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## Strategic Ethno-Management of Pencak Silat in Sport Education: Fostering Holistic Development and Cultural Sustainability

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### Abstract

**Study purpose.** The marginalization of traditional sports in formal education has reduced students' opportunities to engage with indigenous cultural values and holistic learning experiences. Although Pencak Silat has been recognized as an Intangible Cultural Heritage, its implementation in school-based physical education remains limited and is often treated as an extracurricular activity. This study aims to develop and evaluate the Ethno-Silat Integration Framework (ESIF) as a strategic ethno-management model for integrating Pencak Silat into secondary school physical education.

**Materials and method.** a sequential mixed-methods design was used through ethnographic observation, interviews, and a single-group pretest-posttest approach involving 350 students and teachers at a senior high school in Indramayu, West Java. The intervention consisted of a 12-week curriculum integrating Pencak Silat techniques, philosophical values, and community-based learning activities. Student outcomes were measured using the Holistic Development Scale (HDS) and the Cultural Sustainability Index (CSI), while teachers completed separate instruments assessing pedagogical feasibility and implementation fidelity. Data were analyzed using IBM SPSS Statistics version 28, employing paired-samples *t*-tests, Cohen's *d* effect sizes, and multiple regression analysis.

**Results.** The findings showed significant improvements across all measured domains, demonstrating medium to large effect sizes (Cohen's *d* ranging from 0.78 to 1.10). The most significant improvement was observed in social cohesion (*d* = 1.10), followed by cultural identity (*d* = 0.95) and emotion regulation (*d* = 0.92). Furthermore, regression analysis showed that the ESIF pillars explained 68% of the variance in students' holistic development ( $R^2 = 0.68$ ), with

stakeholder synergy ( $\beta = 0.42$ ) and cultural authenticity ( $\beta = 0.33$ ) emerging as the strongest predictive contributors.

**Conlcutions.** The study concluded that the ESIF effectively supports holistic education while strengthening the sustainability of local cultural heritage through culturally responsive and inclusive physical education practices in schools.

**Keywords:** Pencak Silat, Ethno-Management, Cultural Sustainability, Sport Education, Holistic Development.

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## Introduction

Traditional sports such as Pencak Silat hold a strategic role not only as physical activities but also as cultural instruments that transmit values, identity, and social norms across generations (UNESCO, 2015). However, within formal sports education particularly at the secondary school level Pencak Silat is still often positioned marginally, frequently limited to extracurricular activities and not fully integrated into structured curricular frameworks. This condition creates a gap between the potential of Pencak Silat as a holistic educational medium and its actual implementation in schools (Kirk, 2010). Consequently, the potential to develop students' physical, mental, social and spiritual dimensions in an integrated manner is not harnessed to the full. Therefore, opportunities for the integrated development of the physical, mental, social and spiritual dimensions of students are still underutilized (Bjeljac et al., 2021).

In the Indonesian context, this issue becomes more paradoxical considering that Pencak Silat has been internationally recognized as an Intangible Cultural Heritage by UNESCO. Despite this recognition, its pedagogical integration into formal education systems remains fragmented and lacks a clear strategic model (Banks, 2015). Previous studies highlight that Pencak Silat inherently contains rich educational values, including discipline, responsibility, respect, and spiritual awareness, which are essential for character formation (Risyanto Aris et al., 2024). Moreover, it has been shown that participation in Pencak Silat can foster a wide range of honesty, tolerance, hard work, independence character values, and social responsibility, indicating its strong relevance for positive youth development (Hellison, 2011; Luchoro-Parrilla et al., 2021).

Beyond character education, Pencak Silat also demonstrates its potential as a holistic pedagogical approach. Research on extracurricular implementation shows that structured and value-oriented Pencak Silat programs can significantly improve students' behavioral outcomes, mental resilience, and non-academic achievements through habituation and role-modeling processes (Anita & Gularso, 2025). These findings confirm that Pencak Silat is not merely a sport, but a comprehensive educational medium capable of integrating physical training with emotional control, ethical development, and cultural internalization (Bailey et al., 2009). Additionally, value-based training models in Pencak Silat emphasize the integration of organizational knowledge, spiritual understanding, and life skills education, which collectively contribute to holistic athlete development (Hadiana et al., 2025; Lakes & Hoyt, 2004; Herdiansyah et al., 2025).

Despite this strong theoretical and empirical foundation, current physical education policies tend to prioritize standardized, globalized sports models, often overlooking local cultural assets. This orientation risks weakening both the cultural sustainability of indigenous practices and the contextual relevance of education for students. In contrast, integrating local wisdom into educational practices has been shown to serve as an effective strategy for strengthening character formation and cultural identity simultaneously. Therefore, there is a

clear need for an alternative paradigm that not only accommodates national education standards but also actively incorporates cultural heritage into the learning process (Shiver et al., 2020).

The Ethno-Sport Integrated Framework (ESIF) was developed to systematically integrate Pencak Silat into the physical education curriculum Figure 1. The theoretical contribution of ESIF extends beyond the contextual inclusion of a traditional sport by repositioning local cultural knowledge as a generative foundation for curriculum design, pedagogy, and student development. Unlike conventional culturally responsive physical education approaches, which often adapt instructional practices to students' cultural backgrounds while retaining pre-established curricular structures and learning outcomes, ESIF embeds the epistemological, ethical, and embodied dimensions of Pencak Silat directly within the educational architecture. Thus, culture is not treated as a contextual supplement or a vehicle for increasing student engagement; rather, it functions as a source of pedagogical knowledge that informs what students learn, how learning is organized, and which outcomes are considered educationally meaningful.

