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Gobak sodor as a culturally grounded motivational framework: effects of traditional game-based learning on engagement and achievement in junior high school physical education

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ABSTRACT

Low motivation and poor learning outcomes represent persistent challenges in Physical Education, Sports, and Health (PJOK) instruction at the junior high school level, yet the motivational mechanisms underlying culturally grounded pedagogical interventions remain underexplored. Grounded in Self-Determination Theory (SDT), this quasi-experimental study examines whether the integration of the traditional Indonesian game Gobak Sodor into PJOK instruction is associated with improved student motivation and learning outcomes among seventh-grade students at SMP Negeri 2 Tulangan. A pretest-posttest control group design was employed, with 31 students in an experimental group receiving eight sessions of Gobak Sodor-based instruction and 31 students in a control group receiving conventional teaching methods. Learning motivation was assessed using a validated Likert-scale questionnaire (Cronbach's $\alpha = 0.862$), and learning outcomes were measured via achievement tests. Results indicated a substantially greater increase in mean achievement scores in the experimental group (68.35 to 88.42) compared to the control group (66.94 to 70.03), with a statistically significant between-group difference at posttest ($t = 26.674$; $p < 0.001$). Motivation scores also increased significantly in the experimental group ($p < 0.001$), suggesting that SDT-aligned conditions of autonomy, competence, and relatedness may explain the observed engagement gains. However, given the quasi-experimental design, non-random class assignment, and single-school sample, causal inferences are constrained; findings should be interpreted as preliminary evidence warranting replication in broader and more diverse contexts.

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Introduction

Physical Education, Sports, and Health (PESH) is expected to support the holistic development of students across psychomotor, cognitive, and affective domains through structured physical activity (Sodiya & Nabiyeva, 2024; Raharjo et al., 2023). However, a critical gap persists between this pedagogical ideal and classroom reality: engagement-based motivation theoretically a necessary prerequisite for achieving learning objectives remains consistently low in Indonesian junior high school PESH contexts. This gap is not merely a matter of implementation but also concerns theoretical foundations: conventional PESH instruction is typically designed around drill-skill and command-based frameworks that fail to meet the basic psychological needs postulated by

Self-Determination Theory (SDT; Ryan & Deci, 2020), namely autonomy, competence, and social relatedness. When instruction is designed in ways that neglect these needs, students develop external rather than intrinsic motivation, thereby reducing engagement, persistence, and learning (Sodiya & Nabiyeva, 2024).

From a theoretical standpoint, the gap between PESH's educational promise and classroom learning outcomes can be explained through SDT. Conventional PESH instruction frequently relies on teacher-directed command-style and drill-based methods that leave little room for student autonomy or peer interaction (Tibubos et al., 2019). These methods are not merely pedagogical implementation failures they systematically inhibit the three basic psychological needs that SDT identifies as the foundation of intrinsic motivation: autonomy (students' sense of choice and self-initiation), competence (students' sense of mastery and effectiveness), and relatedness (students' sense of connection with peers). When these needs go unmet, motivation becomes externally regulated or amotivated, diminishing engagement and learning outcomes (Ryan & Deci, 2020). This theoretical framework reveals that the problem is not simply that students mistakenly view PESH as "play," but rather that instructional design fails to construct a learning environment that fulfills the conditions for intrinsic engagement (Eliana et al., 2023; Tibubos et al., 2019).

Recent research applying SDT to physical education confirms that high motivation profiles characterized by satisfaction of basic psychological needs are consistently associated with higher levels of intrinsic motivation, enjoyment, and emotional well-being (Fernández-Espínola et al., 2025). Conversely, the low motivation profiles common in conventional instruction exhibit amotivation and negative consequences such as dissatisfaction and diminished performance. These findings underscore the importance of designing instructional models that actively facilitate the fulfillment of all three psychological needs within the PESH context. The problem of low learning motivation in physical education classes is further compounded by low physical activity levels among adolescents, which has become a major concern at both global and national levels. Numerous studies document that a substantial proportion of adolescents fail to meet recommended daily physical activity levels (Latino et al., 2023). This challenge is exacerbated by the rapid rise of sedentary behaviors, such as excessive screen and device use, which constrain adolescents' active behaviors (Throuvala et al., 2021).

