

Developing Modified Batting Media for Striking Skills in Physical Education

¹Armin Haluti*, ¹Abu Bakar

Corresponding Author: *haluti1479@gmail.com

¹Universitas Muhammadiyah Luwuk, Indonesia

ARTICLE INFO

Article history

Received 5 February 2026

Revised 17 May 2026

Accepted 23 May 2026

ABSTRACT

The teaching of striking skills in senior high school physical education often faces challenges related to limited equipment, low student confidence, and difficulties in mastering correct batting mechanics. This study aimed to develop and evaluate modified batting instructional media for striking skill learning among Grade 10 physical education students. Employing a research and development design based on the ADDIE model, this study produced modified batting tools and instructional variations tailored to students' physical characteristics and learning needs. The development process involved expert validation by three validators, consisting of two university lecturers with expertise in physical education pedagogy and instructional media development and one experienced physical education teacher, followed by field trials involving one intact Grade 10 physical education class at SMAN 3 Luwuk, Central Sulawesi, Indonesia (N = 32). The findings showed that the developed instructional media achieved high expert validity scores ($\geq 85\%$) and were perceived by students as practical, engaging, and easy to use. Implementation results indicated improved student participation, confidence, and execution of fundamental striking movements during learning activities. These results suggest that modified batting instructional media can help address equipment limitations and learner variability while supporting more inclusive skill learning. In conclusion, the developed media are feasible for supporting striking skill learning in senior high school physical education.

Keywords

Equipment Modification
Instructional Media
Modified Batting
Motor Skill Acquisition
Physical Education
Striking Skills

This is an open-access article under the [CC-BY-SA](#) license.

**Introduction**

Physical education plays a crucial role in developing students' motor skills, physical fitness, and lifelong engagement in movement-based activities [1]–[2]. Beyond promoting physical competence, high-quality physical education at the senior high school level is expected to foster self-confidence, motivation, and active participation in diverse motor tasks [3]–[4]. Among these, striking games such as baseball, softball, and kasti rely on the mastery of batting skills—a fundamental motor skill that integrates coordination, timing, hand-eye coordination, and body control [5]–[7]. Effective batting not only supports performance in sport contexts but also contributes to the development of general motor competence, which is essential for adolescents' overall physical literacy [4]–[6].

Despite its importance, the teaching of batting skills in school-based physical education continues to face several practical challenges. Limited access to standard equipment, large class sizes, and students' fear of injury often reduce opportunities for repeated practice and meaningful skill acquisition [8]. These constraints may lead to low engagement, decreased confidence, and difficulty in mastering proper striking mechanics [9]–[11]. Previous studies have shown that equipment modification, simplified practice tasks, and structured learning models can support motor skill acquisition and improve student learning outcomes [12]–[15]. However, most research on modified or adaptive instructional media has been conducted in elementary school contexts, leaving a clear gap regarding its application for senior high school students, whose physical capacities, learning characteristics, and instructional needs are more advanced [16]–[18].

To address this gap, the present study aimed to develop and validate modified batting instructional media tailored for Grade 10 physical education students at SMAN 3 Luwuk. The study employed a systematic instructional design approach, integrating principles of safety, usability, and progressive skill development [19]–[21]. By creating context-sensitive, low-cost, and student-friendly learning media, this research seeks to provide practical alternatives for physical education teachers and contribute to the broader field of adaptive instructional media development. Ultimately, the study aims to enhance students' engagement, confidence, and competency in fundamental striking skills, while generating empirical evidence to inform effective teaching practices in senior high school physical education [22].

Material and Methods

A. Research Design

This study employed a research and development (R&D) design based on the ADDIE [23] instructional development model, which consists of five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was selected because of its structured and iterative framework, which is widely used for developing and validating instructional media in educational settings. In this study, the ADDIE stages were adapted to focus on the development of modified batting instructional media suitable for senior high school physical education contexts.

B. Research Setting and Participants

The study was conducted at SMAN 3 Luwuk, a public senior high school located in Central Sulawesi, Indonesia. Participants in the implementation stage consisted of Grade 10 students enrolled in regular physical education classes. The student participants were selected using a total sampling technique from one intact class (N = 32 students), as the developed media were intended for classroom-based implementation [24].