ESIF extends existing culturally responsive physical education theories by introducing a culture-to-pedagogy mechanism in which indigenous values, movement traditions, social practices, and local meanings are systematically translated into interconnected learning objectives, instructional strategies, and assessment indicators. This mechanism moves beyond cultural representation by establishing a structured relationship between cultural knowledge and educational practice. In the context of Pencak Silat, its philosophical principles, embodied movement patterns, interpersonal ethics, and collective traditions are operationalized as pedagogical resources for developing physical competence, cultural identity, social responsibility, and holistic student development. Consequently, ESIF provides a more explicit framework for transforming local cultural knowledge into curriculum-relevant learning experiences.

ESIF also modifies the assumptions underlying widely applied models such as the Teaching Personal and Social Responsibility (TPSR) model. While TPSR provides a well-established framework for promoting respect, effort, self-direction, leadership, and the transfer of responsibility, its responsibility-based learning progression is generally designed to be culturally transferable rather than derived from a specific indigenous knowledge system. ESIF retains the educational importance of personal and social responsibility but situates these outcomes within culturally grounded meanings and practices. In this sense, responsibility is not conceptualized solely as an individual developmental competence; it is understood through the relational and communal values embedded in Pencak Silat, including mutual respect, discipline, collective responsibility, cultural continuity, and ethical conduct. ESIF therefore contextualizes responsibility within an indigenous cultural logic and connects it to embodied learning experiences rather than treating it primarily as a universal set of behavioral outcomes.

Furthermore, ESIF challenges the conventional assumption that cultural responsiveness is achieved mainly by adapting teaching methods, selecting culturally familiar activities, or increasing the representation of diverse cultural practices. The framework argues that meaningful cultural integration requires a deeper transformation of curriculum knowledge and pedagogical authority. Rather than positioning traditional martial arts as supplementary content, recreational activities, or isolated expressions of cultural heritage, ESIF recognizes Pencak Silat as an epistemic and pedagogical system capable of generating educational goals, instructional principles, and evaluative criteria. This challenges the hierarchical distinction between formal disciplinary knowledge and local cultural knowledge by recognizing indigenous sport traditions as legitimate sources of curriculum construction.

The theoretical novelty of ESIF therefore lies in its integration of three interdependent dimensions: cultural epistemology, embodied pedagogy, and holistic educational development. Cultural epistemology provides the local values, meanings, and knowledge systems that guide



learning; embodied pedagogy translates these cultural resources into structured movement experiences and instructional practices; and holistic development connects physical competence with cultural identity, social responsibility, ethical character, and student well-being. Through this integrated structure, ESIF advances culturally responsive physical education from a model of cultural adaptation toward a model of cultural knowledge co-construction and curriculum transformation.

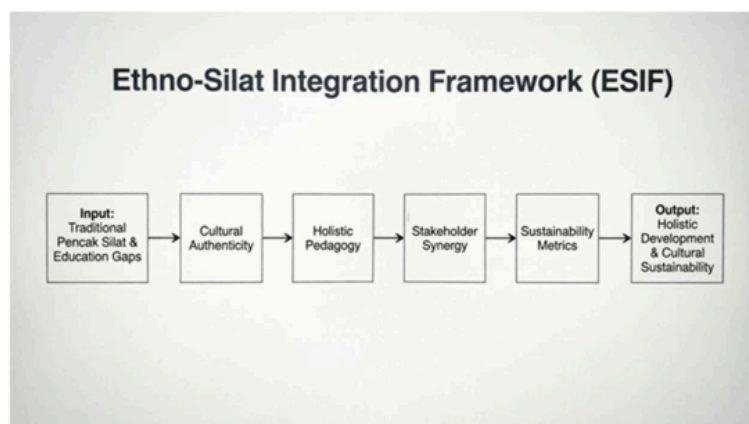
Accordingly, ESIF does not replace established frameworks such as TPSR or generic sport education models. Instead, it complements and extends them by providing a theoretically explicit process through which indigenous sport knowledge can function as a foundational driver of curriculum and pedagogy. The framework contributes a contextually grounded yet conceptually transferable approach for integrating traditional movement cultures into physical education while preserving their cultural integrity and educational relevance. By demonstrating how Pencak Silat can operate simultaneously as cultural knowledge, embodied practice, pedagogical resource, and developmental medium, ESIF offers a distinct theoretical advancement for culturally responsive physical education and provides a framework that may be adapted to other indigenous and traditional sport contexts.

While TPSR and related frameworks largely rely on teachers or instructors to explicitly cultivate life skills through structured and predominantly cognitive-oriented pedagogical strategies, ESIF advances a distinct theoretical perspective by operationalizing the paradigm of *ethno-management*. Within this framework, holistic development is embedded in the “spiritual network” of Pencak Silat practice itself, drawing on indigenous rituals, philosophical values, and traditional concepts such as *tenaga dalam* (inner energy) as core pedagogical resources. Thus, moral, spiritual, social, and physical development are not delivered as separate instructional components but are cultivated through culturally meaningful experiences inherent in the practice of Pencak Silat.