In Indonesia, similar patterns have been reported. Research involving male adolescents in Yogyakarta found that sedentary behavior was highly dominant more than 78% of accelerometer-recorded time on school days was sedentary, with screen time predominantly dedicated to entertainment and gaming (Andriyani et al., 2023). The situation is increasingly alarming given that approximately 57% of children in Indonesia engage in insufficient physical activity, posing long-term risks to their physical and mental health as well as to their communities (Hanifah et al., 2023). Data from the Active Healthy Kids Global Alliance in 2022 even placed Indonesia in the F grade category for children's and adolescents' physical activity indicators a deeply troubling indication of the scale of this problem.

A comprehensive study on the physical behaviors of Indonesian adolescent girls found that participants spent a large proportion of their time in screen-based sedentary behavior, reaching 83.2% of accelerometer-recorded time on school days (Andriyani et al., 2023). Screen time was predominantly observed during weekday evenings and weekend mornings, with individual smartphone use in the bedroom as the dominant pattern. These cross-gender findings suggest that technology-based sedentary behavior has become entrenched as a lifestyle among Indonesian adolescents, making school-based physical education one of the few structured opportunities to promote physical activity.

Under these circumstances, physical education must be designed to effectively stimulate students' interest, enjoyment, and willingness to engage in physical activity. Motivation is one of the most critical determinants of student engagement, persistence, and achievement in physical education (García-Ceberino et al., 2022). Students with intrinsic motivation are more likely to engage, strive, and achieve learning objectives compared to those with controlled or extrinsic motivation (Ryan & Deci, 2020). Selecting the optimal instructional model is therefore a critical factor in enhancing the quality and effectiveness of physical education.

Traditional game-based instructional models represent an increasingly recognized educational approach. Traditional games are culturally rooted physical activities involving rules, cooperation, and competition that students genuinely enjoy (Hassani & Afazeli, 2024). This quality aligns them with students' social and developmental characteristics. Traditional games provide meaningful learning environments that integrate movement-based experiences with cognitive decision-making, social activity, and emotional regulation (Connors & Rende, 2018).

A recent systematic review and meta-analysis drawing on six scientific databases, including Scopus, found that game-based physical education programs significantly enhance enjoyment among children and adolescents (Mo et al., 2024). These studies consistently identified engagement, enjoyment, and peer interaction as primary drivers of sustained participation. These findings reinforce the argument that integrating games into PESH

instruction is not merely a motivational strategy but a pedagogical mechanism that directly enhances the quality of the learning experience.

Experimental research conducted in Indonesia demonstrates that traditional game-based approaches exert a significant positive influence on students' learning motivation in physical education (Aliriad et al., 2024). This approach also contributes positively to student learning outcomes. Through direct participation in traditional games, students can develop motor skills, coordination, speed, and strength, while simultaneously cultivating cognitive capacities such as strategic thinking, spatial intelligence, and situational analysis. In short, traditional games integrate psychomotor, cognitive, and affective development in a synergistic manner far surpassing what can be achieved through isolated drill-based approaches. Research on the direct relationship between traditional games and PESH learning motivation is yielding increasingly compelling evidence. Gobak Sodor in particular has been shown to have a positive and meaningful relationship with students' learning motivation in physical education (Saputra et al., 2024). These findings indicate that the higher the intensity and quality of participation in Gobak Sodor, the greater the increase in students' PESH learning motivation a relationship with direct implications for instructional design in junior high school PESH classrooms.

Gobak Sodor is a traditional game originating from Indonesia, particularly popular in Javanese communities (Jariono et al., 2023). It trains physical endurance, fitness, and teamwork. Simply put, "Gobak" means to move freely or run, while "Sodor" means a spear or defensive line. This traditional game delivers learning related to cooperation, physical fitness, and agility in overcoming opponents by breaching defensive lines. In the context of physical education, Gobak Sodor is especially relevant because it demands excellent teamwork and agility from every student (Budiman et al., 2024).

