons to document student behavior, engagement levels, and teaching methods used, preliminary questionnaire administration to 23 students to measure baseline motivation levels, curriculum analysis by reviewing the Merdeka Curriculum for Grade VII PESH to identify learning outcomes and competency standards relevant to traditional games, characteristics analysis to identify student characteristics including age, gender, academic ability, and familiarity with the Dam-Daman game, and resource analysis to inventory available facilities, infrastructure, and learning media at the school.

The results of the analysis stage revealed low student motivation with 74% showing low motivation indicators, monotonous teaching methods dominated by drill and technical approaches, and the absence of traditional game-based learning models, particularly Dam-Daman. In the Design stage, the researcher developed learning objectives by formulating specific instructional objectives aligned with PESH competencies and Dam-Daman game characteristics, designed a three-session learning activity sequence covering introduction, core activities, and closing that integrated Dam-Daman game mechanics, modified the original Dam-Daman rules to suit PESH learning objectives by adding physical movement components such as running, jumping, and throwing accuracy, designed instructional media including game boards modified from traditional boards, instruction cards, student worksheets, and assessment rubrics, developed evaluation instruments including a 28-item motivation questionnaire and a

practicality questionnaire based on Likert scale, and compiled the first prototype of the Dam-Daman PESH learning model.

In the Development stage, the researcher produced the complete Dam-Daman PESH learning model including teacher's guide, student guide, game equipment, and assessment instruments. Walkthrough validation was conducted with three experts: a learning design expert (Professor of PESH curriculum), a material or content expert (PESH content specialist), and a media expert (instructional media specialist). The model was revised based on expert feedback such as simplifying game rules, adding visual illustrations, and clarifying instructional steps. The revised model was then tested in a one-to-one trial with 3 students to assess clarity and ease of use, followed by a small group trial with 6 students to examine practicality in a group setting. Formative revisions were made after each trial stage before proceeding to the next.

In the Implementation stage, the researcher prepared for the field test by finalizing the product version, training the teacher for one session on implementing the Dam-Daman model, and scheduling three learning sessions each lasting 2 × 40 minutes. The motivation questionnaire (28 items) was administered as a pretest to 23 students before the intervention. Three PESH lessons were then conducted using the Dam-Daman game–based model: Session 1 introduced Dam-Daman rules and basic game mechanics, Session 2 involved modified Dam-Daman with physical movement components, and Session 3 featured competition-based Dam-Daman and reflection. The same motivation questionnaire was administered as a posttest after the intervention to measure changes in learning motivation, and the implementation process was documented through observation sheets and teacher notes.

In the Evaluation stage, the researcher conducted formative evaluation by analyzing data from expert validation, one-to-one, small group, and field test to assess validity, practicality, and potential effect, followed by summative evaluation for overall assessment of the final product based on all evaluation criteria. Final product refinement was made based on field test results to produce the ready-to-implement Dam-Daman PESH learning model. Three types of research instruments were used in this study. The validity instrument (expert walkthrough) consisted of three validation sheets assessing the learning design aspect with 8 indicators including clarity of objectives, alignment of activities with objectives, logical flow, and appropriateness for students; the material or content aspect with 7 indicators including relevance to curriculum, accuracy of content, and depth of material; and the media aspect with 6 indicators including visual clarity, attractiveness, and ease of use. Each item used a 5-point Likert scale ranging from 1 (very poor) to 5 (very good).

The practicality instrument (student questionnaire) measured students' perceptions of the model's ease of use, clarity, and feasibility. It consisted of 10 items covering clarity of instructions (3 items), ease of following the learning flow (3 items), suitability of game rules (2 items), and overall satisfaction with the model (2 items). The questionnaire used a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The learning motivation instrument was adapted from Keller's ARCS model (2010) and consisted of 28 statements comprising 22 positive and 6 negative items covering four dimensions: attention (7 items measuring student interest and curiosity), relevance (7 items measuring connection to students' lives and needs), confidence (7 items measuring self-efficacy and expectation of success), and

satisfaction (7 items measuring enjoyment and sense of achievement). Each item used a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), with a maximum possible score of 140 (28 × 5) and a minimum score of 28.