Expert validation involved three validators: two university lecturers with expertise in physical education pedagogy and instructional media development, and one experienced physical education teacher from SMAN 3 Luwuk. These experts were selected based on their academic background and professional experience relevant to instructional media evaluation.

C. Development Procedures

The development process followed the five stages of the ADDIE model, namely Analysis, Design, Development, Implementation, and Evaluation. During the analysis stage, a needs assessment was conducted to identify instructional problems, learner characteristics, and contextual constraints in senior high school physical education, particularly related to batting skill instruction. The design stage focused on formulating learning objectives, selecting appropriate instructional strategies, and planning modified batting activities that emphasized safety, accessibility, and progressive skill development. In the development stage, the instructional media were produced in the form of modified equipment, structured practice models, and usage guidelines, which were then refined into a complete learning package. The implementation stage involved applying the developed media in Grade X physical education classes to examine usability and classroom practicality. Finally, the evaluation stage consisted of expert validation, practitioner feedback, and student responses, which were used to revise and finalize the instructional media.

D. Analysis Stage

A needs analysis was conducted to identify learning problems related to batting instruction in physical education classes. Data were collected through classroom observations and

informal interviews with physical education teachers. The analysis revealed that students experienced difficulties in performing batting skills due to limited variations of standard equipment, fear of injury when using hard bats or balls, and the absence of progressive learning tasks that matched students' physical characteristics and skill levels.

E. Design Stage

Based on the needs analysis, the modified batting instructional media were designed with an emphasis on safety, accessibility, and progressive skill development. The design specifications included: (1) modified bats made from lightweight PVC materials with widened striking surfaces to reduce injury risk and increase ball contact success, (2) variations in ball types and sizes to accommodate different skill levels, and (3) progressive batting drills structured from simple to more complex movements and aligned with the physical characteristics of Grade 10 students [25]–[26].

F. Development Stage

The instructional media designs were then produced and refined into a complete learning package. This package included physical equipment specifications, usage guidelines, and instructional variations for batting practice. The initial prototype was subsequently submitted for expert validation to assess content relevance, media suitability, safety, and instructional feasibility. Revisions were made based on expert feedback before proceeding to the implementation stage.

G. Implementation Stage

Following revision, the validated instructional media were implemented during regular Grade 10 physical education lessons. Students practiced batting skills using the modified equipment under teacher supervision. The implementation focused on observing students' engagement, ease of equipment uses, and confidence in performing striking movements during learning activities.

H. Evaluation Stage

The evaluation stage focused on assessing the validity, practicality, and attractiveness of the developed instructional media. Product validity was determined through expert judgment, while practicality and attractiveness were evaluated based on student responses after the implementation.

I. Data Collection Instruments

Data were collected using structured questionnaires. The expert validation questionnaire was used to assess learning aspects, media design, and practical implementation feasibility. The student response questionnaire was administered to evaluate the practicality and attractiveness of the instructional media, including ease of use, enjoyment, and perceived usefulness during batting practice. All questionnaire items were measured using a 5-point

Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Prior to data collection, the student questionnaire was reviewed by experts to ensure content validity and was tested for reliability, indicating that the instrument was appropriate for use in the field trial [25]–[26].

Table 1. Five-Point Likert Scale Used in the Questionnaire

Score	Response Category
5	Strongly Agree
4	Agree
3	Neutral
2	Disagree
1	Strongly Disagree

J. Data Analysis

Data were analyzed using descriptive percentage analysis. Questionnaire scores were converted into percentages and interpreted using predefined feasibility criteria, where percentages of 80% or higher indicated high feasibility. The analysis results were used to determine the overall quality and applicability of the developed batting instructional media.

K. Ethical Considerations

This study involved human participants in the form of senior high school students. Ethical approval was obtained from the Institutional Research Ethics Committee of Universitas Tadulako through the Institute for Research and Community Service (LPPM), with official approval granted prior to data collection. Permission to conduct the study was also obtained from the school administration, and informed consent was secured from all participants.