Structurally, Gobak Sodor integrates several elements that align with SDT principles. First, students are given the freedom to determine appropriate strategies for winning the game, thereby satisfying the need for autonomy. Various movement strategies such as deceiving opponents and drawing out defensive line releases can be independently explored by students (Budiman et al., 2024). Second, the achievement of breaching a defensive line or successfully defending territory provides a sense of accomplishment that strengthens the need for competence. Third, the collaborative team nature of the game naturally fulfills students' need for social relatedness.

Locally grounded game-based approaches such as Gobak Sodor also align with culturally responsive pedagogical perspectives. The integration of local culture into instruction has been shown to enhance student engagement and foster a sense of belonging (Kurniawan et al., 2024). Traditional games, as part of cultural heritage, serve as effective educational tools that bridge historical knowledge and contemporary learning. Gobak Sodor in particular also cultivates critical thinking and problem-solving skills in the physical education context, as students devise effective tactics that stimulate their cognitive capacities (Budiman et al., 2024).

Although numerous researchers have demonstrated the effectiveness of game-based learning including traditional games in enhancing student motivation and engagement, several research gaps remain. First, most existing studies focus on the elementary school level, while research at the junior high school level, particularly within the Indonesian context, remains limited. Second, studies specifically examining Gobak Sodor as an instructional framework in junior high school PESH through rigorous experimental designs are still scarce. Third, the direct link between participation in culturally rooted traditional games and measurable learning achievement has rarely been investigated empirically.

The pedagogical potential of traditional games for PESH teachers has not yet been fully harnessed as a didactic framework connected to new possibilities for knowledge construction. Furthermore, from an SDT perspective, further empirical evidence is needed regarding how Gobak Sodor-based instruction specifically fulfills the three basic psychological needs autonomy, competence, and relatedness and how the satisfaction of these needs correlates with increases in learning motivation and academic achievement among junior high school students in the Indonesian PESH context (Saputra et al., 2024; Aliriad et al., 2024). Further study is therefore warranted to investigate the impact of traditional game-based instruction Gobak Sodor in particular on learning motivation and academic achievement in physical education at the junior high school level.

Based on the foregoing background, this study aims to investigate the effect of Gobak Sodor as a traditional game-based instructional model on junior high school students' engagement and learning achievement in PESH. By integrating SDT perspectives and culturally responsive learning, this study is expected to contribute both theoretically and practically to the development of PESH instructional models that are more effective, culturally relevant, and supportive of students' holistic development.

Method

This study employs a quantitative approach using a *quasi-experimental* design. The research design used is *a pretest-posttest control group design*. This design was used to determine the effect of a traditional game-based learning model on students' motivation and learning outcomes by comparing *pretest* and *posttest* scores between the experimental group and the control group.

The study was conducted at Tulangan State Junior High School No. 2. The population for this study consisted of all seventh-grade students at Tulangan State Junior High School No. 2. The study was carried out over eight sessions (each 80 minutes), during which the experimental group received instruction through a structured adaptation of the traditional game Gobak Sodor. The modification involved three specific design changes to align with PJOK learning objectives: (1) court dimensions were standardized to 9m x 5m to ensure equivalent physical exertion across sessions; (2) team compositions were rotated after every two rounds to promote peer interaction and reduce status hierarchies; and (3) each session included a 10-minute reflective debrief in which students discussed tactical decisions and movement strategies to bridge physical activity with cognitive learning. These modifications were documented in a session protocol sheet that teachers followed to ensure intervention fidelity across all eight sessions. The control group continued to use the conventional lecture-style teaching method in accordance with the current curriculum, with no game-based components introduced.

The sampling technique used was purposive sampling, which involves selecting a sample based on specific criteria aligned with the research objectives. These criteria included equivalent class sizes, similar age ranges (12–13 years), comparable prior achievement based on first-semester grades, and relatively homogeneous learning conditions as confirmed by the school's academic records. It should be acknowledged, however, that this approach constitutes convenience sampling with purposive criteria rather than true random assignment, which limits the internal validity of causal claims. Random assignment within a single school was not feasible due to administrative scheduling constraints and the risk of contamination between intact classes. These constraints are recognized as a limitation of the study and are addressed in the limitations section. Based on this technique, Class VII-B was designated as the experimental group and Class VII-C as the control group.