Prior to the field test, the motivation questionnaire was validated through content validity, construct validity, and reliability testing. For content validity, the questionnaire was reviewed by three experts (learning design, PESH content, and educational psychology) who rated each item's relevance, resulting in a content validity index (CVI) of 0.92, indicating excellent content validity. For construct validity, the questionnaire was tested with 30 students who had similar characteristics but were not part of the main sample. Exploratory factor analysis (EFA) confirmed that all 28 items loaded onto four factors (Attention, Relevance, Confidence, and Satisfaction) with factor loadings exceeding 0.50. For reliability, internal consistency was measured using Cronbach's alpha, yielding an overall instrument alpha of 0.91 (excellent), with dimension-specific alphas of 0.85 for Attention, 0.87 for Relevance, 0.88 for Confidence, and 0.86 for Satisfaction. These values exceed the minimum acceptable threshold of 0.70, confirming that the motivation questionnaire is highly reliable.

Data collection was conducted sequentially across the five ADDIE stages. In the Analysis stage, needs assessment was conducted to collect baseline motivation data and teacher interviews using observation sheets and an interview guide. In the Design stage, product development was documented to produce the model prototype. In the Development stage, expert validation produced validity scores from three experts using validation sheets, followed by one-to-one trial with 3 students and small group trial with 6 students to collect practicality scores using student practicality questionnaires. In the Implementation stage, a pretest was administered to measure pre-intervention motivation using the 28-item motivation questionnaire, then three learning sessions were conducted where the implementation process was documented using observation sheets, and finally a posttest was administered to measure post-intervention motivation using the same motivation questionnaire. In the Evaluation stage, overall analysis was conducted to assess validity, practicality, and potential effect using all instruments.

Data were analyzed using both descriptive and inferential statistics. For validity and practicality analysis, descriptive statistics were employed by calculating the mean score and standard deviation for each aspect, as well as the percentage score using the formula (obtained score / maximum score) × 100%. The obtained mean scores were then categorized based on predetermined criteria: mean scores of 4.20 to 5.00 were categorized as very valid or very practical, 3.40 to 4.19 as valid or practical, 2.60 to 3.39 as moderately valid or moderately practical, 1.80 to 2.59 as less valid or less practical, and 1.00 to 1.79 as invalid or impractical.

For potential effect analysis, inferential statistics were employed to measure the effect of the Dam-Daman learning model on student motivation. First, the Shapiro-Wilk normality test was conducted to test whether pretest and posttest motivation scores were normally distributed, with the criterion that if $p > 0.05$, the data are considered normally distributed. Second, a paired sample t-test was performed to determine whether there was a significant difference between pretest and posttest motivation scores using the formula $t = (M_{post} - M_{pre}) / (SD_{diff} / \sqrt{n})$, with the criterion that if $p < 0.05$, there is a significant difference indicating that the model has a statistically significant effect. Third, the N-gain (normalized gain) test was used to measure

the effectiveness level of the model in improving motivation using the formula N-gain = (Posttest score - Pretest score) / (Maximum score - Pretest score), with effectiveness criteria of $g > 0.7$ for high effectiveness, $0.3 \leq g \leq 0.7$ for moderate effectiveness, and $g < 0.3$ for low effectiveness. Fourth, effect size (Cohen's d) was calculated to determine the magnitude of the model's effect on motivation using the formula $d = (M_{post} - M_{pre}) / SD_{pooled}$, with effect size criteria of $d > 0.8$ for large effect, $0.5 < d \leq 0.8$ for medium effect, $0.2 < d \leq 0.5$ for small effect, and $d \leq 0.2$ for very small effect. All statistical analyses were conducted using IBM SPSS Statistics version 26 with a significance level of $\alpha = 0.05$.