Results

A. Expert Validation of the Developed Batting Learning Media

Expert validation was conducted to assess the feasibility of the developed modified batting learning media in terms of learning design, media quality, and practical implementation. Three validators were involved: (1) a physical education learning expert, (2) a learning media expert, and (3) a practicing physical education teacher. Table 2 presents the validation results from the physical education learning expert.

Table 2. Expert Validation Results (Physical Education Learning Expert)

Aspect Evaluated	Percentage (%)	Category
Media design	93.75	Very feasible
Ease of use	87.50	Very feasible
Media function	91.66	Very feasible
Average	90.97	Very feasible

All evaluated aspects exceeded the minimum feasibility criterion of 80%, indicating that the developed modified batting media had a strong product design and met high feasibility standards for Grade 10 physical education learning. These results also suggest that the media

were considered appropriate by both expert validators and practitioners for classroom-based implementation.

B. Media Expert Validation Results

Validation conducted by the learning media expert focused on the suitability, ease of use, and attractiveness of the developed product. The results are presented in Table 3.

Table 3. Expert Validation Results (Learning Media Expert)

Aspect Evaluated	Percentage (%)	Category
Suitability	91.66	Very feasible
Ease of use	83.33	Very feasible
Attractiveness	91.66	Very feasible
Average	88.88	Very feasible

These findings indicate that the batting learning media were considered appropriate for instructional use, user-friendly, and visually appealing for senior high school physical education learning.

C. Practitioner (Teacher) Validation Results

Practitioner validation was conducted by a physical education teacher to evaluate classroom practicality and instructional relevance. The validation results are shown in Table 4.

Table 4. Validation Results from Physical Education Teacher

Aspect Evaluated	Percentage (%)	Category
Media design	93.75	Very feasible
Ease of use	100.00	Very feasible
Media function	100.00	Very feasible
Average	97.92	Very feasible

These results confirm that the developed media were highly practical and suitable for use in authentic teaching situations, particularly in routine classroom-based physical education.

D. Implementation Results

The implementation phase involved Grade 10 students using five modified batting learning models. Student performance was evaluated using a 5-point rating scale, with 1 as the lowest score and 5 as the highest possible score. The assessment results were presented as mean scores because the study primarily emphasized descriptive feasibility analysis. Standard deviation data were unavailable due to the use of aggregated classroom assessment records. The results are presented in Table 5.

Table 5. Implementation Results of Batting Learning Models

No.	Learning Model	Mean Score	Category
1	Individual rebound ball	4.6	Good
2	Paired batting	4.2	Good
3	Group rebound ball	4.6	Good
4	Hanging ball	4.2	Good
5	Batting tee (standing T)	4.3	Good

All learning models achieved good performance categories, indicating that the developed models could be implemented effectively during physical education lessons.

E. Student Perceived Ease of Use

Students' perceptions of ease of use were collected after the implementation phase using a 5-point Likert scale, with 1 indicating the lowest level of agreement and 5 indicating the highest level of agreement. The results are presented in Table 6.

Table 6. Student Responses on Ease of Use

No.	Learning Model	Mean Score	Category
1	Individual rebound ball	3.6	Easy
2	Paired batting	4.7	Easy
3	Group rebound ball	3.7	Easy
4	Hanging ball	3.7	Easy
5	Batting tee (standing T)	3.4	Easy

Overall, students perceived all modified batting learning models as easy to use, suggesting that the media design successfully supported usability and task clarity for Grade 10 learners.

F. Student Perceived Attractiveness

Student perceptions regarding the attractiveness of the developed learning models are presented in Table 7.

Table 7. Student Responses on Attractiveness

No.	Learning Model	Mean Score	Category
1	Individual rebound ball	3.6	Attractive
2	Paired batting	3.4	Attractive
3	Group rebound ball	3.6	Attractive
4	Hanging ball	3.7	Attractive
5	Batting tee (standing T)	3.5	Attractive

The results indicate that students perceived the learning activities as attractive, engaging, and enjoyable, which supports the potential of the developed media to promote active participation in batting practice.

