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The Lawe Kokohu Surfing Training Model for High School Extracurricular Activities

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Abstract. This study aimed to develop the Lawe Kokohu surfing training model for senior high school extracurricular activities, analyze its feasibility through expert validation, and examine its effectiveness in improving three fundamental surfing techniques: paddling, the pop-up, and riding. A Research and Development approach was applied using the ADDIE model at SMA Negeri 15 Seram Bagian Barat, Maluku. The subjects were 30 male novice students aged 16 to 17 years from grades X and XI, selected through purposive sampling, and effectiveness was tested using a one-group pretest-posttest design. Surfing skills were measured with a 12-item rubric (maximum score 48) assessed by three raters (ICC = 0.988 for the pretest and 0.989 for the posttest), and the data were analyzed using a paired-sample t-test at a significance level of 0.05 together with Cohen's d. Expert validation retained 24 of the 27 training variations (S-CVI/UA = 0.89), comprising 18 land-based and 6 water-based exercises. The mean score increased from 32.89 to 42.19, $t(29) = -8.618$, $p < 0.001$, $d = 1.57$. The model is therefore feasible and associated with improved fundamental surfing skills, although further testing using a control group is recommended.

Keywords: Extracurricular Activity; Lawe Kokohu; Research and Development; Surfing Training Model; Traditional Game

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INTRODUCTION

Sports development has shown a positive trend in recent years, characterized by increasing public participation in various physical activities for fitness, healthy lifestyles, competitive achievement, and recreation (Eime et al., 2024). Surfing is one of the sports experiencing the most rapid global growth, with its popularity rising exponentially leading up to its Olympic debut (Mejuto et al., 2024). In Indonesia, the growth of surfing is supported by the country's geography as an archipelagic nation; approximately two-thirds of its territory consists of marine waters, encompassing 17,380 islands and a coastline stretching over 81,000 kilometers (BIG, 2024; Siswanto, 2018). Premier surfing destinations, such as Bali, Lombok, Lampung, Yogyakarta, Mentawai, Sumba, and Banyuwangi, continue to attract both domestic and international surfers. This situation has fostered the development of surfing as a component of sports tourism and sporting events, while simultaneously strengthening coastal community culture (Román et al., 2022).

As part of Indonesia's maritime identity, surfing not only impacts the tourism sector but also holds significant potential for integration into the educational sphere (Pérez-Gutiérrez et al., 2023). Education, as a planned endeavor, must enhance intellectual and moral dimensions and cultivate an appreciation for diversity, goals that can be achieved, in part, through cultural interventions (Sumarni et al., 2023). In this context, physical education plays a strategic role in integrating the learning process with a culture-based approach (Adela et al., 2023; Bonato et al., 2024). Consequently, surfing is viewed as a comprehensive medium for integration into physical education curricula, particularly in coastal regions with strong ties to maritime culture.

The integration of surfing into physical education in Indonesia is a relatively new development. Nevertheless, several schools have adopted surfing as an innovative outdoor-based physical education activity (Pérez-Gutiérrez et al., 2023). In West Sumbawa Regency, the "Surfing Goes to School" program has been implemented since 2024; Pesisir Barat Regency in Lampung has planned surfing as an extracurricular activity since 2023 and has even conducted training for local coastal children (Siregar et al., 2022a); and SMA Negeri 1 Pundong in Yogyakarta has run a surfing extracurricular program for the past four years, based on the author’s interview with the school’s surfing coach. In contrast to these emerging efforts in Indonesia, other countries have long implemented similar programs. Raglan Area School in New Zealand has operated a

Surfing Academy since 1998, offering surfing as a physical education subject for students in Years 11 to 13 (Raglan Area School), while Miami State High School in Australia runs a Surfing Excellence Program for students in Years 7 to 12 (Miami State High School), and the surf team of San Clemente High School in California has competed at the national scholastic level since around 2000 (Ponsi). In Maluku Province, SMA Negeri 15 Seram Barat has developed a surfing extracurricular activity using the Lawe Kokohu approach, a traditional surfing practice originating from Latu Village. The implementation of this program aligns with the concept of outdoor education, which has been associated with increased physical activity during learning (Hernawan, 2023) and with greater self-confidence and socialization among students (Silva et al., 2022). Through the Lawe Kokohu extracurricular activity, students not only learn technical surfing skills but also gain experience in crafting surfboards from waste wood, improve their ocean literacy, and contribute to the preservation of local culture.