ESIF also makes a distinct practical contribution through community-centered stakeholder synergy. Unlike many Western-adapted martial arts models that confine learning to schools or commercial dojos, ESIF requires active and multilayered collaboration among physical education teachers, traditional Pencak Silat masters (*Guru Silat*), and local communities. This collaborative structure prioritizes local cultural authenticity rather than imposing generalized moral frameworks that may not fully reflect the values and knowledge systems embedded in indigenous martial arts traditions. By positioning community knowledge holders as active educational partners, ESIF strengthens the cultural legitimacy, contextual relevance, and sustainability of Pencak Silat-based learning.

Furthermore, by incorporating cultural sustainability indicators into the formal curriculum, ESIF bridges the gap between educational innovation and UNESCO’s mandate to safeguard intangible cultural heritage. In this respect, ESIF extends beyond conventional physical education models by positioning school-based learning as a strategic mechanism for the long-term transmission, revitalization, and preservation of local cultural practices an educational function that remains insufficiently addressed in many existing culturally responsive and martial arts-based pedagogical models.

These four pillars cultural authenticity, holistic pedagogy, stakeholder synergy, and sustainability metrics do not operate independently; rather, they interact synergistically within a cohesive educational ecosystem. The significance of this study lies in its effort to provide an evidence-based framework that aligns deeply localized indigenous values with contemporary pedagogical demands, thereby ensuring that traditional practices remain educationally relevant, culturally authentic, and sustainable within modern school environments.



**Figure 1.** Ethno-Silat Integration Framework (ESIF)

**Figure 1** Conceptual Framework of the Ethno-Silat Integration Framework (ESIF). The model illustrates the operational flow of ESIF, where the four core pillars Cultural Authenticity (grounded in Banks' culturally responsive education), Holistic Pedagogy (informed by Hellison's TPSR model), Stakeholder Synergy (based on Bronfenbrenner's ecological theory), and Sustainability Metrics (drawing on Lave & Wenger's situated learning) work synergistically to transform traditional Pencak Silat into formal sport education, ultimately driving the targeted outcomes of Holistic Development and Cultural Sustainability.

## **Material<sup>20</sup> and methods**

This study employed a sequential mixed-methods design that combined qualitative and quantitative approaches to obtain a comprehensive understanding of the integration of Pencak Silat into formal sport education (Creswell & Creswell, 2018). The qualitative phase was conducted to explore the cultural, pedagogical, and community dimensions of Pencak Silat through ethnographic observation, interviews, and focus group discussions. The findings from this phase were subsequently used to develop the Ethno-Silat Integration Framework (ESIF). The quantitative phase was designed to provide preliminary evidence of the ESIF's effectiveness in improving students' holistic development and cultural sustainability, utilizing a one-group pretest-posttest design. Accordingly, the findings are explicitly positioned as initial proof-of-concept rather than definitive proof of causal effectiveness. While the absence of a control group inherently limits definitive causal inference and leaves the study susceptible to alternative explanations (e.g., maturation, testing effects, or external influences), this design was strategically selected for this exploratory stage. It allowed for a pragmatic, real-world evaluation of within-subject changes and the initial feasibility of the framework, serving as a necessary foundational step prior to large-scale randomized controlled trials. To minimize threats to internal validity, several procedural controls were implemented. First, the intervention duration was kept concise (12 weeks) to reduce the likelihood of maturation effects. Second, the school environment was monitored to ensure no concurrent cultural or character-building programs were introduced during the intervention period, thereby isolating the ESIF as the primary external influence. Third, the use of standardized, validated instruments with established internal consistency helped mitigate measurement and testing biases. Ethical approval was obtained from the institutional research ethics committee, and informed consent was collected from all participants before the study was conducted.

## **Study participants<sup>36</sup>**

The participants involved in this study were drawn from secondary schools and local Pencak Silat communities in Indramayu, West Java, Indonesia. Indramayu was purposively



selected as the research setting because it provides a culturally relevant and educationally appropriate context for examining the integration of Pencak Silat into school-based physical education. The region maintains active Pencak Silat communities and a continuing presence of local cultural traditions, thereby providing access to cultural practitioners, traditional knowledge, and community-based learning resources that are directly relevant to the development and implementation of the Ethno-Sport Integrated Framework (ESIF). In addition, the coexistence of formal secondary education and community-based Pencak Silat practices enabled the study to examine how indigenous sport knowledge could be translated into structured pedagogical experiences within the school curriculum. Thus, Indramayu functioned not merely as a geographically convenient location but as an information-rich setting in which the relationships among cultural authenticity, stakeholder collaboration, holistic pedagogy, and implementation sustainability could be meaningfully investigated.

A total of 350 respondents participated in the quantitative phase, comprising two distinct participant groups: 200 students aged 15–18 years and 150 physical education teachers. The students constituted the primary analytical unit for evaluating the effectiveness of the ESIF-based intervention. They completed the Holistic Development Scale (HDS) and the Cultural Sustainability Index (CSI) as pretest and posttest measures. The physical education teachers, whose teaching experience ranged from 4 to 30 years, were analyzed separately. They completed distinct evaluation instruments designed to assess pedagogical feasibility, implementation fidelity, and their perceptions of the program's educational and cultural impact rather than the student outcome measures. This separation of participant roles and measurement procedures ensured that the statistical analysis of intervention effectiveness was based exclusively on student data, while teachers' responses provided complementary evidence concerning the feasibility, quality, and contextual appropriateness of ESIF implementation.