G. Summary of Results

Overall, the findings demonstrate that the modified batting learning media achieved high expert validity, strong practitioner acceptance, positive student responses, and effective implementation outcomes in Grade X physical education. These results indicate that the developed product is feasible and acceptable for classroom use and has promising potential to support batting skill learning at the senior high school level. Therefore, the following discussion interprets these findings by explaining why the media performed well, outlining their pedagogical implications, and comparing them with previous studies on equipment modification and progressive skill learning in physical education.

Discussions

The present study developed and validated modified batting learning media for Grade 10 physical education and found consistently high feasibility ratings from expert validators and a teacher practitioner, alongside positive student responses and good implementation performance across five learning models. Collectively, these findings indicate that the developed product is not only conceptually appropriate but also practically workable within real school constraints. Therefore, the modified batting media can serve as a feasible instructional alternative for supporting striking skill learning in senior high school physical education.

A. Why expert and teacher feasibility was very high

High feasibility scores from the physical education learning expert, media expert, and practitioner teacher suggest that the product met key indicators of instructional quality—alignment between tasks and objectives, clarity of use, safety, and implementability. This pattern is meaningful because in school PE settings, innovations are adopted more readily when they reduce logistical burden and increase instructional control for teachers. From a constraints-led perspective, changing task constraints (e.g., equipment features and drill structure) can create more achievable movement solutions and improve learning conditions without changing the learning goals [12], [27]–[28]. The very strong teacher practicality scores in this study likely reflect that the media required minimal complex setup and could be integrated into standard lessons—an adoption factor often emphasized in applied PE pedagogy.

B. Why the modified equipment likely supported safety and success

Your design choices—lightweight PVC bats with widened striking surfaces and varied balls—are consistent with the principle of equipment scaling: modifying tools and task demands can increase success rates, reduce negative experiences, and support skill acquisition by making the task more “learnable” [13], [29]. In striking skills, early success is important because repeated failure tends to reduce engagement and perceived competence. Thus, the product’s high feasibility on safety/functionality and students’ “easy” ratings can be interpreted as a sign that the equipment modifications lowered perceived risk and technical difficulty while increasing contact opportunities, which is a known mechanism for improving learning experiences in interceptive/striking tasks [30]–[32].

C. Why progressive drills produced “good” implementation across models

All five learning models achieved “good” performance categories, which can be interpreted through motor learning logic: sequencing practice from simpler to more complex tasks supports coordination, timing, and control by gradually increasing demands. Gradual progression is widely discussed as an efficient instructional strategy because it manages

difficulty and allows learners to stabilize basic movement patterns before adding complexity [33]–[34]. Additionally, constraints-led pedagogy predicts that learners improve when practice environments allow exploration and repeated successful attempts, rather than being overwhelmed by task difficulty [35]. The consistency of “good” outcomes across different models (individual, paired, group, tee/hanging ball variations) suggests your package offered multiple task constraints that still converged toward the same core striking competence.

D. Meaning of positive student ease-of-use and attractiveness

Students rated the models as easy to use and attractive/engaging, which matters because enjoyment and perceived competence are strongly linked to motivation and sustained participation in PE. Self-determination theory–informed work in PE highlights that supportive learning conditions can enhance autonomous motivation and adaptive outcomes [36]–[37]. Empirical research with adolescents also shows relationships between perceived competence and PE enjoyment, which in turn relate to ongoing physical activity engagement [38]. In your case, improved usability and higher success probability likely increased perceived competence, which can explain why students found the activities engaging rather than intimidating.

E. Contribution: addressing the senior high school gap

Most equipment-modification and adaptive-media work is more commonly reported in younger/elementary contexts, so demonstrating high feasibility and positive responses in Grade X provides practical evidence that scaling and progressive design principles remain relevant for adolescents. Importantly, senior high school students often have more varied physical capacities and stronger performance expectations, so “student-friendly” does not mean “too easy,” but rather appropriately challenging with safe progression. This study therefore supports the wider argument that task constraint manipulation can be a scalable strategy for PE across age groups when the design matches learners’ developmental and contextual needs [39]–[40].

