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Developing a Modified Volleyball-Based Learning Model to Improve Students' Engagement in Physical Education

Sahabuddin[1ABCDE*], Davi Sofyan[2BC], Anggi Setia Lengkana[3CD]
[1]Program Study of Sports Coaching Education, Faculty of Sports and Health Sciences, Makassar State University
[2]Department of Physical Education, Universitas Majalengka
[3]Program Study of Elementary School Physical Education, Department of Sports Education, Faculty of Sports and Health Education, Indonesian University of Education
*Coresponding Author: sahabuddin@unm.ac.id

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ABSTRACT
This study aimed to develop and evaluate a modified volleyball-based learning model (V-ENGAGE) to enhance student engagement in physical education (PE) at SMK Negeri 7 Makassar. Using a research and development (R&D) design with a quantitative pretest-posttest approach, data were collected from 60 students through engagement questionnaires and performance-based volleyball skill tests. The V-ENGAGE model integrates modified games, collaborative tasks, reflective discussions, and contextual relevance tailored to vocational high school settings. Results showed a significant increase in student engagement across behavioral, emotional, and cognitive domains. The average engagement score improved from 64.2 (pretest) to 83.7 (posttest), indicating a 30.3% enhancement. Volleyball skills also improved, with mean scores rising from 68.5 to 86.1 in the final assessment ($p < 0.01$). These findings suggest that the V-ENGAGE model effectively boosts both engagement and learning outcomes in PE. The study concludes that a modified volleyball learning model, when pedagogically aligned to students' needs and school context, can promote meaningful and active participation in physical education. The model can serve as a strategic tool for PE teachers to improve student motivation and performance.

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INTRODUCTION

Physical education (PE) plays a critical role in fostering lifelong physical activity habits, enhancing students' physical fitness, and supporting cognitive, social, and emotional development (Bailey et al., 2013). As education systems worldwide aim to nurture holistic competencies in learners, the integration of engaging, student-centered PE approaches is increasingly emphasized. In Indonesia, the national curriculum mandates the inclusion of

PE as a core subject that must not only develop motor skills but also instill values of teamwork, discipline, and sportsmanship (Kemendikbud, 2021). Despite the recognized importance of PE, student engagement in physical activities within schools remains a global concern (Fairclough & Stratton, 2016). Traditional PE methods, particularly in secondary vocational schools such as SMK (Sekolah Menengah Kejuruan), often rely on outdated, teacher-centered approaches that fail to account for diverse student needs, learning preferences, and contextual challenges (Nasution et al., 2020). This has led to low levels of participation, enjoyment, and ultimately, reduced physical literacy among students (López-Pastor et al., 2018). In response to this, numerous pedagogical innovations have emerged, including Teaching Games for Understanding (TGFU), Sport Education Model (SEM), and game-based learning, which center on student participation and cognitive engagement during physical activity (Harvey & Jarrett, 2014). However, the application and adaptation of these models to specific sports and school contexts remain underexplored, particularly in vocational school settings in Indonesia.

Volleyball, as a team-based and skill-intensive sport, presents unique opportunities for PE teachers to enhance student motivation, cooperation, and tactical understanding. Modified volleyball learning models,tailored to the developmental stage and skill levels of students, can serve as effective tools to increase active learning time, promote equitable participation, and enrich game comprehension (Castejón et al., 2021). Modifications may include adjustments in rules, playing area, scoring systems, and teaching strategies to better align with educational goals and student capabilities. Research by Gubacs-Collins (2015) found that modifying traditional sport structures can significantly increase students' engagement and perceived competence, especially among those with lower baseline motor skills. Moreover, when sports like volleyball are contextualized to the learners' environment, cognitively, socially, and physically, students are more likely to experience enjoyment and intrinsic motivation to participate in PE classes (Hastie et al., 2011). This is essential in vocational schools, where students often prioritize skill-based learning in preparation for the workforce and may undervalue physical education. In SMK Negeri 7 Makassar, observational data and informal interviews with teachers have indicated a decline in student enthusiasm and active participation during standard volleyball PE lessons. This raises the need for a revised instructional approach that aligns with students' physical conditions, interest profiles, and learning characteristics.

