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The Learning Ecology of Sprint Running in Physical Education: A Qualitative Multiple-Case Study of Instructional Practices, Learner Diversity, and Contextual Constraints

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ABSTRACT

Background & objective: Sprint running in physical education requires repeated practice, technica feedback, appropriate task organisation, and adaptation to differences in learner ability. However evidence is still limited regarding how these components operate together under authentic schoo conditions. This study aimed to analyse the sprint-running learning process in physical education focusing on curriculum alignment, instructional implementation, teaching methods and feedback assessment, learner diversity, and contextual constraints.

Materials & Methods: A qualitative multiple-case study was conducted across 20 public junior high schools in Medan, North Sumatra, Indonesia. Participants comprised 36 physical education teachers and 300 students, supported by 20 school-level document profiles. Data were collected through 140 non-participant observation sessions, semi-structured interviews, document analysis, and field notes Data were analysed using within-case and cross-case coding following the interactive framework Descriptive frequencies were calculated for coded teacher and student records and reported as n/N (%)

Results: Curriculum alignment was identified in 35/36 teacher records (97.2%), technical feedback ir 34/36 (94.4%), and multidomain assessment in 33/36 (91.7%). Student heterogeneity was coded ir 29/36 records (80.6%). Facility constraints occurred in 28/36 teacher records (77.8%), while waiting time was reported in 233/300 student records (77.7%). Students also reported useful feedback (83.0%) and preference for games or relay activities (75.0%).

Conclusions: Sprint instruction showed a strong curricular and pedagogical foundation but remained constrained by facilities, waiting time, instructional organisation, and learner heterogeneity. Improving practice opportunities through diagnostic differentiation, efficient group organisation, formative feedback, and context-appropriate media may strengthen sprint-learning implementation.

Keywords
physical education; running; adolescent; teaching; feedback.

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INTRODUCTION

Physical education (PE) is a learning domain in which movement practice, conceptual understanding, social interaction, health, and personal development are developed through active participation (Mackinney, 2025; Nashwan, 2026). Within the Merdeka Curriculum, PE at the lower-secondary level is expected to support not only the acquisition of movement skills, but also students' ability to understand, apply, analyse, and adapt movement in different situations (Kaloka et al., 2025, p. 19; Syaukani et al., 2023, p. 72). The curriculum therefore positions movement learning within a broader competency framework that includes cognitive, affective, and psychomotor development (Bian et al., 2024, p. 1306454; Dudley, 2015, p. 15) . In this context, the quality of PE cannot be evaluated solely by whether students complete a physical task; it also depends on how learning is planned, organised, supported, assessed, and adapted to students' needs.

Sprint running represents an important PE content area because successful performance requires the coordinated development of body position, arm action, step pattern, acceleration, reaction, and start and finish techniques (Brunssen et al., 2025, p. 5; Saleh et al., 2026). Learning to sprint therefore requires more than repeated running. Students need opportunities to observe correct movement, perform the skill repeatedly, receive specific feedback, identify technical errors, and progressively adjust their movement (Haugen et al., 2019, p. 52). A process-oriented understanding of sprint instruction is consequently important because the learning conditions in which practice occurs may shape the quality and distribution of students' opportunities to develop movement competence.

This issue becomes more complex in heterogeneous PE classes. Students may differ in prior sport experience, movement competence, confidence, motivation, and readiness to perform high-intensity tasks (Bryan & Solmon, 2007, p. 379; Zhang et al., 2021, p. 5001). Differentiated instruction has consequently been identified as a relevant strategy for responding to learner diversity in PE. Recent literature from the Indonesian context indicates that differentiated learning can support more responsive instruction, but its implementation is affected by teacher preparation,

resources, assessment practices, and classroom conditions (Colquitt et al., 2017; Prabawanata et al., 2025) . This suggests that recognising learner differences is not sufficient; teachers also need practical mechanisms for translating those differences into task organisation, practice progression, and feedback.