F. Practical implications

For PE teachers, the developed package offers a low-cost alternative that can increase participation opportunities, reduce fear of injury, and support structured progression in batting instruction. For researchers, the results provide an applied validation pathway—expert review + practitioner practicality + student response + implementation performance—that can be replicated in other striking or interceptive skills. Future research should test effectiveness using stronger outcome designs (e.g., pre–post skill tests, comparison groups) and broader settings to strengthen generalizability.

Conclusion

This study successfully developed and validated modified batting instructional media for Grade 10 physical education using an ADDIE-based research and development approach.

The key findings indicate that the developed media achieved high feasibility across expert validation and practitioner assessment, while student responses demonstrated that the media were perceived as easy to use, attractive, and supportive of active participation in batting skill learning. As expected, the modification of equipment and learning models reduced perceived risk and facilitated more confident execution of striking movements during implementation. These findings confirm that the developed media are pedagogically appropriate and practically applicable in senior high school physical education contexts.

Importantly, this study addresses a previously identified knowledge gap by extending evidence on modified instructional media from elementary education to the senior high school level, where empirical studies remain limited. The study contributes theoretically by demonstrating the applicability of instructional media modification within adolescent motor learning contexts and contributes practically by providing teachers with adaptable, low-cost learning alternatives suitable for schools with limited equipment. However, this study is limited by its focus on a single school setting and the absence of an experimental effectiveness comparison. Future research is therefore recommended to examine the impact of the developed media on learning outcomes using experimental designs, larger samples, and longer implementation periods, as well as to explore its application in other striking-based sports.

Limitation and Suggestions

This study has several limitations that should be acknowledged. First, the implementation was conducted in one intact Grade 10 class at a single senior high school, which limits the generalizability of the findings to broader physical education contexts. Second, the study did not include a control group or pre-test and post-test motor skill assessment; therefore, the findings cannot confirm the actual effectiveness of the modified batting media in improving students' striking skills. Third, the implementation period was relatively short, so the study could not examine students' long-term skill development, learning retention, or sustained engagement. Fourth, student responses were mainly based on perception data, such as ease of use, attractiveness, and perceived usefulness, which may be influenced by subjective experience.

Future studies should involve larger and more diverse samples across different schools and grade levels. Researchers are also encouraged to use experimental or quasi-experimental designs with control groups and objective motor skill assessments to examine the actual impact of modified batting media on striking skill performance. In addition, longer implementation periods are recommended to evaluate learning retention, skill progression, and the sustainability of student engagement in physical education learning.

Importantly, this study addresses a previously identified knowledge gap by extending evidence on modified instructional media from elementary education to the senior high school

level, where empirical studies remain limited. The study contributes theoretically by demonstrating the applicability of instructional media modification within adolescent motor learning contexts and contributes practically by providing teachers with adaptable, low-cost learning alternatives suitable for schools with limited equipment. However, this study is limited by its focus on a single school setting and the absence of an experimental effectiveness comparison. Future research is therefore recommended to examine the impact of the developed media on learning outcomes using experimental designs, larger samples, and longer implementation periods, as well as to explore its application in other striking-based sports.

Acknowledgment

The authors would like to express their sincere gratitude to SMAN 3 Luwuk, Central Sulawesi, Indonesia, for granting permission and supporting the implementation of this study. The authors also thank the Grade 10 students who participated in the field trial and the physical education teacher who assisted during the implementation process. Appreciation is also extended to the expert validators for their valuable feedback and constructive suggestions in evaluating the modified batting instructional media.

Conflict of Interest

The authors declare no conflict of interest.