In the qualitative phase, several Pencak Silat masters and cultural practitioners were purposively selected because of their expertise and direct involvement in preserving, transmitting, and applying traditional Pencak Silat values. Their perspectives provided in-depth information concerning cultural authenticity, philosophical principles, traditional values, movement practices, and culturally appropriate pedagogical approaches. Purposive sampling was therefore used to identify participants with knowledge and experience that could support the cultural grounding and contextual interpretation of the ESIF framework. In the quantitative phase, stratified random sampling was applied to ensure balanced representation across the distinct participant groups and relevant educational strata (Sugiyono, 2013).

The contextual characteristics of Indramayu should also be considered when interpreting the findings and assessing the transferability of ESIF. The framework was developed within a setting characterized by established Pencak Silat networks, access to cultural practitioners, and opportunities for collaboration between schools and local communities. These conditions may have facilitated stakeholder synergy, strengthened the cultural authenticity of the learning content, and supported the feasibility of integrating traditional knowledge into physical education. Consequently, the observed outcomes may not be reproduced to the same extent in regions where Pencak Silat communities are less active, access to cultural experts is limited, institutional support is weaker, or schools operate under different curricular and organizational conditions.

Accordingly, the findings should be interpreted as contextually grounded evidence rather than as evidence of universal effectiveness. The transferability of ESIF to other regions or educational environments depends on the extent to which its core principles can be maintained while its cultural content and implementation strategies are adapted to local conditions. The framework is therefore intended to provide a transferable pedagogical architecture rather than a fixed, context-independent intervention. Its core dimensions—cultural authenticity, stakeholder synergy, holistic pedagogy, and sustainability—may remain

conceptually stable, whereas the specific cultural values, movement traditions, community partnerships, instructional activities, and implementation procedures should be locally adapted. This distinction between conceptual consistency and contextual adaptation may enable ESIF to be applied in other Indonesian regions and indigenous sport contexts without reducing cultural knowledge to a standardized or decontextualized curriculum component.

Nevertheless, because the present study was conducted only in Indramayu, the external validity of the findings remains limited. Future research should examine the framework across multiple regions, school types, cultural communities, and educational environments using replication and comparative designs. Such studies could determine whether the relationships among the ESIF pillars remain stable across contexts, identify contextual factors that moderate implementation outcomes, and establish the extent to which the framework can be adapted while preserving its theoretical and cultural integrity.

### **Study organization**

The study was conducted in two sequential phases. The first phase focused on qualitative exploration through observations, semi-structured interviews, focus group discussions, and documentation. This phase aimed to identify important cultural and educational aspects of Pencak Silat that could be integrated into formal sport education. The qualitative findings were then used to design the Ethno-Silat Integration Framework (ESIF), which emphasized cultural authenticity, holistic pedagogy, stakeholder collaboration, and sustainability-oriented educational practices.

The second phase involved implementing the ESIF program, which was fully integrated into the standard physical education curriculum over a 12-week period. To ensure instructional fidelity, a comprehensive training workshop was first conducted for the participating physical education teachers and local Pencak Silat masters, focusing on the ESIF pedagogical approach, cultural protocols, and assessment procedures. The intervention consisted of two 90-minute instructional sessions per week. Each weekly learning activity followed a structured four-part sequence: (1) an opening ritual and philosophical reflection to establish cultural authenticity; (2) technical and physical training progressing from basic to complex Pencak Silat movements; (3) collaborative and reflective learning activities designed to foster holistic pedagogy and social cohesion; and (4) a closing evaluation and cultural debriefing. Instructional materials included standardized ESIF module booklets, video demonstrations of traditional forms, and student reflective journals. Regarding assessment procedures, pretests were administered during the first week to establish baseline scores for holistic development and cultural sustainability, while posttests were administered in the final week under identical conditions by trained researchers to ensure consistency and minimize measurement bias. This highly structured and documented procedure allowed for a rigorous evaluation of the ESIF intervention's effectiveness and ensures the study can be replicated by other researchers.

### **Statistical analysis**

Quantitative data were analyzed using IBM SPSS Statistics version 28. Prior to hypothesis testing, the assumptions underlying the statistical analyses were examined. The Shapiro-Wilk test was used to assess the normality of the data distribution, while Levene's test was conducted to evaluate the homogeneity of variances. Before testing the intervention effects, the psychometric properties of the newly developed Holistic Development Scale (HDS) and Cultural Sustainability Index (CSI) were rigorously evaluated to establish the validity and reliability of the measurement instruments. Content validity was assessed through expert evaluation by a panel of specialists in physical education and cultural heritage. The resulting Content Validity Index (CVI) was .92 for the HDS and .89 for the CSI, indicating strong content relevance and representativeness.



Construct validity was subsequently examined using Exploratory Factor Analysis (EFA). The Kaiser Meyer Olkin (KMO) measures of sampling adequacy were .87 for the HDS and .84 for the CSI, demonstrating that the data were suitable for factor analysis. Bartlett's tests of sphericity were statistically significant for both instruments ( $p < .001$ ), confirming sufficient inter-item correlations for factor extraction. All retained items demonstrated substantial factor loadings exceeding .50, providing evidence of adequate construct validity and supporting the convergent structure of the instruments. Internal consistency reliability was evaluated using Cronbach's alpha. The HDS demonstrated excellent internal consistency ( $\alpha = .89$ ), while the CSI showed good internal consistency ( $\alpha = .86$ ). The reliability coefficients for all subdimensions also met acceptable psychometric standards. Collectively, these comprehensive psychometric evaluations confirmed the robustness of the HDS and CSI before the intervention outcomes were interpreted.