Feedback is particularly important in skill-based PE because students need information that connects their current movement with the intended movement pattern. Previous evidence has indicated that feedback can contribute to motor skill learning, particularly when it is specific and directly related to movement performance (Han et al., 2022; Lee et al., 1993). Subsequent evidence has further examined feedback as a mechanism for promoting motor-skill learning in PE (Zhou et al., 2022). In sprint learning, feedback may concern start position, reaction, acceleration mechanics, arm action, step rhythm, and finishing technique (Hermassi et al., 2019, p. 2102; Zhou et al., 2021). However, the pedagogical value of feedback also depends on whether learners have sufficient opportunities to practice and whether the teacher can distribute corrective information across students.

Game-based and collaborative activities provide another potentially important component of PE pedagogy. Recent evidence suggests that collaborative and game-based approaches can support participation and movement learning when the design of the activity remains closely connected to the intended learning outcomes (Kumar et al., 2025; Saha et al., 2026; Triansyah et al., 2025, p. 1295). Indonesian research has also examined game-based approaches in sprint-related learning and reported positive learning responses, although such studies commonly focus on the effectiveness of a particular intervention or activity(Herlandy et al., 2024, p. 193; Videnovik et al., 2023, p. 17; Yasriuddin et al., 2024, p. 191). The distinction is important because a game may increase engagement without necessarily ensuring that the technical demands of sprint learning are adequately addressed (Tyni et al., 2022, p. 31578). Understanding how games, drills, demonstrations, and feedback are combined in real PE lessons therefore requires attention to the whole instructional process rather than to one teaching method in isolation.

The physical and organisational environment may further influence the quality of sprint instruction. Sprint learning requires space for repeated movement, equipment that supports appropriate starting and running tasks, sufficient instructional time, and an organisational structure that minimises unnecessary waiting (Nicholson et al., 2021, p. 272; Shearer et al., 2021, p. 68). In schools where facilities are limited or classes are large, teachers may need to adapt equipment, group students, rotate practice stations, or modify tasks. Such adaptations are pedagogically important because they affect how much active practice students receive and how effectively technical feedback can be provided (Ma et al., 2023, p. 140; Nguyen et al., 2021, p. 11). Accordingly, facilities, class organisation, and instructional time should be considered part of the learning ecology rather than merely as background conditions.

Despite growing research on differentiated instruction, feedback, and game-based learning in PE, an important knowledge gap remains. Much of the existing sprint-related literature examines whether a particular model, game, or training approach improves learning outcomes. Such intervention-focused studies provide valuable evidence about specific strategies, but they provide less information about how sprint instruction operates as an interconnected process under authentic school conditions (Allen et al., 2011, p. 1037; Turvey & Pachler, 2019, p. 103748). In particular, there is a need to examine the relationship among curriculum planning, instructional organisation, teacher demonstration, feedback, differentiated tasks, assessment, student experience, and contextual constraints across multiple school settings.

This study addresses that gap through a qualitative multiple-case examination of sprint-running instruction across 20 public junior high schools in Medan, North Sumatra, Indonesia. Rather than testing the causal effectiveness of a single instructional intervention, the study investigates how sprint learning is planned, implemented, assessed, and adapted in authentic school environments. Evidence is considered across teacher and student perspectives, non-participant observations, interviews, documentary materials, and field notes. The study also examines the extent to which recurring instructional patterns converge across cases and data sources.

The novelty of the study lies in its process-oriented and ecological perspective. Instead of treating curriculum alignment, feedback, games, differentiation, assessment, and facilities as independent topics, the study examines how these elements interact to shape opportunities for active practice and learning in sprint instruction. This perspective is especially relevant for contexts in which teachers must maintain curriculum expectations while working with heterogeneous learners, limited resources, and finite instructional time.

Accordingly, the study aims to analyse the sprint-running learning process in PE across the participating junior high schools with five interconnected foci: (1) lesson planning and learning objectives; (2) instructional implementation and organisation of practice; (3) teaching methods, learning media, and teacher feedback; (4) assessment of student learning; and (5) contextual constraints and instructional adaptations. By addressing these dimensions together, the study seeks to provide a contextual explanation of how sprint instruction is organised in practice and to identify pedagogical mechanisms that may be strengthened in future PE implementation and intervention research.