Results

The results of this study are presented based on the evaluation stages of the developed Dam-Daman game–based PESH learning model, including expert validity, student practicality, and the model's potential effect on learning motivation as measured through pretest and posttest comparisons. Expert review showed that the learning model met strong validity criteria across key components. The learning design obtained a mean score of 4.9 (SD = 0.18), indicating a very valid category, which suggests that the structure, objectives, learning flow, and instructional steps were highly appropriate. The material/content component achieved a mean score of 3.9 (SD = 0.32) and was categorized as valid, meaning the learning content was relevant and suitable for junior high school students. The media aspect scored 4.3 (SD = 0.27), classified as very valid, reflecting that the learning materials and supporting media were clear, attractive, and feasible for classroom use.

Table 2. Validity scores of dam-daman PESH learning model

Aspect	Mean	Standard Deviation (SD)	Maximum Score	Category
Learning design	4.9	0.18	5.0	Very valid
Material/content	3.9	0.32	5.0	Valid
Media	4.3	0.27	5.0	Very valid

Student practicality testing produced consistently high results in the early trial stages. In the one-to-one stage, the model achieved a mean practicality score of 4.5 (SD = 0.35), categorized as very practical, indicating that students found the model easy to understand and implement. In the small group stage, the practicality score remained high with a mean of 4.3 (SD = 0.41), also categorized as very practical, showing that the model was feasible and effective when applied in a group learning setting.

Table 3. Practicality scores of dam-daman PESH learning model

Stage	Number of Students	Mean	Standard Deviation (SD)	Maximum Score	Category
One-to-one	3	4.5	0.35	5.0	Very practical
Small group	6	4.3	0.41	5.0	Very practical

In the field test involving 23 students, the motivation questionnaire was administered as both pretest (before intervention) and posttest (after intervention). The maximum possible score for the motivation questionnaire was 140 (28 items × 5). The pretest obtained a total score of 79, which is equivalent to 56.4% (79/140 × 100%), falling into the moderate motivation category. After the implementation of the Dam-Daman game–based learning model, the posttest obtained a total score of 119, equivalent to 85.0% (119/140 × 100%), falling into the high motivation category. This represents an increase of 40 points or 28.6% from pretest to posttest.

Table 4. Pretest and posttest motivation scores

Test	Total Score	Percentage	Maximum Score	Category
Pretest	79	56.4%	140	Moderate
Posttest	119	85.0%	140	High

Based on Keller's ARCS model, the motivation questionnaire was divided into four indicators: Attention, Relevance, Confidence, and Satisfaction. The following table presents the pretest and posttest scores for each indicator.

Table 5. Motivation scores by indicator (ARCS model)\

Indicator	Pretest Score	Pretest (%)	Posttest Score	Posttest (%)	Increase
Attention (7 items, max 35)	19	54.3%	30	85.7%	+11 (31.4%)
Relevance (7 items, max 35)	20	57.1%	29	82.9%	+9 (25.8%)
Confidence (7 items, max 35)	18	51.4%	30	85.7%	+12 (34.3%)
Satisfaction (7 items, max 35)	22	62.9%	30	85.7%	+8 (22.8%)
Total (28 items, max 140)	79	56.4%	119	85.0%	+40 (28.6%)

As shown in Table 4, the Confidence indicator showed the highest increase (34.3%), followed by Attention (31.4%), Relevance (25.8%), and Satisfaction (22.8%). All four indicators moved from moderate to high categories after the intervention. Prior to conducting parametric statistical tests, the Shapiro-Wilk normality test was performed on pretest and posttest motivation scores. The results are presented in Table 5.

Table 6. Normality test results (shapiro-wilk)

Test	Shapiro-Wilk Statistic	df	p-value	Interpretation
Pretest	0.945	23	0.214	Normally distributed ($p > 0.05$)
Posttest	0.938	23	0.156	Normally distributed ($p > 0.05$)

Both pretest and posttest data were normally distributed ($p > 0.05$), satisfying the assumption for parametric testing. A paired sample t-test was conducted to determine whether there was a significant difference between pretest and posttest motivation scores.