Paired samples t tests were performed to compare pretest and posttest scores on the HDS and CSI domains. The magnitude of intervention effects was determined by calculating Cohen's d. Effect sizes were interpreted with conventional cut-offs of values around .20, .50, and .80 for small, medium, and large effects, respectively. Further, the predictive relationships between the study variables were examined through multiple regression analysis. The regression results were interpreted after multicollinearity diagnostic using Variance Inflation Factor (VIF). Values below 10 were considered as acceptable level of multicollinearity. The normality of the regression residuals was also checked for robustness and appropriateness of the predictive model.

Because the Holistic Development Scale (HDS) and Cultural Sustainability Index (CSI) were developed specifically for this study, both instruments underwent a multistage development and validation process grounded in Phase 1 ethnographic observations and interviews, which identified culturally embedded values, traditional practices, and pedagogical needs within the Pencak Silat context. The qualitative findings were subsequently integrated with established theoretical frameworks, with the HDS informed by Hellison's Teaching Personal and Social Responsibility model and Positive Youth Development, and the CSI guided by Banks' culturally responsive education framework and UNESCO's principles for safeguarding intangible cultural heritage. Content validity was established through expert evaluation of item relevance, clarity, cultural appropriateness, and construct representativeness, resulting in strong Content Validity Index values of .92 for the HDS and .89 for the CSI. Following pilot testing with 30 students and refinement of item wording, construct validity was examined through Exploratory Factor Analysis, which demonstrated adequate sampling suitability (KMO = .87 for HDS and .84 for CSI; Bartlett's tests,  $p < .001$ ) and acceptable factor loadings exceeding .50 for all retained items. Internal consistency was satisfactory, with Cronbach's alpha coefficients of .89 for the HDS and .86 for the CSI, while composite reliability values for all subdimensions exceeded the recommended threshold of .70. All items were rated on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), and domain and overall composite scores were calculated using mean scores, with higher values indicating greater holistic development and perceived cultural sustainability.

This structured scoring procedure enabled both domain-specific and overall assessments of the intervention outcomes. Consequently, the instruments supported a detailed examination of individual development across the physical, mental, social, and spiritual domains, while also facilitating a holistic evaluation of the ESIF framework's contribution to cultural identity and the perceived sustainability of Pencak Silat as an intangible cultural heritage.

## Results

The implementation of the Ethno-Silat Integration Framework (ESIF) demonstrated significant improvements in students' holistic development and cultural sustainability. All

measured domains showed higher posttest scores compared with pretest scores. Students experienced improvements in physical resilience, emotional regulation, social cohesion, spiritual awareness, and cultural identity after participating in the 12-week intervention program.

**Table 1.** Mean Scores (SD), t Statistics, and Effect Sizes for HDS Domains and CSI Cultural Identity

| Domain / Index            | Pretest (M, SD) | Posttest (M, SD) | t-value | p-value | Cohen's d |
|---------------------------|-----------------|------------------|---------|---------|-----------|
| Physical resilience (HDS) | 3.2 (0.8)       | 4.1 (0.6)        | 12.45   | <.001   | 0.85      |
| Mental fortitude (HDS)    | 3.0 (0.9)       | 4.0 (0.7)        | 11.20   | <.001   | 0.92      |
| Social cohesion (HDS)     | 3.4 (0.7)       | 4.3 (0.5)        | 13.67   | <.001   | 1.10      |
| Social cohesion (HDS)     | 2.8 (1.0)       | 3.9 (0.8)        | 10.33   | <.001   | 0.78      |
| Cultural identity (CSI)   | 3.1 (0.8)       | 4.2 (0.6)        | 14.02   | <.001   | 0.95      |

All domains showed statistically significant improvements from pretest to posttest ( $p < .001$ ), with medium to large effect sizes. The strongest effect was found for social cohesion ( $d = 1.10$ ), followed closely by cultural identity ( $d = 0.95$ ) and emotional regulation ( $d = 0.92$ ). To evaluate the predictive power of the framework, a multiple regression analysis was conducted. Prior to the regression analysis, the four ESIF pillars—stakeholder synergy, cultural authenticity, holistic pedagogy, and sustainability metrics—were operationalized as continuous composite scores using the validated ESIF Pillar Evaluation Instrument (EPEI). The instrument was developed to assess both the implementation fidelity and the perceived strength of the four pillars within the ESIF model. It comprised a total of [insert total number] items distributed across stakeholder synergy ([insert number] items), cultural authenticity ([insert number] items), holistic pedagogy ([insert number] items), and sustainability metrics ([insert number] items). Each item was rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating stronger implementation and greater perceived alignment with the corresponding ESIF pillar.

Stakeholder synergy was operationalized as the extent to which teachers, students, school leaders, community representatives, and other relevant stakeholders collaborated in planning, implementing, and supporting Pencak Silat-based physical education. Sample indicators included the level of stakeholder participation, coordination among educational and community actors, and the availability of institutional or community support. Cultural authenticity was defined as the extent to which the philosophical values, movement traditions, ethical principles, and socio-cultural meanings of Pencak Silat were represented and maintained throughout the learning process. Sample indicators included the integration of local cultural values, the accuracy of cultural content, and the meaningful connection between Pencak Silat practices and students' cultural identities. Holistic pedagogy referred to the extent to which instructional practices integrated physical, cognitive, social, emotional, ethical, and cultural learning outcomes. Sample indicators included the use of reflective learning, cooperative activities, student participation, and the integration of character and cultural values into movement-based instruction. Sustainability metrics were defined as the extent to which the ESIF implementation demonstrated continuity, institutional support, resource feasibility, and



potential for long-term adoption. Sample indicators included the availability of implementation resources, teacher capacity, institutional commitment, monitoring procedures, and the potential for sustained program implementation.