The lack of structured surfing development programs within the school system is a common issue in Indonesia's coastal regions. Key obstacles in developing novice athletes include a scarcity of training modules or guidelines for physical education teachers, limited access to sports science-based training methods, and a reliance on trial-and-error independent practice in open water without specific dry-land physical conditioning. This condition is exacerbated by limited scientific evidence regarding surfing training methods; A scoping review identified only eight studies meeting the criteria, none of which objectively measured wave-riding performance (Donaldson et al., 2022). This situation is underscored by a preliminary study involving 15 novice students participating in the "Surfing Lawe Kokohu Latu 2025" traditional competition at SMA Negeri 15 Seram Barat. Data revealed that 60% of participants failed to execute the "pop-up" technique correctly during their first five attempts. Furthermore, the students' average paddling endurance ranged from only 3 to 5 minutes before they experienced significant muscle fatigue. Interviews with the school principal and physical education teacher confirmed that training methods remain conventional, relying heavily on wave availability during the east wind season (May–September), and lack support from systematic training guidelines tailored to the motor development characteristics of high school students.

From theoretical and physiological perspectives, surfing is an intermittent activity that demands muscular strength, paddling endurance, and dynamic balance (Guo & Wang, 2022; Klingner et al., 2022; Mejuto et al., 2024). Numerous studies have shown

that surfing can be integrated into education, both as part of the formal physical education curriculum and as an activity program outside the classroom. Within the formal curriculum, a systematic review of twelve documents from five countries concluded that surfing should be introduced progressively in three phases (school, swimming pool, and beach), beginning with bodyboarding because it is easier and safer than shortboard surfing (Pérez-Gutiérrez et al., 2021). Silva et al. (2022) implemented six weeks of surfing in physical education classes for 190 students and reported short-term improvements in self-confidence and socialization, while also describing surfing as a safe activity for students.

Bravo et al. (2016) measured the heart rate responses of high school students participating in surfing physical education, and Santos et al. (2020) described a partnership in Portugal that developed a local physical education curriculum using surfing in schools to foster students' life skills. Rocher et al. (2020) examined the benefits of outdoor sports in blue spaces through the School Nautical Activities program in Viana do Castelo, Portugal, in which surfing is taught as part of physical education. Pérez-Gutiérrez et al. (2023) described how the progressive land, pool, and ocean sequence can be implemented in physical education, while Martínez-Pastor and Zulaika (2026) proposed surfing as new content for physical education in secondary schools located in coastal areas because of its emotional, physical, motor, and social benefits. Outside the formal curriculum, surfing has been delivered as game-based basic training for coastal children in Pesisir Barat, Lampung (Siregar et al., 2022a), developed into a beginner-level training model focusing on stand-up and take-off techniques (Siregar et al., 2022b), and organized as structured programs for young people with social, emotional, or developmental needs (Benninger et al., 2020; Hignett et al., 2018; Matos et al., 2017; McKenzie et al., 2021; Nilsson et al., 2025), and such programs have also been reported to improve young people’s well-being and educational trajectories (Nada et al., 2026). From a medical perspective, a systematic review of nineteen epidemiological studies found that skin injuries are the most frequent injury type and being struck by one’s own surfboard the most frequent mechanism (McArthur et al., 2020), which is why beginner programs rely on soft-top boards and structured risk management procedures. Nevertheless, these previous studies leave a research gap that warrants further investigation.

These research gaps are interconnected. First, regarding subject characteristics, previous studies have generally focused on children and early adolescents, with limited

examination of high school students in late adolescence, a group possessing greater physical and cognitive maturity (Matos et al., 2017; Nilsson et al., 2025; Silva et al., 2022; Siregar et al., 2022a), while the few studies involving high school students examined physiological responses to surfing physical education rather than a structured training model (Bravo et al., 2016). Second, concerning the structure and scope of training techniques, the surfing training model developed by Siregar et al. (2022b) is limited to "stand-up" and "take-off" skills. Meanwhile, the scoping review by Donaldson et al. (2022) focused on training methods for improving paddling performance rather than presenting a structured technical training framework. Although Pérez-Gutiérrez et al. (2023) recommended a progressive training approach involving land, pool, and ocean stages, that program was implemented within a mandatory curriculum subject to various logistical constraints and training load adjustments. Consequently, among the studies reviewed, no extracurricular surfing training model for high school students has comprehensively integrated the three fundamental techniques: paddling, pop-up, and riding. Third, regarding the source of the training content, none of the previous studies has developed surfing training from a folk or traditional game. Studies on surfing in schools have adopted modern surfing instruction, as reflected in the progressive school, pool, and beach sequence beginning with bodyboarding summarized by Pérez-Gutiérrez et al. (2021), while studies that integrate traditional games into physical education have focused on children's motor skills, learning interest, or cultural enculturation and have not involved water sports (Adela et al., 2023; Komaini et al., 2024). Even the game-based surfing training for coastal children by Siregar et al. (2022a) used general games rather than a traditional coastal game.