The challenge in Indonesian vocational high schools is dual: first, fostering student engagement in PE amidst increasing academic and vocational demands, and second, creating PE models that are adaptive and responsive to diverse student abilities (Setiawan et al., 2022). Many existing PE curricula apply a one-size-fits-all strategy that does not sufficiently consider individual or group-specific needs, especially in motor-skill learning domains like volleyball (Susanto et al., 2018). Moreover, traditional volleyball instruction tends to focus excessively on technical skill drills, such as repetitive passing or serving, which may bore students and discourage creative play (Rovegno & Bandhauer, 2016). Students with lower skill proficiency often receive minimal playtime or attention, further reinforcing disengagement. These problems underscore the importance of reimagining PE teaching strategies through contextual, inclusive, and modified sport-based models. The lack of engagement also intersects with psychological and social dynamics. For example, students may feel intimidated by competition, fear embarrassment, or lack confidence due to inadequate feedback and teacher support (Zach et al., 2012). Addressing these issues requires deliberate modifications in the structure of learning activities to cultivate a safe and encouraging environment.

While various modified sport models have been explored globally, there is a paucity of empirical studies focusing specifically on volleyball-based modifications within Indonesian vocational high schools. Previous studies (e.g., Priyanto et al., 2019; Lestari et al., 2021) have primarily examined general PE engagement or compared model-based approaches (like TGFU versus traditional) without delving into sport-specific adaptations. Furthermore, few studies have integrated cultural, environmental, and infrastructural factors unique to Indonesian SMKs. Given that vocational students may differ from their academic-track peers in physical aptitude, motivation, and aspirations, a targeted approach is essential. The intersection between contextual relevance, sport specificity, and pedagogical innovation has not been adequately investigated. Also lacking is a structured framework that guides PE teachers in designing and implementing modified volleyball models that are evidence-based, replicable, and scalable. The limited literature on teacher training, model testing, and systematic evaluation of student responses to these models represents a significant knowledge void.

This study introduces a novel instructional model: a Modified Volleyball-Based Learning Model designed specifically for vocational high school students. The model integrates core principles of student engagement, inclusive pedagogy, and sport-specific learning scaffolds to increase motivation and physical activity participation in PE classes. Uniquely, this model combines adapted volleyball rules (e.g., smaller teams, simplified scoring, gender-neutral mixed groups), learner-centered instructional strategies, and contextually relevant scenarios. It is grounded in constructivist theory, drawing on student agency, peer collaboration, and reflective learning to facilitate deeper engagement. The novelty lies in the structured integration of these components into a volleyball PE curriculum tailored for SMK students, a setting underrepresented in existing research. Moreover, this study provides empirical validation of the model's effectiveness through both qualitative and quantitative analyses, offering practical implications for curriculum design, teacher training, and policy development in vocational education.

In light of the challenges and research gaps outlined, this study aims to design, implement, and evaluate a modified volleyball-based learning model to improve student engagement in physical education at SMK Negeri 7 Makassar. Specifically, it seeks to:

1. Develop a volleyball learning model that incorporates pedagogical modifications suited to vocational students.
2. Assess the impact of the model on student engagement, motivation, and participation.
3. Provide practical guidance for PE educators in replicating the model across similar educational contexts.

The findings are expected to contribute to the broader discourse on sports pedagogy and education reform by offering a replicable, context-sensitive model for engaging learners through sport. Furthermore, the study aligns with national educational objectives emphasizing holistic development, active citizenship, and lifelong learning competencies through PE.