Table 7. Paired sample t-test results

Test	Mean	SD	Mean Difference	t-value	df	p-value	Conclusion
Pretest	79.00	8.45	40.00	12.347	22	0.000	Significant ($p < 0.05$)
Posttest	119.00	7.92					

The paired sample t-test revealed a statistically significant difference between pretest and posttest motivation scores ($t(22) = 12.347$, $p = 0.000$, $p < 0.05$). This indicates that the Dam-Daman game–based PESH learning model had a significant positive effect on students' learning motivation. The N-gain (normalized gain) test was used to measure the effectiveness level of the model in improving student motivation.

Table 8. N-Gain test results

Indicator	Pretest Mean	Posttest Mean	N-Gain Score	Category
Attention	19.00	30.00	0.69	Moderate effectiveness
Relevance	20.00	29.00	0.60	Moderate effectiveness
Confidence	18.00	30.00	0.71	High effectiveness
Satisfaction	22.00	30.00	0.62	Moderate effectiveness
Overall	79.00	119.00	0.66	Moderate effectiveness

The overall N-gain score was 0.66, which falls into the moderate effectiveness category ($0.3 \leq g \leq 0.7$). The Confidence indicator achieved high effectiveness ($g = 0.71$), while Attention, Relevance, and Satisfaction showed moderate effectiveness. Cohen's d was calculated to determine the magnitude of the model's effect on learning motivation.

Table 9. Effect Size (Cohen's d)

Indicator	Mean Difference	Pooled SD	Cohen's d	Category
Attention	11.00	2.15	5.12	Large effect
Relevance	9.00	2.08	4.33	Large effect
Confidence	12.00	2.22	5.41	Large effect
Satisfaction	8.00	1.98	4.04	Large effect
Overall	40.00	8.21	4.87	Large effect

The overall Cohen's d value was 4.87, which far exceeds the threshold for a large effect ($d > 0.8$). This indicates that the Dam-Daman game–based learning model had a very large effect on students' learning motivation.

Discussion

The results of this study indicate that the Dam-Daman traditional game–based PESH learning model meets key quality criteria in educational product development, namely validity, practicality, and a significant positive effect on students' learning motivation. This section discusses these findings in depth by relating them to relevant theories, comparing them with previous studies, and acknowledging the limitations of the research. The high expert validity scores across learning design ($M = 4.9$, $SD = 0.18$, very valid), material/content ($M = 3.9$, SD

= 0.32, valid), and media (M = 4.3, SD = 0.27, very valid) suggest that the model is conceptually and pedagogically sound.

The "very valid" rating on learning design implies that the learning objectives, activity sequence, and instructional steps are well aligned and appropriate for junior high school PESH contexts. This aligns with the ADDIE development framework, which emphasizes that a systematic design process produces a product with strong content and construct validity (Cahyadi, 2019; Hidayat & Nizar, 2021). The "valid" category for content indicates that the learning materials are relevant to students' needs and can support PESH competencies. The inclusion of physical movement components such as running, jumping, and throwing accuracy into the traditional Dam-Daman game represents an innovative adaptation that maintains cultural authenticity while meeting curricular demands.

This finding is consistent with (Mulyani, 2016), who stated that traditional games can be modified to suit educational objectives without losing their original cultural values. The "very valid" media score confirms that the model is supported by learning media that are feasible, understandable, and attractive for classroom use. The game boards, instruction cards, student worksheets, and assessment rubrics were designed to be simple, low-cost, and easily reproducible, which is particularly important for schools with limited resources. This finding supports (Sadiman, 2010) assertion that effective learning media must be clear, engaging, and appropriate for the target audience.

In terms of practicality, the consistently high student response scores in the one-to-one (M = 4.5, SD = 0.35, very practical) and small group (M = 4.3, SD = 0.41, very practical) stages demonstrate that the model is easy to implement and well accepted by learners. Very practical ratings in both stages indicate that students could follow instructions, understand the rules and learning flow, and participate comfortably both individually and in group settings. This finding is important because a learning model may be theoretically strong but still fail if it is difficult to apply in real class situations. The slight decrease from one-to-one to small group is reasonable, as group implementation typically introduces more variation in student behavior, classroom dynamics, and time management.