MATERIALS AND METHODS

Research Design
Research Sites and Case Definition
Participants and Sampling
Eligibility and Exclusion Criteria
Data Sources and Data Collection
Coding Framework and Data Analysis
Trustworthiness
Researcher Reflexivity

Researcher reflexivity was incorporated because professional backgrounds in physical education and sprint-related activities could influence data collection and interpretation. The research team comprised three researchers with complementary backgrounds: a university lecturer/researcher in physical education, a sprint-running coach, and an Indonesian national-level track-and-field athlete. A structured observation protocol, reflexive field notes, and cross-source comparison were used to reduce the risk of relying on a single interpretation. When researchers differed in interpretation, the underlying evidence was revisited and discussed until an

interpretation supported by the dataset was established.

Ethical Approval and Consent

Data Management and Availability

Reporting Standards

Editorial consistency note before submission

The revised Methods section is aligned with the current Results dataset: 20 school cases, 36 PE teachers, 300 students, and 20 school-level document profiles; 140 observation sessions; qualitative coding followed by descriptive frequency tabulation (n/N, %); and no inferential or causal testing. One remaining manuscript-level inconsistency must be resolved before submission: the title and Introduction currently identify SMP Swasta Asuhan Jaya Kota Medan, whereas the Methods and revised Results identify 20 public junior high schools in Medan.

RESULTS

The empirical coding dataset comprised records from 20 school cases, 36 physical education (PE) teachers, 300 students, and 20 school-level document profiles. The Results are reported as descriptive frequencies of coded evidence (n/N, %) rather than as population prevalence estimates. Percentages therefore describe the proportion of records in the supplied dataset in which a theme was coded as present.

Evidence Base and Cross-Case Pattern

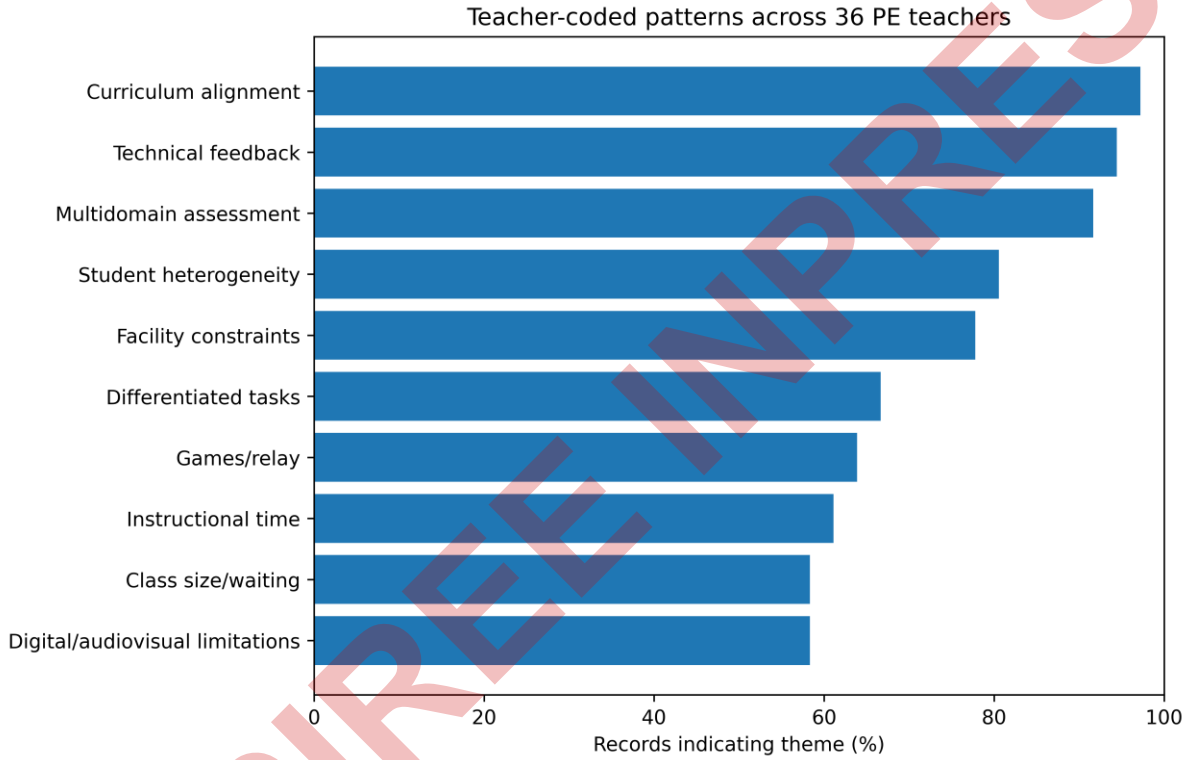

Figure 1. Teacher-coded patterns across the 36 PE teacher records.