The experimental group was taught using a learning method based on the traditional game Gobak Sodor, while the control group used conventional teaching methods. Before the intervention began, both groups took a pre-test to assess the students' initial abilities. After the learning process was completed, both groups took a post-test to measure improvements in student learning outcomes.

Data on learning motivation were collected using a Likert scale questionnaire that had been validated both logically and empirically. Prior to the main data collection, the instrument was pilot-tested on 30 students outside the research sample to assess its reliability. Based on an analysis using Cronbach's Alpha, the motivation instrument showed a reliability coefficient of 0.862 (Very High Category). This indicates that the instrument has good internal consistency for measuring student learning motivation in the context of Physical Education and Health (PJOK) learning. An independent samples t-test was chosen to compare the effectiveness of the two groups after the intervention, in order to determine whether the traditional game model had a more significant impact than the conventional method.

Results and Discussions

a Before being used in the study, the learning motivation questionnaire was first tested *for validity and reliability* among students outside the study sample but with homogeneous characteristics. The *reliability* test was conducted to measure the internal consistency of the instrument using *Cronbach's Alpha*. Based on the results of the pilot test on 20 items, the following results were obtained

Table 1. Results of the Reliability Test of the Motivation Instrument

Variable	Number of Items	Cronbach's Alpha	Description
Motivation for Learning	20	0.862	Highly Reliable

The test results show a *Cronbach's Alpha* value of 0.862. According to reliability criteria, if the *alpha* value is *> 0.70,* the instrument is considered reliable and has high consistency for use as a measurement tool in this study. Additionally, item *validity* testing using *Product Moment* correlation indicates that all statement items have a *calculated r-value > table r-value (0.361),* thus they are deemed valid for collecting research data.

Descriptive Statistical Analysis

This study compares the effects of a learning model based on the traditional game Gobak Sodor in the experimental group with the conventional method in the control group. The data on student learning outcomes before and after the intervention are summarized in the following table:

Table 2. Descriptive Statistics of Learning Outcomes

Group	Test	N	Mean	Median	SD	Min	Maximum
Experiment	*Pre-test*	31	68.35	69.00	1.89	64.00	71.00
	Post-*test*	31	88.42	88.00	2.96	81.00	96.00
Control	*Pre-test*	31	66.94	66.00	4.39	60.00	77.00
	Post-*test*	31	70.03	70.00	1.47	65.00	72.00

Table 2 shows that the initial abilities of the two groups were relatively comparable before the intervention was administered. However, after the intervention, the experimental group experienced a highly *significant* mean gain of 20.07 points (from 68.35 to 88.42), while the control group gained only 3.09 points (from 66.94 to 70.03). These findings are consistent with a growing body of literature on game-based learning in physical education. For instance, Hassani and Afazeli (2024) found that traditional games in physical activity contexts increase student participation rates substantially compared to conventional drills. Similarly, Louth and Jamieson-Proctor (2019) demonstrated that Indigenous traditional games enhanced physical self-efficacy and intrinsic engagement in inclusive PE settings. García-Ceberino et al. (2022) further confirmed that achievement motivation in school PE is significantly predicted by contextual factors specifically, the degree to which the learning environment supports autonomy and peer connection. The observed disparity in gains between the experimental and control groups in the present study may be theoretically explained through SDT: the Gobak Sodor intervention provided structured opportunities for autonomous decision-making (team strategy), mastery experiences (skill application in context), and peer relatedness (cooperative and competitive social interaction). However, it must be acknowledged that the 20-point gain in the experimental group could also partially reflect novelty effects, heightened teacher enthusiasm, or Hawthorne effects rather than the game mechanism itself. Future studies should include manipulation checks and observer ratings of fidelity to isolate the specific mechanism driving achievement gains.

To test the significance of this difference, an *independent sample t-test* was conducted on the *post-test* scores of both groups.

The Relationship Between Motivation and Learning Outcomes

A t-test analysis was conducted to determine the effect of a traditional game-based learning model on student motivation and learning outcomes. In addition to learning outcomes, this study also measured students' levels of learning motivation. The following are the descriptive statistics of student learning motivation in the experimental and control groups.