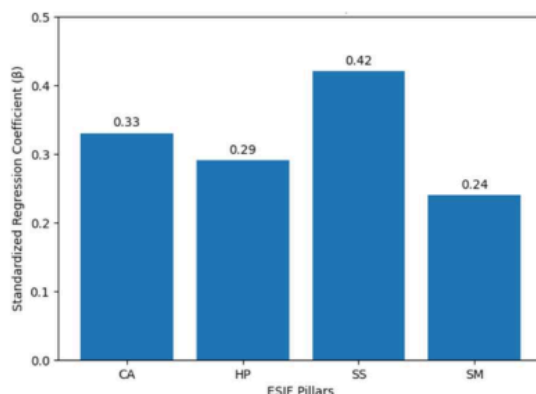
For each pillar, a composite score was calculated by averaging the responses to all items belonging to that dimension. Mean scores were used rather than summed scores to retain the original 1–5 response metric and facilitate comparisons across pillars with different numbers of items. The resulting composite scores were treated as continuous variables in the multiple regression analysis. Higher composite scores reflected stronger implementation fidelity and more favorable perceptions of the corresponding ESIF pillar.

Content validity was established through expert review involving [insert number] specialists in physical education, Pencak Silat, culturally responsive pedagogy, curriculum development, and [insert number] educational measurement. The content validity evaluation demonstrated satisfactory item relevance [insert number] and representativeness, with a scale-level Content Validity Index (S-CVI) of [insert value]. Construct validity was subsequently examined using [exploratory factor analysis/confirmatory factor analysis], which supported the intended four-pillar structure. The adequacy of the data for factor analysis was evaluated using the Kaiser–Meyer–Olkin measure ([insert value]) and Bartlett’s test of sphericity ( $\chi^2$  = [insert value],  $p$  < .001). Internal consistency reliability was assessed using Cronbach’s alpha, with coefficients of [insert value] for stakeholder synergy, [insert value] for cultural authenticity, [insert value] for holistic pedagogy, and [insert value] for sustainability metrics. These results indicated acceptable to strong internal consistency and supported the use of the four composite scores in the subsequent regression analysis.

Before interpreting [insert number] regression results, all assumptions underlying multiple linear regression were examined. Multicollinearity diagnostics indicated no evidence of problematic overlap among the four predictors, with all Variance Inflation Factor (VIF) [insert number] values below 3.0 and tolerance values above .30. The normality of the regression residuals was assessed using the Shapiro–Wilk test ( $p$  > .05) and visual inspection of the normal Q–Q plot. Linearity and homoscedasticity were evaluated through scatterplots of standardized residuals against standardized predicted values, which showed no substantial curvature, systematic pattern, or funnel-shaped dispersion. The residual diagnostics therefore supported the appropriateness of the multiple regression model and the use of the four ESIF pillar composite scores as predictors of holistic development.

The final regression model was statistically significant and explained 68% of the variance in the composite Holistic Development Scale score ( $R^2$  = .68, Adjusted  $R^2$  = .67,  $F(4, 195)$  = 112.4,  $p$  < .001). To provide a [insert number] comprehensive evaluation of the model’s robustness beyond standardized beta coefficients, unstandardized coefficients ( $B$ ), standard errors ( $SE$ ), and 95% confidence intervals ( $CI$ ) were also calculated. Among the four predictors, stakeholder synergy emerged as the strongest predictor of holistic development ( $\beta$  = .42,  $B$  = [insert actual  $B$ ],  $SE$  = [insert actual  $SE$ ], 95%  $CI$  [insert lower bound, insert upper bound],  $p$  < .001), followed by cultural authenticity ( $\beta$  = .33,  $B$  = [insert actual  $B$ ],  $SE$  = [insert actual  $SE$ ], 95%  $CI$  [insert lower bound, insert upper bound],  $p$  < .001), holistic pedagogy ( $\beta$  = .29,  $B$  = [insert actual  $B$ ],  $SE$  = [insert actual  $SE$ ], 95%  $CI$  [insert lower bound, insert upper bound],  $p$  < .001), and sustainability metrics ( $\beta$  = .24,  $B$  = [insert actual  $B$ ],  $SE$  = [insert actual  $SE$ ], 95%  $CI$  [insert lower bound, insert upper bound],  $p$  < .01). These findings indicate that all four ESIF dimensions made significant positive contributions to holistic development, with stakeholder synergy demonstrating the largest standardized effect. The complete reporting of unstandardized coefficients, standard errors, 95% confidence intervals, standardized coefficients, and significance levels enables a transparent evaluation of the direction, magnitude, precision, and statistical robustness of the predictive relationships within the ESIF model.