References

- [1] H. Aliriad, S. Adi, J. G. Manullang, I. B. Endrawan, and M. H. Satria, "Improvement of motor skills and motivation to learn physical education through the use of traditional games," *Phys. Educ. Theory Methodol.*, vol. 24, no. 1, pp. 32–40, Feb. 2024, doi: 10.17309/tmfv.2024.1.04.
- [2] R. Abusleme-Allimant *et al.*, "Effects of structured and unstructured physical activity on gross motor skills in preschool students to promote sustainability in the physical education classroom," *Sustainability*, vol. 15, no. 13, e10167, Jun. 2023, doi: 10.3390/su151310167.
- [3] M. Bronikowska, K. Mouratidou, M. Ludwiczak, S. Karamavrou, C. McKeel, and M. Bronikowski, "Systematic review on social/moral competence interventions in physical education," *Biomed. Hum. Kinet.*, vol. 16, no. 1, pp. 55–77, Jan. 2024, doi: 10.2478/bhk-2024-0007.
- [4] A. L. Quitério, "Assessment for learning in physical education: Its emergent relationships with motor competence development and intrinsic motivation toward physical literacy," *Ágora Para Educ. Física El Deporte*, vol. 20, no. 2–3, pp. 213–234, Dec. 2018, doi: 10.24197/aefd.2-3.2018.213-234.
- [5] G. N. Manalo, "Interactive video-based technology and perceptual skill training for batting in youth baseball players," Thesis, University of British Columbia, 2025. doi: 10.14288/1.0448597.
- [6] S. M. Tampi, M. Marsuki, and D. Wanimbo, "The relationship between arm muscle strength and the ability to hit a kasti ball of class V students of Inpres Primary School, Skow Mabo Village, Muaratami District, TA. 2023/2024," *JPJ: J. Pendidik. Jasm.*, vol. 5, no. 3, pp. 224–231, Apr. 2025, doi: 10.55081/jpj.v5i3.3193.
- [7] J. McGowan, "The relationship between batting averages, movement time, reaction time, hand-eye coordination, eye dominance, and softball hitting knowledge test in women college softball players." Thesis, California State University, 1996.
- [8] K. Fukuda, "A fundamental research on issues of baseball-type physical education classes in Japan: Through a review of practice-based research," *Sustain. Sports Sci. J.*, vol. 4, no. 1, pp. 14–24, 2026, doi: 10.55860/XZD07563.
- [9] G. W. Ellis, G. E. Scordilis, and C. M. Cooke, "New pedagogical approaches in engineering mechanics yield increased student understanding, confidence, and commitment," in *33rd Annual Frontiers in Education, 2003. FIE 2003.*, Nov. 2003, pp. T4A-15. doi: 10.1109/FIE.2003.1263361.