However, the score remaining in the "very practical" category suggests that the model is stable and adaptable when applied in a larger learning setting. This finding aligns with (Mulyatiningsih, 2013), who noted that formative evaluation through staged trials (one-to-one, small group, and field test) is essential for identifying and resolving implementation issues before wider dissemination. The most significant finding of this study is the substantial increase in student learning motivation after the implementation of the Dam-Daman game–based model. The pretest score of 79 (56.4%, moderate category) increased to 119 (85.0%, high category) on the posttest, representing an increase of 40 points or 28.6%.

The paired sample t-test confirmed that this difference was statistically significant ($t(22) = 12.347$, $p = 0.000$), and the effect size (Cohen's $d = 4.87$) indicates a very large effect. These results provide strong empirical evidence that the Dam-Daman model has a significant positive effect on student motivation, moving beyond the claim of "potential effect" to a statistically proven effect. The improvement in student motivation can be explained using Keller's ARCS model (2010), which identifies four components of motivation: Attention, Relevance,

Confidence, and Satisfaction. The current study measured all four components, and each showed substantial improvement.

Attention increased from 54.3% to 85.7% (an increase of 31.4%). Dam-Daman captures students' attention because it is a game that involves strategy, competition, and uncertainty of outcomes. Unlike repetitive drill exercises, Dam-Daman presents novel challenges in each session, which stimulates curiosity and maintains engagement. This finding aligns with (Prawiyogi et al., 2021), who found that game-based learning increases student attention spans compared to conventional methods. Relevance increased from 57.1% to 82.9% (an increase of 25.8%). The Dam-Daman game is part of the local cultural heritage of Musi Rawas Regency, making it familiar and relevant to students' daily lives.

When students see a connection between what they learn in school and their out-of-school experiences, they perceive the learning as more meaningful. This supports (Hamalik, 2011) theory that learning is most effective when it is relevant to the learner's life context. Confidence showed the highest increase, from 51.4% to 85.7% (an increase of 34.3%). Confidence refers to students' belief in their ability to succeed. The modified Dam-Daman game provides multiple opportunities for success: students can succeed in strategizing, in executing physical movements, or in cooperating with teammates. This gradual building of mastery experiences enhances self-efficacy.

This finding is consistent with (Salsabila & Ningsih, 2021), who reported that the Dam-Daman game enhances students' self-efficacy in academic contexts. The current study extends this finding to the physical education context. Satisfaction increased from 62.9% to 85.7% (an increase of 22.8%). Satisfaction comes from both intrinsic enjoyment of the game and extrinsic recognition of achievement. The competition-based session (Session 3) provided opportunities for students to demonstrate their skills and receive positive feedback from peers and the teacher, which contributed to overall satisfaction with the learning experience. The results also support Vygotsky's play theory, which posits that play serves as a zone of proximal development (ZPD) where children can achieve higher levels of functioning through socially mediated activities.

In the Dam-Daman game, students collaborated, negotiated rules, and solved problems together, enabling them to perform at levels beyond their individual capabilities. The significant improvement in motivation, particularly in the Confidence component (N-gain = 0.71, high effectiveness), suggests that the playful yet structured nature of Dam-Daman provides an optimal challenge level that promotes mastery and self-efficacy. The findings of this study are consistent with and extend previous research on traditional game-based learning. (Afifah, 2023) developed a traditional snake-and-ladder game model to improve locomotor and manipulative movements in early childhood, reporting positive effects on student engagement.

The current study similarly found positive effects but focused on a different age group (junior high school) and a different outcome (motivation), while also providing statistical evidence of effect size. (Damayanti et al., 2023) emphasized that introducing traditional games can preserve Indonesian culture while increasing student involvement in learning. The current study provides empirical support for this claim, demonstrating that cultural relevance (Relevance indicator increased by 25.8%) is a key mechanism through which traditional games

enhance motivation. (Murdiansyah, 2022) analyzed the relationship between Dam-Daman playing skills and mathematics learning outcomes, finding a positive correlation.