Lesson Planning and Curriculum Alignment

Instructional Implementation, Demonstration, Games, and Feedback

Time, Class Organization, and Facility Constraints

Differentiation, Task Difficulty, and Learner Response

Digital Media and Multidomain Assessment

Table 4. Cross-source convergence of recurring themes

Theme	Teachers n/N (%)	Students n/N (%)	Cross-source reading	Caution
Technical / useful feedback	34/36 (94.4%)	249/300 (83.0%)	Strong convergence around feedback as a recurrent instructional feature.	Teacher and student indicators are related but not identical.
Games / relay	23/36 (63.9%)	225/300 (75.0%)	Game-based activity recurs in both teacher practice and student preference.	Preference should not be interpreted as causal effectiveness.
Waiting / class-size constraint	21/36 (58.3%)	233/300 (77.7%)	Waiting is more salient in student experience than in teacher coding.	Different indicators capture related constructs.
Facility limitations	28/36 (77.8%)	187/300 (62.3%)	Resource constraints recur across both sources.	Constraints are contextual rather than universal.
Differentiation / task difficulty	24/36 (66.7%)	183/300 (61.0%)	Differentiation is visible in both instructional organization and learner experience.	Presence does not establish quality or causal benefit.

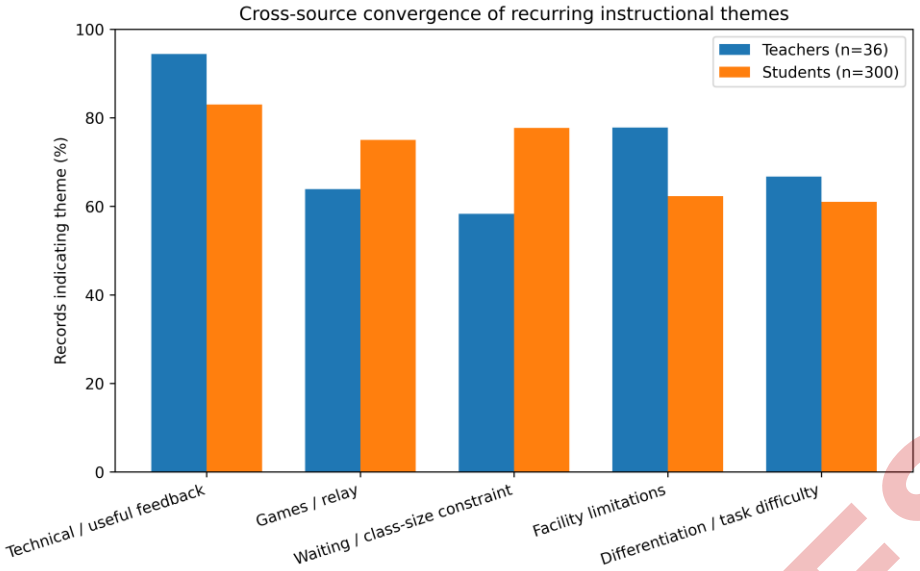

Figure 2. Cross-source convergence of recurring instructional themes.

Overall, the Results identify a coherent instructional pattern across the school cases: curriculum-aligned planning and strong technical feedback coexist with recurring constraints involving facilities, waiting time, instructional time, and learner heterogeneity. The student records reinforce several of these patterns, particularly the salience of useful feedback, teacher demonstration, games/relay activities, and waiting time. The findings are descriptive and cross-case; they should not be interpreted as evidence that any single instructional strategy caused improved learning outcomes.

DISCUSSION

This study examined sprint-running instruction in physical education across 20 school cases by integrating teacher, student, and contextual evidence. The central finding is that the instructional process was not characterised by an absence of pedagogical strategy; rather, it was characterised by a relatively strong instructional foundation that was constrained by the conditions in which practice occurred. Curriculum alignment was coded in 35 of 36 teacher records (97.2%), technical feedback in 34 (94.4%), and multidomain assessment in 33 (91.7%). At the same time, facility constraints were coded in 28 records (77.8%), while student waiting time was reported in 233 of 300 student records (77.7%). This combination suggests that the principal challenge is the translation of sound instructional intentions into sufficiently frequent, differentiated, and feedback-rich practice opportunities.