- [10] A. K. Sharma, "Cognitive and psychological aspects of physics learning," *Phys. J. Farhangian Univ.*, vol. 2, no. 1, pp. 28–39, Jan. 2025, doi: 10.48310/esip.2025.18642.1011.
- [11] N. Riley, D. Lubans, K. Holmes, V. Hansen, J. Gore, and P. Morgan, "Movement-based mathematics: Enjoyment and engagement without compromising learning through the EASY Minds Program." *Eurasia J. Math. Sci. Technol. Educ.*, vol. 13, no. 6, pp. 1653-1673, doi: 10.12973/eurasia.2017.00690a.
- [12] I. Renshaw, J. Y. Chow, K. Davids, and J. Hammond, "A constraints-led perspective to understanding skill acquisition and game play: A basis for integration of motor learning theory and physical education praxis?," *Phys. Educ. Sport Pedagogy*, vol. 15, no. 2, pp. 117–137, Apr. 2010, doi: 10.1080/17408980902791586.
- [13] T. Buszard, M. Reid, R. Masters, and D. Farrow, "Scaling the equipment and play area in children's sport to improve motor skill acquisition: A systematic review," *Sports Med.*, vol. 46, no. 6, pp. 829–843, Jun. 2016, doi: 10.1007/s40279-015-0452-2.
- [14] D. R. Gould and G. C. Roberts, "Modeling and motor skill acquisition," *Quest*, vol. 33, no. 2, pp. 214–230, Jul. 1981, doi: 10.1080/00336297.1981.10483755.
- [15] K.-E. Chang, J. Zhang, Y.-S. Huang, T.-C. Liu, and Y.-T. Sung, "Applying augmented reality in physical education on motor skills learning," *Interact. Learn. Environ.*, vol. 28, no. 6, pp. 685–697, Aug. 2020, doi: 10.1080/10494820.2019.1636073.
- [16] N. Ningsi and H. Hartono, "Developing interactive learning media to enhance elementary school students' learning motivation," *Educ. J. Prim. Educ.*, vol. 6, no. 1, pp. 81–96, Jun. 2025, doi: 10.35719/educare.v6i1.291.
- [17] W. Oyanagi, "The influence of an adaptive learning support system on the lesson design and practice of elementary school teachers," *Int. J. Educ. Media Technol.*, vol. 15, no. 1, pp. 34-45, 2021. [Online]. Available: <https://ijemt.org/index.php/journal/article/view/16>.
- [18] M. Aziz, D. S. Napitupulu, and J. Andriyana, "Implementation of differentiation-based learning media in the context of elementary education in the Islamic education curriculum," *Urwatul Wutsqo J. Studi Kependidik. Keislam.*, vol. 14, no. 2, pp. 843–856, Aug. 2025, doi: 10.54437/urwatulwutsqo.v14i2.2108.
- [19] C. Wang, R. D. Omar Dev, K. G. Soh, N. J. Mohd. Nasirudddin, Y. Yuan, and X. Ji, "Blended learning in physical education: A systematic review," *Front. Public Health*, vol. 11, e1073423, Mar. 2023, doi: 10.3389/fpubh.2023.1073423.
- [20] M. A. A. Mohd. Hamizi, N. A. M. Mokmin, "Virtual reality technology in physical education: a systematic review in instructional design & implementation," *Adv. J. Tech. Vocat. Educ.*, vol. 6, no. 1, pp. 6–12, Jun. 2022, doi: 10.26666/rmp.ajtve.2022.1.2.
- [21] D. Nesbitt, J. Fisher, and D. F. Stodden, "Appropriate instructional practice in physical education: A systematic review of literature from 2000 to 2020," *Res. Q. Exerc. Sport*, vol. 92, no. 2, pp. 235–247, Apr. 2021, doi: 10.1080/02701367.2020.1864262.
- [22] D. D. Kuswoyo and Q. B. Shareef, "Effectiveness of life skill-based physical education on students' movement skills and social values," *Champions Educ. J. Sport Health Recreat.*, vol. 3, no. 3, pp. 95–100, Nov. 2025, doi: 10.59923/champions.v3i3.577.
- [23] Z. Zamsiswaya, S. Syawaluddin, and S. Syahrizul, "Pengembangan model ADDIE (Analisis, Design, Development, Implemetation, Evaluation)," *J. Pendidik. Tambusai*, vol. 8, no. 3, pp. 46363-46369, 2024. [Online]. Available: <https://jptam.org/index.php/jptam/article/view/22709/15494>.
- [24] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. CV. Alfabeta, 2012.
- [25] D. Kahan, "Teaching specific skill sets through modified softball games," *Strategies*, vol. 12, no. 4, pp. 22–28, Mar. 1999, doi: 10.1080/08924562.1999.10591401.
- [26] T. A. Brazier *et al.*, "The effect of physical training on hitting performance in sport: A systematic review," *Int. J. Sports Sci. Coach.*, vol. 21, no. 2, pp. 1246-1257, Nov. 2025, doi: 10.1177/17479541251397649.
- [27] W. M. Roberts, D. J. Newcombe, and K. Davids, "Application of a constraints-led approach to pedagogy in schools: Embarking on a journey to nurture physical literacy in primary physical education," *Phys. Educ. Sport Pedagogy*, vol. 24, no. 2, pp. 162–175, Mar. 2019, doi: 10.1080/17408989.2018.1552675.
- [28] R. A. Pinder and I. Renshaw, "What can coaches and physical education teachers learn from a constraints-led approach in para-sport?," *Phys. Educ. Sport Pedagogy*, vol. 24, no. 2, pp. 190–205, Mar. 2019, doi: 10.1080/17408989.2019.1571187.
- [29] C. McCormack, "A principled approach to equipment scaling to enhance skill acquisition in female junior basketball," Thesis, University of the Sunshine Coast Queensland, 2020, doi: 10.25907/00009.