The current study extends this finding by showing that Dam-Daman can be adapted for physical education and that its benefits extend to affective outcomes (motivation), not just cognitive outcomes. However, unlike previous studies that often relied on descriptive statistics alone, the current study employed inferential statistics (paired t-test, N-gain, Cohen's d) to provide stronger evidence of the model's effectiveness. This represents a methodological contribution to the field of traditional game-based learning research. Based on the discussion above, several factors explain why the Dam-Daman model achieved strong results across all three evaluation criteria

1. Cultural familiarity Students were already familiar with Dam-Daman as a local traditional game, reducing the cognitive load of learning new rules and increasing perceived relevance.
2. Systematic development The ADDIE model ensured that each stage of development (Analysis, Design, Development, Implementation, Evaluation) was completed before moving to the next, resulting in a well-structured product.
3. Formative evaluation Tessmer's staged trials (expert validation, one-to-one, small group, field test) allowed for iterative refinement based on feedback from experts and students.
4. Integration of physical activity The modification of Dam-Daman to include running, jumping, and throwing accuracy aligned with PESH learning objectives while maintaining the game's strategic elements.
5. Low-cost materials The use of simple, locally available materials (wooden boards, seeds, pebbles, bottle caps) makes the model accessible to schools with limited resources.
6. Alignment with motivation theory The model naturally incorporates all four ARCS components (Attention, Relevance, Confidence, Satisfaction), as demonstrated by the improvements in each indicator.

Despite the promising findings, this study has several limitations that should be acknowledged. First, the field test was conducted in only one school (SMP Ma'arif NU Tugumulyo, Musi Rawas Regency) with a relatively small sample size of 23 students. While this sample size was sufficient for the paired t-test (which has adequate statistical power), the findings may not be generalizable to other schools with different student populations, geographic locations, or cultural contexts. Second, this study did not include a control group. Without a control group that received conventional instruction or an alternative treatment, it is not possible to definitively attribute the observed improvements solely to the Dam-Daman model.

Factors such as the novelty effect (students being excited simply because something new was introduced) or maturation (natural improvement over time) cannot be completely ruled out. Therefore, while the results show a statistically significant effect, the study design does not allow for causal claims. Third, the intervention was relatively short, consisting of only three learning sessions (each 2 × 40 minutes). The long-term effects of the Dam-Daman model on motivation are unknown. It is possible that motivation might decline after the novelty wears off, or alternatively, that sustained implementation might produce even larger effects. Fourth, the study measured only motivation as an outcome.

Other important PESH outcomes such as physical fitness, motor skill development, knowledge acquisition, and social-emotional learning were not assessed. It is possible that the Dam-Daman model may have differential effects on these other outcomes. Fifth, the teacher who implemented the model was trained by the researcher, which may have introduced implementation fidelity issues in real-world settings where such intensive training may not be feasible. Additionally, the Hawthorne effect (participants behaving differently because they know they are being observed) cannot be ruled out. Sixth, the motivation questionnaire, while validated and reliable, relies on self-report data, which may be subject to social desirability bias (students reporting higher motivation than they actually feel to please the researcher).

Despite these limitations, the study has several important implications. For PESH teachers, the Dam-Daman model provides a ready-to-implement, low-cost, culturally relevant alternative to conventional drill-based methods. Teachers are encouraged to adapt the model to their local contexts by incorporating other traditional games familiar to their students. For curriculum developers and policymakers, the findings suggest that traditional games deserve a more prominent place in the PESH curriculum, particularly in regions where such games are part of local heritage. The Ministry of Education and local education authorities may consider developing guidelines for integrating traditional games into formal physical education instruction.

For future researchers, several directions are recommended. First, experimental studies with pretest-posttest control group designs are needed to establish causal effectiveness. Second, longitudinal studies should examine whether motivation gains are sustained over longer periods (e.g., one semester or one academic year). Third, future research should include additional outcome measures such as physical activity intensity (using accelerometers or pedometers), motor skill assessments, and social-emotional learning outcomes. Fourth, replication studies in different schools, regions, and grade levels are needed to establish the generalizability of the findings. Fifth, qualitative studies (interviews, focus groups, classroom observations) could provide deeper insights into why and how the Dam-Daman model affects student motivation.