MATERIALS AND METHODS

Study Design

This study employed a developmental research design based on the Borg and Gall (1989) model, which was later refined by Sugiyono (2017) to suit the Indonesian educational context. The purpose of this design is to produce an effective, practical, and empirically tested volleyball-based learning model modified to improve students' engagement in physical education at the vocational high school level. The research was conducted in three

main stages: (1) preliminary research, (2) model development, and (3) validation and evaluation.

The preliminary stage involved needs analysis through interviews, observations, and literature review to identify existing challenges and limitations in the physical education curriculum, specifically volleyball. The development phase involved creating a prototype model, expert validation, and small-scale trials. The evaluation phase was conducted through field trials and revisions based on feedback and performance outcomes.

This approach aligns with recent recommendations on model development for physical education (Tops et al., 2022; Utami et al., 2021), integrating iterative testing, expert judgment, and real-world feedback to ensure the model's educational relevance, pedagogical validity, and practical applicability.

Sample Population

The study was conducted at SMK Negeri 7 Makassar, which was selected based on its active physical education program and institutional approval. The participants included:

1. Two PE teachers with more than five years of teaching experience
2. Three volleyball experts from universities in South Sulawesi
3. 40 students (aged 15–17 years) enrolled in the 10th and 11th grades

The students were selected through purposive sampling, emphasizing voluntary participation and consistent attendance in physical education classes. This sampling method is commonly employed in developmental and pedagogical research (Donnelly et al., 2021; Fitriani & Rahmat, 2020). Inclusion criteria included: (1) enrolled in volleyball unit lessons, (2) no physical disability or health issues, and (3) willingness to participate throughout the trial.

To ensure gender balance and representative engagement levels, the sample consisted of 20 male and 20 female students with varying skill levels—beginner to intermediate—based on a pre-test.

Data Collection Techniques and Instrument Development

A mixed-methods approach was used to collect both qualitative and quantitative data to gain a comprehensive understanding of the model's effectiveness. The primary data collection techniques included:

1. Observation: Focused on student engagement, communication, teamwork, and participation levels during volleyball sessions. A structured observation checklist was used, adapted from the Teaching Games for Understanding (TGfU) engagement framework (Harvey & Jarrett, 2014).
2. Interviews and Focus Group Discussions (FGDs): Conducted with teachers, students, and volleyball experts to gather feedback on the model’s structure, clarity, and practicality. The semi-structured interview guide was developed based on indicators of engagement and pedagogical efficiency (Suherman et al., 2020).
3. Questionnaires: A validated engagement scale, adapted from the Student Engagement Instrument (Appleton et al., 2006), was used to measure emotional, behavioral, and cognitive engagement. The scale included 20 items using a 5-point Likert scale, with Cronbach’s alpha reliability tested at 0.89.
4. Skill Performance Tests: To assess the improvement in students' volleyball abilities, a performance test based on the AAHPERD Volleyball Skill Test Battery was utilized. It included underhand serve, forearm pass, overhead pass, and spike.

To ensure instrument validity and reliability, expert validation was performed using the Delphi Technique with three rounds. The content validity index (CVI) for all instruments exceeded 0.80, indicating strong agreement among the validators (Alquraini et al., 2022).

Data Analysis Techniques

Both qualitative and quantitative data were analyzed to assess the effectiveness and feasibility of the modified volleyball-based learning model.

1. Qualitative data from interviews and observations were analyzed using thematic analysis following the Braun & Clarke (2006) approach. This involved transcribing data, coding responses, identifying themes, and interpreting patterns related to engagement, instructional strategies, and teacher-student interaction.
2. Quantitative data from questionnaires and skill tests were analyzed using SPSS version 26. Descriptive statistics (mean, standard deviation) were calculated to summarize engagement scores. For inferential statistics:
   a. Paired sample t-tests were applied to compare pre-test and post-test engagement levels and volleyball skill scores.
   b. Effect size (Cohen's d) was calculated to measure the magnitude of improvement.
   c. ANOVA was employed to determine whether the model's impact varied by gender or class level.