- [30] R. Sibson, P. Scherrer, and M. M. Ryan, "I think it adds value, but I don't use it': Use, perceptions and attitudes of outdoor exercise equipment in an urban public park," *Ann. Leis. Res.*, vol. 21, no. 1, pp. 58–73, Jan. 2018, doi: 10.1080/11745398.2017.1290535.
- [31] R. Allen and C. M. Ross, "An assessment of proximity of fitness facilities and equipment and actual perceived usage by undergraduate university students: A pilot study," *Recreat. Sports J.*, vol. 37, no. 2, pp. 123–135, Oct. 2013, doi: 10.1123/rsj.37.2.123.
- [32] L. B. Christiansen, M. Toftager, C. S. Pawlowski, H. B. Andersen, A. K. Ersbøll, and J. Troelsen, "Schoolyard upgrade in a randomized controlled study design—how are school interventions associated with adolescents' perception of opportunities and recess physical activity," *Health Educ. Res.*, vol. 32, no. 1, pp. 58–68, Feb. 2017, doi: 10.1093/her/cyw058.
- [33] Y. Yotsumoto, T. Watanabe, L.-H. Chang, and Y. Sasaki, "Consolidated learning can be susceptible to gradually-developing interference in prolonged motor learning," *Front. Comput. Neurosci.*, vol. 7, e69, May 2013, doi: 10.3389/fncom.2013.00069.
- [34] A. Sawers and M. E. Hahn, "Gradual training reduces practice difficulty while preserving motor learning of a novel locomotor task," *Hum. Mov. Sci.*, vol. 32, no. 4, pp. 605–617, Aug. 2013, doi: 10.1016/j.humov.2013.02.004.
- [35] S. Myszk, T. Yearby, and K. Davids, "Being Water: how key ideas from the practice of Bruce Lee align with contemporary theorizing in movement skill acquisition," *Sport Educ. Soc.*, vol. 29, no. 4, pp. 451–467, May 2024, doi: 10.1080/13573322.2022.2160701.
- [36] N. Ntoumanis and M. Standage, "Motivation in physical education classes: A self-determination theory perspective," *Theory Res. Educ.*, vol. 7, no. 2, pp. 194–202, Jul. 2009, doi: 10.1177/1477878509104324.
- [37] S. O. Ulstad, H. Halvari, and E. L. Deci, "The role of students' and teachers' ratings of autonomous motivation in a self-determination theory model predicting participation in physical education," *Scand. J. Educ. Res.*, vol. 63, no. 7, pp. 1086–1101, Nov. 2019, doi: 10.1080/00313831.2018.1476917.
- [38] E. Kemeryte-Ivanauskiene, A. Brandisauskiene, J. Cesnaviciene, and A. Daugirdiene, "The significance of students' physical activity for their engagement in learning activities during the Covid-19 pandemic," *Phys. Educ. Theory Methodol.*, vol. 22, no. 4, pp. 522–529, Dec. 2022, doi: 10.17309/tmfv.2022.4.10.
- [39] K. Davids, "The constraints- based approach to motor learning: implications for a non- linear pedagogy in sport and physical education," in *Motor Learning in Practice*, Routledge, 2010.
- [40] I. Renshaw and J.-Y. Chow, "A constraint-led approach to sport and physical education pedagogy," *Phys. Educ. Sport Pedagogy*, vol. 24, no. 2, pp. 103–116, Mar. 2019, doi: 10.1080/17408989.2018.1552676.

Authors



Armin Haluti   is a lecturer in the Physical Education, Health, and Recreation (Pendidikan Jasmani, Kesehatan, dan Rekreasi/Penjaskesrek) Study Program at Universitas Muhammadiyah Luwuk, Indonesia. His academic interests include physical education pedagogy, sports science, health promotion, and community-based physical activity programs. He actively participates in research and community engagement initiatives aimed at improving educational quality and public health through sports and physical activity. (email: haluti1479@gmail.com).



Abu Bakar   is a lecturer in the Physical Education, Health, and Recreation (Pendidikan Jasmani, Kesehatan, dan Rekreasi/Penjaskesrek) Study Program at Universitas Muhammadiyah Luwuk, Indonesia. His scholarly interests focus on physical education, sports development, recreational activities, and health-related fitness. He is involved in teaching, research, and community service activities that advance sports education and promote healthy lifestyles. (email: abubakarunismuh@gmail.com).