Curriculum Alignment Provides a Strong Instructional Foundation

Feedback Is a Core Mechanism Linking Demonstration and Practice

Game-Based Activities Function as Engagement-Supporting Pedagogy, Not Merely Recreation

Differentiation Remains the Main Pedagogical Development Gap

Practice Time and Resource Constraints Shape the Pedagogy Itself

Multidomain Assessment Is Present, but Its Formative Function Needs Strengthening

Digital Media Should Be Used to Improve Visual Feedback, Not as a Technological Add-On

Theoretical and Practical Contribution

Limitations and Interpretation of the Evidence

Several limitations should guide interpretation. First, the study is qualitative and cross-case; the coded frequencies describe the occurrence of themes in the supplied dataset and should not be interpreted as estimates of prevalence in the wider population. Second, the teacher and student indicators are not perfectly equivalent constructs, so cross-source percentages should be interpreted as evidence of thematic convergence rather than direct measurement agreement. Third, the study did not objectively quantify active learning time, movement repetitions, or technical improvement. Fourth, because the design was not experimental, the findings cannot establish that feedback, games, differentiation, or digital media caused improvements in sprint performance. Finally, the interpretation depends on alignment between the empirical dataset and the study description; the manuscript should ensure that the final Methods, Results, and Discussion all report the same school and participant frame before submission.

Overall Interpretation

Taken together, the findings indicate that sprint-running instruction can be pedagogically structured and responsive even in resource-constrained settings, but instructional quality depends strongly on how opportunities for practice, feedback, and differentiation are organised. The most consequential issue is therefore not the selection of a single superior method. Instead, the evidence points to an ecological view of PE instruction in which curriculum goals, teacher feedback, learner diversity, task design, class organisation, assessment, and available resources operate as an interdependent system. This interpretation is consistent with recent evidence showing that both game-based pedagogy and differentiated instruction are most meaningful when their design is closely matched to learner needs and contextual conditions (Saha et al., 2026; Suherman et al., 2026).

CONCLUSION

This study concludes that sprint-running instruction in physical education is characterised by a relatively strong instructional foundation combined with persistent contextual constraints. Across the school cases, curriculum alignment, technical feedback, and multidomain assessment emerged as recurrent features of instruction. Teacher and student evidence also showed convergence regarding the importance of teacher feedback, direct demonstration, and game- or relay-based activities. These findings indicate that the main challenge is not the absence of instructional strategies, but the extent to which those strategies can be organised to provide equitable and sufficiently frequent opportunities for active practice.

The study further concludes that learner heterogeneity, waiting time, facility limitations, and instructional-time constraints shape the implementation of sprint instruction. Differentiation was present but was not consistently supported by systematic diagnostic processes, while student waiting time remained a prominent feature of the learning experience. Teachers responded through task adaptation, modified equipment, group organisation, and varied instructional activities. However, these adaptations do not completely remove the structural limitations affecting practice opportunities and individual feedback.

From a pedagogical perspective, the findings support an integrated approach in which curriculum planning, diagnostic differentiation, technical feedback, game-based practice, formative assessment, and efficient class organisation are treated as interconnected components rather than separate strategies. In particular, station-based practice, small-group organisation, peer-supported feedback, and simple visual or offline digital media may provide practical mechanisms for increasing active learning opportunities in resource-constrained settings. Because the study employed a qualitative multiple-case design, the findings should be interpreted as contextual and analytical rather than as evidence of causal effectiveness or statistical generalisation. Future research should examine the instructional strategies identified in this study using mixed-methods, quasi-experimental, or experimental designs, including objective measures of active learning time, movement repetitions, technical performance, and learning outcomes. Such studies could determine whether the pedagogical mechanisms identified here translate into measurable improvements in sprint-learning performance across different school contexts.

DECLARATIONS

Ethical Approval
Consent to Participate
Consent for Publication
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Conflict of Interest
Data Availability
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Generative AI Disclosure

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