In summary, the Dam-Daman game–based PESH learning model meets the criteria of being valid, practical, and effective in enhancing junior high school students' learning motivation. The model's effectiveness is supported by statistically significant pretest-posttest differences, a large effect size (Cohen's d = 4.87), and moderate to high N-gain scores across all motivation indicators. These findings are consistent with motivation theory (Keller's ARCS model and Vygotsky's play theory) and align with previous research on traditional game-based learning. However, the study has limitations including the absence of a control group, small sample size, single-school setting, short intervention period, and reliance on self-report data. Therefore, while the model shows strong positive effects, further testing with rigorous experimental designs is needed to prove its causal effectiveness and generalizability. The study recommends that PESH teachers apply this model as a contextual and enjoyable learning alternative, while future researchers conduct wider trials across different schools and grade levels to strengthen the evidence base.

Conclusion

The physical education learning model based on the traditional Dam-Daman game has been systematically developed using the ADDIE approach combined with Tessmer's formative evaluation. The model meets the criteria of being valid, highly practical, and effective in increasing junior high school students' learning motivation. This model is suitable for use as a contextual, enjoyable, and culturally relevant alternative for physical education instruction, particularly in regions where traditional games remain part of local heritage. Based on the findings and limitations of this study, the following recommendations are provided for teachers, future researchers, and policymakers.

Teachers are encouraged to implement the Dam-Daman game–based learning model as an alternative to conventional drill-based methods. A 4 to 6 session implementation module is recommended to achieve optimal results, consisting of an introductory session to explain rules and basic mechanics, two to three sessions of modified Dam-Daman with progressive physical movement components (running, jumping, throwing accuracy), one session of competition-based Dam-Daman to enhance confidence and satisfaction, and one closing session for reflection and feedback. Teachers should ensure that game equipment (boards, seeds, or bottle caps) is prepared using low-cost, locally available materials to maintain accessibility.

Prior to implementation, teachers are advised to assess students' baseline motivation levels to measure individual progress. The model can be adapted for other grade levels (elementary or senior high school) after appropriate modifications are made to suit student characteristics, such as simplifying rules for younger students or adding more complex strategies and physical challenges for older students. Future researchers are strongly encouraged to test the effectiveness of the Dam-Daman learning model using rigorous experimental designs, such as a randomized controlled trial (RCT) or a pretest-posttest control group design, to establish causal evidence of the model's effectiveness.

Such studies should include a control group receiving conventional instruction or an alternative treatment to isolate the specific effect of the Dam-Daman model. Additionally, future research should expand outcome measures beyond motivation to include motor learning outcomes (e.g., fundamental movement skills, coordination, agility), physical activity intensity (measured using accelerometers or pedometers), knowledge acquisition (cognitive understanding of rules, strategies, and health concepts), and social-emotional learning outcomes (e.g., cooperation, sportsmanship, self-regulation). Longitudinal studies are needed to examine whether motivation gains are sustained over longer periods (e.g., one semester or one academic year) and to assess potential novelty effects.

Replication studies should be conducted in different schools, geographic regions (urban, suburban, rural), and grade levels (elementary, junior high, senior high) to establish the generalizability of the findings. Qualitative studies (interviews, focus groups, classroom observations) are also recommended to gain deeper insights into the mechanisms through which the Dam-Daman model affects student motivation and engagement. Local education authorities, such as the Musi Rawas Regency Education Office and the Ministry of Education, may consider integrating traditional game–based learning models, including Dam-Daman, into the PESH curriculum as part of local content (muatan lokal). This integration would serve a

dual purpose: enhancing student motivation and engagement while preserving and promoting local cultural heritage. Policymakers are encouraged to support teacher training programs focused on the development and implementation of traditional game–based learning models, as well as to allocate resources for the production of low-cost, standardized game equipment for schools. Schools are advised to establish traditional game clubs or extracurricular activities to complement classroom instruction and provide additional opportunities for students to engage with local cultural games.

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