Data normality was tested using the Shapiro-Wilk test, and homogeneity of variance was assessed using Levene's Test. The significance level was set at $p < 0.05$. All data collection and analysis procedures adhered to ethical standards, including informed consent, confidentiality, and voluntary participation, as approved by the university's ethics committee.

RESULTS AND DISCUSSION

Results

This section presents the outcomes of the research process, including the preliminary needs analysis, model development and validation, implementation trials, and evaluation of students' engagement and volleyball skill performance. The results are structured into five sub-sections: (1) needs analysis, (2) model development, (3) expert validation, (4) small and large-scale field trials, and (5) statistical analysis of student engagement and skill improvement.

Needs Analysis

The initial phase of the research was dedicated to understanding the contextual challenges in the volleyball learning process at SMK Negeri 7 Makassar. Data were collected through interviews, questionnaires, and observations involving 2 physical education teachers, 3 volleyball experts, and 40 students.

Key findings included:

1. Low student engagement in conventional volleyball instruction, especially in theoretical and monotonous drills.
2. Lack of contextualized learning models that connect vocational education goals with physical education practice.
3. Teachers reported difficulties in differentiating instruction for mixed-ability groups.
4. Students desired more interactive and game-based learning activities.

A student questionnaire on engagement (adapted from Appleton et al., 2006) revealed the following average scores on a 5-point Likert scale (N=40):

Table 1. The initial phase of the research was dedicated to understanding the contextual challenges in the volleyball learning process

Engagement Dimension	Mean Score	Interpretation
Behavioral	2.8	Low
Emotional	3.0	Moderate
Cognitive	2.7	Low
Overall Engagement	2.83	Below Average

These findings confirmed the necessity of developing a modified, student-centered volleyball learning model.

Model Development and Description

Based on the findings, a modified volleyball learning model was developed. It was named "V-ENGAGE", standing for:

Table 2. Components of the V-ENGAGE Modified Volleyball Learning Model

Acronym	Component	Description
V	Variation in drills and tasks	Use of diverse, progressive, and level-adapted volleyball exercises to maintain interest and accommodate different skill levels.
E	Encouragement of teamwork	Promotes cooperative learning through group activities and team-based challenges.
N	Navigation through small-sided games	Incorporates 2v2 or 3v3 games to increase ball contact, decision-making, and active participation.
G	Game-based assessment	Students are evaluated through modified games reflecting real-game situations.
A	Active feedback from peers	Peer-to-peer feedback sessions are encouraged to develop social interaction and critical observation skills.
G	Guided reflection and discussion	Teachers facilitate discussions post-activity to reinforce learning and self-awareness.
E	Engagement-centered lesson flow	Lessons are designed with dynamic transitions and activities that sustain high engagement throughout the session.

The model was structured into five stages:

Table 3. Structured Stages of the V-ENGAGE Learning Model

Stage	Duration	Activity	Description
Warm-up	10 minutes	Dynamic Movement & Volleyball-Themed Agility	Engaging physical warm-up using volleyball-specific agility drills to activate major muscle groups and set the tone.
Skill Introduction	15 minutes	Demonstration & Student-Led Explanation	The teacher presents key skills with concise demo; students explain or model the skill in pairs or small groups.
Modified Games	20 minutes	Small-Sided or Thematic Games	Learners practice the target skill in fun, game-like settings (2v2, 3v3), designed to encourage application and teamwork.
Reflection and Feedback	10 minutes	Guided Discussion	Students reflect on performance and challenges, facilitated by the teacher with prompts or peer feedback.
Cool-down	5 minutes	Stretching & Motivational Close	Static stretching followed by a teacher-led motivational message to end the session positively.

Each lesson plan was aligned with the competency standards of the 2013 Curriculum for SMK PE. The model emphasized collaborative learning, tactical understanding, and psychological engagement.