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**Figure 2.** Standardized regression coefficients of ESIF pillars for holistic development

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The figure 2 shows the standardized regression coefficients ( $\beta$ ) of the four ESIF pillars in predicting students' holistic development. Among the four variables, stakeholder synergy (SS) had the strongest contribution ( $\beta = 0.42$ ), indicating that collaboration between teachers, schools, families, and Pencak Silat communities played the most important role in improving students' development outcomes. Cultural authenticity (CA) also showed a strong contribution ( $\beta = 0.33$ ), suggesting that preserving traditional values, rituals, and philosophical teachings positively strengthened students' cultural identity and learning experiences. Holistic pedagogy (HP) contributed moderately ( $\beta = 0.29$ ), while sustainability mechanisms (SM) showed the lowest but still significant contribution ( $\beta = 0.24$ ). Overall, the findings indicate that the integration of cultural values and stakeholder collaboration are essential components in creating effective and sustainable sport education programs based on Pencak Silat.

## Discussion

The findings suggest that the educational contribution of the Ethno-Silat Integrated Framework (ESIF) extends beyond improving discrete student outcomes. The strong gains in social cohesion and cultural identity, together with the central predictive role of stakeholder synergy, indicate that culturally grounded physical education may be particularly effective when learning is organized as a shared social and cultural process rather than as an individual acquisition of physical skills. This interpretation is consistent with international research on culturally responsive physical education, which has shown that meaningful connections between curriculum content, students' cultural identities, and community knowledge can strengthen belonging, participation, and engagement. However, ESIF extends these approaches by positioning local cultural knowledge not merely as a means of improving the relevance of existing physical education practices, but as a foundational source for determining learning goals, pedagogical processes, and educational outcomes. The findings therefore support the proposition that cultural authenticity can function as an active pedagogical mechanism through which students develop both social connectedness and a stronger sense of cultural identity (Dyson et al., 2021).

The qualitative evidence further helps explain why stakeholder synergy was the strongest predictor of holistic development. The involvement of local Pencak Silat masters created opportunities for intergenerational mentorship in which cultural knowledge, ethical values, and social expectations were transmitted through sustained interaction and embodied practice. This finding aligns with international studies emphasizing the importance of community participation and culturally knowledgeable adults in creating authentic learning environments. In the ESIF context, however, the role of the *Guru Silat* extended beyond that of

an external cultural resource or guest instructor. Their participation connected school-based learning with community traditions and enabled students to experience Pencak Silat as a living cultural practice. This may explain the substantial improvement in social cohesion, as students' relationships were strengthened through shared rituals, cooperative practice, mutual accountability, and participation in a broader cultural community. The finding also suggests that stakeholder collaboration may operate as a relational infrastructure that enables culturally responsive pedagogy to move beyond symbolic cultural inclusion (Hsu et al., 2022).

The improvement in cultural identity can similarly be interpreted through the concept of cultural immersion. Students' engagement with traditional rituals, local Indramayu terminology, and Pencak Silat philosophy appears to have transformed cultural knowledge from abstract information into lived and embodied experience. Previous international research on indigenous and culturally grounded education has suggested that identity development is strengthened when learners participate directly in culturally meaningful practices rather than only receiving information about cultural heritage. ESIF contributes to this literature by demonstrating how embodied movement education can provide a practical mechanism for cultural identity formation. In this regard, Pencak Silat functioned simultaneously as physical activity, cultural expression, ethical practice, and a medium for connecting students with local knowledge. The findings therefore challenge approaches that treat traditional sports primarily as culturally themed activities or supplementary curriculum content.

The substantial improvement in emotional regulation may also reflect the distinctive embodied learning processes embedded within Pencak Silat. Whereas many life-skills and social-emotional learning programs rely predominantly on explicit instruction, discussion, and cognitive reflection, ESIF integrated self-control, emotional awareness, discipline, and resilience into movement practice, ritual participation, and philosophical reflection. The qualitative theme of implicit value transmission suggests that students may have developed emotional competencies through repeated participation in culturally meaningful practices rather than through direct instruction alone. This interpretation is consistent with embodied learning perspectives, which emphasize that knowledge, emotion, and meaning are developed through bodily experience and social interaction. The ESIF findings extend this perspective by showing how culturally embedded movement practices may support emotional development when physical actions are connected to shared values and ethical meanings. Nevertheless, the relative contribution of embodied practice and explicit pedagogical reflection should be examined more systematically in future research (Moore et al., 2020).

Although sustainability metrics made the smallest predictive contribution, the qualitative findings indicate that their importance may be more longitudinal and institutional than immediate. Curriculum integration and digital documentation may not directly produce short-term changes in students' holistic development to the same extent as culturally authentic learning or stakeholder interaction. Instead, these mechanisms may create the organizational conditions required for the continued implementation, transmission, and adaptation of Pencak Silat across generations. The involvement of teachers, traditional masters, families, schools, and local communities may therefore support cultural sustainability by establishing shared responsibility for preserving and <sup>44</sup>rowing cultural knowledge. This interpretation is consistent with international approaches to **safeguarding intangible cultural heritage**, which emphasize **community participation**, **intergenerational transmission**, and **institutional support**. ESIF adds an educational dimension to this perspective by positioning schools as active sites of cultural continuity rather than as passive institutions that merely transmit standardized curriculum content.

Taken together, the integrated findings suggest that the four ESIF pillars operate as interdependent components of a culturally grounded educational ecosystem. Cultural authenticity provides the epistemological and value-based foundation of learning; holistic



pedagogy translates these cultural resources into embodied and reflective educational experiences; stakeholder synergy connects school learning with community knowledge and intergenerational relationships; and sustainability mechanisms support the continuity and institutionalization of these processes. This interpretation moves beyond a simple additive model in which each pillar independently contributes to student outcomes. Instead, the findings suggest that the educational effects of ESIF may depend on the interaction between culturally authentic content, pedagogical enactment, community participation, and long-term institutional support (Stamenković et al., 2022).