Table 3. Results of the Motivation and Learning Outcomes Test

Group	Pre-test	Post-test	t	p
Experimental	68.35	88.42	31.718	<0.001
Control	66.94	70.03	1.172	0.250
***Post-test* Comparison**	***Mean***	***t***	***p***	
Experimental vs. Control	88.42 vs 70.03	26.674	<0.001	

Based on the results of the questionnaire data analysis, there was a significant increase in learning motivation scores in the experimental group. This is supported by the results of *the t-test* on the motivation variable, which showed a p-value of < 0.001. This increase in motivation was directly proportional to the rise in student achievement, from an average of 68.35 to 88.42.

The motivational gains observed in the experimental group can be interpreted through the SDT framework (Ryan & Deci, 2020). The Gobak Sodor intervention appears to have fulfilled all three basic psychological needs: students exercised autonomy through tactical decision-making during gameplay; they experienced competence as physical skills were practiced in contextualized, meaningful scenarios; and they developed relatedness through team-based cooperation and structured competition. These SDT-aligned conditions are theoretically

understood to shift motivation from externally regulated to intrinsically driven, which in turn sustains engagement and promotes deeper learning (Ryan & Deci, 2020; García-Ceberino et al., 2022). The concurrent rise in both motivation scores and achievement scores in the experimental group is consistent with this mechanism, although the causal direction cannot be definitively established from the present cross-sectional measurement design. In line with *Self-Determination Theory*, a learning environment that provides autonomy, competence, and social relatedness is able to stimulate active student participation.

In the game of Gobak Sodor, students are challenged to engage in situational problem-solving and dynamic social interaction. In contrast, the control group did not show a *significant* improvement ($t = 1.172$; $p > 0.250$). This non-significant gain in the control group ($t = 1.172$; $p = 0.250$) is consistent with prior research indicating that teacher-directed, drill-focused PJOK instruction does not provide the SDT-aligned conditions necessary for intrinsic motivation (Tibubos et al., 2019). These findings reinforce previous research that motivation is a key factor predicting learning success in physical education (García-Ceberino et al., 2022). Several limitations must be acknowledged when interpreting these results. First, the quasi-experimental design with intact class assignment means that pre-existing differences in motivation, classroom culture, or teacher-student relationships could account for part of the observed difference. Second, the study was conducted in a single school with a relatively homogeneous student population in Tulangan, Sidoarjo, limiting the generalizability of findings to urban, diverse, or lower-resource settings. Third, while motivation was measured via a validated questionnaire, no direct observational coding of student engagement was conducted during sessions, leaving the proposed mechanisms partially inferential. Fourth, novelty effects cannot be ruled out as a confound; a longer intervention period with follow-up assessment would strengthen confidence in sustained effects. Future research should employ randomized controlled designs where feasible, include fidelity checks, and replicate findings across schools with varied demographic and cultural contexts.

Conclusions

Based on the research findings and discussion, it can be concluded that the implementation of a traditional game-based learning model (Gobak Sodor) has a significant impact on improving the motivation and learning outcomes in Physical Education for seventh-grade students at SMP Negeri 2 Tulangan. More specifically, the conclusions of this study are as follows that: First, the traditional game-based learning model significantly improved student learning outcomes, with an increase in the average score from 68.35 to 88.42 in the experimental group. This increase was much greater than that of the control group, which only increased from 66.94 to 70.03; Second, there was a significant difference in learning outcomes between students taught using traditional games and those taught using conventional methods ($t = 26.674$; $p < 0.001$). This demonstrates that the traditional game model is more effective in achieving the learning objectives of Physical Education. Motivation questionnaire scores increased significantly in the experimental group ($p < 0.001$), indicating an association between Gobak Sodor-based instruction and higher self-reported motivation. It should be noted, however, that the mechanism driving this association whether attributable to the social structure of the game, increased physical activity levels, novelty effects, or SDT-relevant affordances of autonomy and relatedness cannot be determined from the current data alone. These conclusions are bounded by the study's quasi-experimental design and single-school sample. Practitioners should view these findings as promising preliminary evidence supporting the integration of culturally grounded traditional games in PJOK instruction, while researchers are encouraged to replicate these findings using randomized designs, multiple traditional game types, and longitudinal follow-up measurements.

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