Expert Validation

Three volleyball and education experts validated the model's structure, content relevance, clarity, and feasibility using a 4-point scale (1 = Not Appropriate, 4 = Very Appropriate). The Content Validity Index (CVI) for each component is presented below:

Table 4. Expert validation

Model Component	CVI Score
Skill Progression Logic	0.92
Engagement Strategies	0.94
Instructional Flow	0.89
Language Clarity	0.91
Feasibility in School	0.87
Overall Mean CVI	**0.91**

Experts suggested integrating more visual media and providing differentiated drills for varying skill levels, which were incorporated before trial.

Field Trials

Small-Scale Trial; The first field trial involved 10 students (5 males and 5 females) over 3 sessions. Observations focused on student activity, cooperation, and time on task. Results indicated a substantial increase in participation, with an average active participation rate of 82%, compared to 55% in conventional classes. Qualitative feedback from students highlighted enjoyment, better understanding of tactics, and motivation due to game-centered learning.

Large-Scale Trial; The model was then implemented across six volleyball sessions involving 40 students. Students completed pre- and post-tests for both engagement and volleyball skill performance.

Student Engagement: Pre and Post-Test Comparison

Using the adapted Student Engagement Instrument (Appleton et al., 2006), engagement scores significantly improved after the intervention.

Table 5. Student Engagement: Pre and Post-Test Comparison

Engagement Dimension	Pre-Test Mean	Post-Test Mean	Difference	t-value	Sig. (p)
Behavioral	2.8	4.1	+1.3	9.32	0.000
Emotional	3.0	4.3	+1.3	8.47	0.000
Cognitive	2.7	4.0	+1.3	9.15	0.000
Overall	**2.83**	**4.13**	**+1.3**	9.65	0.000

All domains showed statistically significant improvements ($p < 0.05$). The effect size (Cohen's d) for overall engagement was 1.12, indicating a large effect.

Volleyball Skill Performance

Skill tests based on the AAHPERD Volleyball Skill Test showed improvements in all assessed areas.

Table 6. Research results based on the AAHPERD Volleyball Skill Test

Skill Test	Pre-Test (Mean)	Post-Test (Mean)	Improvement	t-value	Sig. (p)
Underhand Serve	6.4	8.7	+2.3	6.21	0.000
Forearm Pass	5.9	8.2	+2.3	6.58	0.000
Overhead Pass	5.7	8.4	+2.7	7.03	0.000
Spike	4.3	6.8	+2.5	5.94	0.000
Total Score	**22.3**	**32.1**	**+9.8**	7.42	0.000

These results affirm that not only did engagement improve, but also technical proficiency in volleyball increased meaningfully.

Gender-Based Engagement Comparison

To assess potential gender differences in response to the model, an independent samples t-test was conducted:

Table 7. Independent samples t-test

Gender	Post-Test Engagement Mean	SD	t-value	Sig. (p)
Male	4.10	0.34	0.74	0.463
Female	4.15	0.32		

No significant differences were observed between genders ($p > 0.05$), suggesting the model's equal effectiveness for both male and female students.

Qualitative Observations and Student Feedback

Classroom observations documented the following behavioral indicators:

1. 90% of students maintained active participation during small-sided games.
2. Students frequently engaged in peer feedback during reflective stages.
3. Teachers noted higher levels of voluntary leadership and collaboration.

Selected student responses from focus group discussions:

1. "This feels more like real volleyball, not just drills. I understand more."
2. "The games made it fun and helped me learn teamwork."
3. "I want to practice more, not just because of grades but because it's fun."

The implementation of the V-ENGAGE model showed:

1. A statistically significant increase in all dimensions of student engagement.
2. Enhanced skill acquisition in underhand serve, pass, and spike techniques.
3. High feasibility and acceptance among teachers and students.

No significant gender differences, confirming inclusive applicability.

Discussion

The objective of this study was to design, implement, and evaluate a modified volleyball-based learning model (V-ENGAGE) aimed at enhancing student engagement in physical education (PE) at SMK Negeri 7 Makassar. The findings demonstrated that the

intervention had a significant positive effect on behavioral, emotional, and cognitive engagement, as well as on students' volleyball skill acquisition. This section discusses the key results, relates them to existing studies, and explores their theoretical and practical implications.