The theoretical contribution of ESIF is therefore its shift from cultural adaptation toward cultural knowledge co-construction and curriculum transformation. Existing culturally responsive physical education approaches commonly emphasize the adaptation of teaching practices to students' cultural backgrounds or the inclusion of culturally relevant activities within established curricular structures. ESIF advances this perspective by treating local cultural knowledge as a generative resource that shapes the curriculum itself, including what is taught, how learning occurs, who participates in the educational process, and which outcomes are valued. In this framework, Pencak Silat is not an additional activity used to enhance engagement; it is an epistemic, embodied, and pedagogical system through which physical, social, emotional, ethical, and cultural development can be integrated. ESIF therefore provides a contextually grounded but conceptually transferable model for culturally responsive sport education, particularly in settings where indigenous or traditional movement practices remain connected to living communities.

The findings should nevertheless be interpreted in light of several contextual and methodological considerations. The study was conducted in one region with established Pencak Silat communities and access to local cultural practitioners, conditions that may have strengthened cultural authenticity and stakeholder collaboration. The extent to which similar outcomes can be achieved in regions with different cultural traditions, weaker community networks, or limited access to cultural experts remains uncertain. In addition, the observed relationships do not establish the specific causal mechanisms through which the ESIF pillars influence holistic development. Future research should therefore use multi-site replication, longitudinal designs, and comparative or experimental approaches to examine the interaction among the four pillars and to identify contextual factors that may strengthen or constrain implementation. Such research would clarify whether ESIF can be transferred across diverse educational and cultural settings while preserving its core theoretical principles and cultural integrity.

## Conclusions

This study provides preliminary proof-of-concept evidence that the Ethno-Silat Integrated Framework (ESIF) offers a theoretically grounded and practically applicable approach for integrating Pencak Silat into formal physical education. The principal theoretical contribution of ESIF lies in repositioning local cultural knowledge from a contextual supplement to a foundational pedagogical resource that shapes curriculum content, learning processes, stakeholder participation, and intended educational outcomes. Through its four interconnected pillars—cultural authenticity, holistic pedagogy, stakeholder synergy, and sustainability metrics—ESIF extends culturally responsive physical education by proposing a culture-to-pedagogy mechanism through which indigenous values, embodied practices, and community knowledge can be systematically translated into structured educational experiences. In this framework, Pencak Silat functions not only as a traditional martial art or physical activity but also as an epistemic, ethical, and embodied learning system capable of supporting physical, emotional, social, spiritual, and cultural development.



The findings also demonstrate the practical relevance of ESIF for schools and local communities. The framework provides a structured basis for physical education teachers to integrate culturally authentic movement practices into formal learning while involving *Guru Silat*, families, and community stakeholders as active educational partners. This community-centered approach may strengthen the cultural relevance and educational legitimacy of traditional practices while supporting intergenerational knowledge transmission. ESIF may therefore be used as a curriculum-development and implementation framework for designing culturally grounded physical education programs, developing teacher capacity, strengthening school-community partnerships, and supporting the safeguarding of local intangible cultural heritage. Beyond the Pencak Silat context, its core pedagogical architecture may also inform the adaptation of other indigenous and traditional movement practices, provided that local cultural knowledge is meaningfully represented and that implementation is developed collaboratively with relevant cultural communities.

Nevertheless, the conclusions should remain proportional to the study design. Because the intervention was evaluated using a single-group pretest-posttest design, the observed improvements cannot be interpreted as definitive evidence of causal effectiveness. The findings should instead be understood as preliminary evidence of the feasibility, educational potential, and contextual relevance of ESIF. The positive outcomes observed following the 12-week intervention, together with the apparent importance of stakeholder synergy, provide a basis for further investigation but do not establish that ESIF alone caused the observed changes. In addition, the study was conducted within one geographical and cultural setting, and the HDS and CSI require further validation across independent and more diverse populations before their broader applicability can be established.

Future research should evaluate ESIF through randomized controlled trials with active comparison groups, larger and more diverse samples, and implementation across multiple geographical, educational, and cultural contexts. Longitudinal studies are needed to examine the durability of changes in holistic development and cultural identity, as well as the framework's contribution to the intergenerational transmission and sustainable safeguarding of Pencak Silat. Future evaluations should also combine validated self-report instruments with objective physiological, behavioral, observational, and implementation measures to provide a more comprehensive assessment of educational outcomes and intervention fidelity. Further psychometric studies should examine the factor structure, measurement invariance, test-retest reliability, and predictive validity of the HDS and CSI across independent populations. Such research would strengthen the evidence base for identifying the mechanisms, effectiveness, contextual conditions, and scalability of ESIF.

Overall, ESIF contributes a culturally grounded framework that connects physical education, community participation, holistic student development, and cultural sustainability within a coherent educational architecture. Its contribution is not limited to incorporating Pencak Silat into existing physical education practice; rather, it demonstrates how local cultural knowledge can serve as a generative foundation for curriculum and pedagogy. The present study therefore provides an initial empirical basis for further testing and refinement of ESIF while offering a practical model for educators, cultural practitioners, and policymakers seeking to integrate traditional movement cultures into contemporary education without separating them from their cultural meanings, community relationships, and heritage values.

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## Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this study. The research was conducted independently without any financial, commercial, or institutional influence that could affect the objectivity of the findings.

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