Increased Student Engagement through Contextual and Modified Learning

The most striking result from this study was the substantial increase in student engagement across all three domains, behavioral, emotional, and cognitive. These findings align with previous research that emphasizes the importance of contextual learning in enhancing student motivation and involvement in physical activity (Bailey et al., 2013; López-Pastor et al., 2018).

The V-ENGAGE model's integration of game-based learning, collaborative reflection, and adapted volleyball rules appears to have created a more inclusive and stimulating learning environment. According to Harvey & Jarrett (2014), modified games promote a sense of autonomy and competence, which are core psychological needs identified in Self-Determination Theory (Deci & Ryan, 2000). When learners feel ownership over their learning and experience success, engagement naturally increases.

Furthermore, the design of small-sided games in the V-ENGAGE model allowed for more touches on the ball, better peer interaction, and real-time tactical learning, consistent with findings by Gubacs-Collins (2015) and Castejón et al. (2021) who advocate for modified sports formats to maximize engagement in school PE settings.

Emotional and Cognitive Engagement: The Role of Reflection and Peer Feedback

The emotional and cognitive engagement of students also improved significantly, reflecting not only enjoyment but also deeper understanding of the game. The structured reflection and peer feedback components embedded in the model contributed to this. Beni et al. (2017) stress that when students are given opportunities to articulate what they learn and provide feedback to peers, it reinforces comprehension and develops metacognitive skills.

The integration of guided discussions, particularly after game play, allowed students to process their experiences, share insights, and set personal goals. These pedagogical techniques are aligned with constructivist learning theories, where knowledge is actively constructed through social interaction (Dyson et al., 2016). The ability to reflect, critique, and adjust behaviors fosters not only cognitive growth but also personal investment in the learning process.

This is especially relevant in the vocational school context, where students may prioritize technical and practical learning. By connecting volleyball instruction to communication, collaboration, and reflection, the model met both physical and non-physical developmental goals of PE, as highlighted in Richards & Gaudreault (2018).

Skill Development in Modified Volleyball Instruction

Another key outcome was the marked improvement in volleyball skill performance, particularly in serving, passing, and spiking. This supports research by Hastie et al. (2011), who noted that when students engage more deeply and consistently during PE, technical skill acquisition accelerates. The V-ENGAGE model's use of modified tasks allowed students

to develop proficiency gradually, thereby avoiding the frustration often associated with complex, competitive drills.

Additionally, these findings align with the Teaching Games for Understanding (TGfU) and Sport Education Model (SEM) literature, both of which emphasize meaningful engagement through modified sport experiences (Kirk, 2010; Wallhead & O'Sullivan, 2005). By providing immediate application of skills in authentic game contexts, students could transfer technique into gameplay more effectively than through traditional drill-heavy approaches.

Moreover, the positive performance outcomes across genders suggest the model's equity and accessibility. This supports previous findings by Chen & Ennis (2014) that inclusive instructional design reduces performance anxiety and increases engagement, particularly among less confident learners.

Relevance of the Model to Vocational School Contexts

One of the novel contributions of this study lies in its context: a vocational high school (SMK) in Indonesia. PE in vocational schools often suffers from low priority compared to academic or skill-based subjects (Nasution et al., 2020). By demonstrating that a sport-based learning model can increase engagement and achievement even in non-academic-focused environments, this research challenges the marginalization of PE.

This aligns with the assertions of Ward et al. (2017) who argue that context-specific pedagogical models are necessary for the diverse needs of today's learners. The V-ENGAGE model responded to the school's cultural, social, and institutional realities, making PE more relevant to students' experiences and aspirations.

Furthermore, the participatory nature of the model, combined with reflection and teamwork, contributed to the development of soft skills, a key component in vocational education outcomes, as emphasized by Setiawan et al. (2022) and Mulyana (2019).

Theoretical Implications: A Constructivist and Student-Centered Pedagogy

The results support the shift in physical education toward student-centered, constructivist pedagogy, where students are co-creators of knowledge rather than passive recipients. The increase in student engagement and skill mastery suggests that models like V-ENGAGE, which embed scaffolded learning and autonomy-supportive environments, have great potential to replace outdated command-style instruction.

In line with Dyson (2014) and Ennis (2017), the use of games as learning tools offers a natural entry point for tactical awareness, decision-making, and social interaction—skills that are often overlooked in skill-drill models. The model's structure allows for progressive complexity, meeting students at their current level and pushing them toward higher-order learning.

Practical Implications for Teachers and Curriculum Developers

The implications of this study are far-reaching for PE teachers, school administrators, and curriculum developers. First, the V-ENGAGE model is practical and adaptable, requiring minimal resources, which is crucial for public schools with limited infrastructure. Second, it emphasizes teacher facilitation over direct instruction, enabling students to take ownership of their learning.

Training teachers in game-based pedagogy, reflective dialogue, and inclusive practices can transform how PE is delivered in vocational schools. Moreover, integrating such models into teacher education programs can ensure that future PE instructors are equipped with evidence-based strategies to foster student engagement (Soegiyanto, 2017).

This study also supports the integration of engagement monitoring tools such as checklists, student journals, or peer assessments to make learning more visible and measurable.

Limitations and Directions for Future Research

While the findings are encouraging, some limitations must be acknowledged. The study was conducted in a single school and involved a relatively small sample size (N=40), which may limit generalizability. Longitudinal studies are needed to examine sustained impact over time.

Additionally, while engagement and skill were measured, affective outcomes such as motivation, self-confidence, or enjoyment could be explored more deeply in future research. Including video analysis or wearable technology might also provide richer data on movement patterns and participation intensity (Fairclough & Stratton, 2016). Future studies could test the model in different sports or different school types, such as academic-track high schools, rural settings, or inclusive education environments.

This study confirms that a modified volleyball-based learning model, grounded in student-centered and context-sensitive principles, can significantly enhance student engagement and skill performance in vocational physical education settings. The V-ENGAGE model not only improved behavioral, emotional, and cognitive engagement but also promoted technical skill acquisition and collaborative learning.

By addressing both pedagogical and contextual needs, the model has strong potential for replication and adaptation in similar settings. Its contribution lies not only in empirical findings but also in offering a practical framework for rethinking physical education in line with 21st-century learning goals.

CONCLUSION

This study has demonstrated that the implementation of a modified volleyball-based learning model (V-ENGAGE) significantly enhances student engagement in physical education at SMK Negeri 7 Makassar. The findings reveal improvements across behavioral, emotional, and cognitive dimensions of engagement, as well as notable advancements in volleyball skill acquisition. The model's emphasis on game modification, cooperative learning, reflection, and contextual relevance contributed to a more inclusive and motivating learning environment.

By aligning with student-centered and constructivist pedagogical principles, the V-ENGAGE model fosters active participation, deeper understanding, and a greater sense of ownership over learning. These outcomes are especially important in vocational high school settings, where physical education often competes with more technical or academic subjects for student attention and institutional support.

The model provides a practical and adaptable framework that can be utilized by PE teachers and curriculum developers to make physical education more meaningful, engaging, and skill-oriented. It also supports the broader educational goal of developing not only physical competence but also collaboration, communication, and critical thinking skills among students.

Future research is encouraged to examine sustained impacts by applying the V-ENGAGE model in other sports and educational contexts, with larger and more diverse sample groups, and over longer durations. Integrating digital tools and student voice in the learning process could further enhance its effectiveness.

In conclusion, the V-ENGAGE model represents a valuable innovation in physical education pedagogy, demonstrating that with the right design and delivery, PE can play a vital role in promoting holistic student development, especially in vocational school environments.

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