Based on the previous studies reviewed above, including the pedagogical orientations synthesized in a systematic review of surfing in formal education (Pérez-Gutiérrez et al., 2021), no research has been found that develops a surfing training model from a folk or traditional game. This study therefore offers novelty by transforming Lawe Kokohu, a traditional wave-surfing game of the coastal children of Latu Village, into a sport-science-based surfing training model for high school extracurricular activities. To address this gap, the study employs a Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) to develop the "Lawe Kokohu" surfing training model. Specifically, the study aims to: (1) develop the Lawe Kokohu surfing training model for high school extracurricular activities; (2) analyze the model's feasibility and validity through expert judgment; and

(3) test the model's effectiveness in improving the paddling, pop-up, and riding skills of students at SMA Negeri 15 Seram Bagian Barat.

METHOD

This study employs a Research and Development (R&D) approach, adapting the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model. This model was selected because it offers a systematic, flexible, and proven instructional development workflow for creating effective sports training tools and programs (Abuhassna & Alnawajha, 2023). The implementation phase utilizes a One-Group Pretest-Posttest design to measure the effectiveness of the developed training model. The research subjects consisted of 30 students participating in the surfing extracurricular program at SMA Negeri 15 West Seram, selected via purposive sampling. All subjects were male students aged 16–17 years from grades X and XI, because grade XII students had already graduated at the time of data collection; their initial skill level is reflected in the pretest mean score of 32.89 out of a maximum of 48. Subject inclusion criteria were established based on principles regarding novice athlete qualifications and training needs analysis; these criteria included being a novice who had not yet mastered basic techniques, having no history of severe injury, agreeing to refrain from independent surfing practice outside the program for the duration of the study, and being active and willing to complete the entire four-week intervention program, which comprised 16 sessions. Students who did not meet these criteria were excluded from the study. Research permission was granted by the school authorities, and the principal and physical education teacher provided approval and supervised every training session.

Data sources for the study included both qualitative and quantitative data. Qualitative data were obtained through semi-structured interviews with the principal and the Physical Education teacher during the analysis phase, as well as through input, critiques, and suggestions from three experts, specialists in testing and measurement, coaching science, and surfing practice, during the development phase. The feasibility of each training drill (totaling 27 items) was assessed by these three experts, and a drill was retained only if it received approval from all three. Content validity was expressed as the Scale-level Content Validity Index based on Universal Agreement (S-CVI/UA), an index commonly used in the development and validation of sports training models (Sutoro et al., 2023). Meanwhile, quantitative data were obtained from pre-test and post-test assessments of fundamental surfing skills, covering paddling, the pop-up/take-off (the movement of standing on the board), and riding (gliding on the wave). Data collection

involved observation, interviews, expert feasibility assessments, and performance testing using a surfing skills instrument based on a 1–4 rubric scale (comprising 12 assessment items with a maximum score of 48). Surfing skill assessments were conducted by three raters to ensure objectivity, and the analyzed scores represented the average of the three raters' evaluations, demonstrating an excellent level of inter-rater agreement (ICC = 0.988 for the pre-test and 0.989 for the post-test).

Qualitative data were analyzed descriptively to revise and refine the training model design. Meanwhile, quantitative data were analyzed using SPSS statistical software. Pre-analysis testing included the Shapiro-Wilk normality test at a significance level of α=0.05, which is recommended for small samples ($n<50$). Subsequently, the effectiveness of the training model, assessed by measuring the mean difference in student skill achievement before and after the intervention, was analyzed using a paired-sample t-test at a significance level of α=0.05, and the effect size was calculated using Cohen's d formula.

RESULT AND DISCUSSION

Result

The final product of this study is the Lawe Kokohu surfing training model, designed to enhance students' surfing skills. This product is the outcome of a development process involving validation and revision based on feedback from experts and surfing practitioners, resulting in a training model aligned with participants' needs, sports training principles, and the specific characteristics of surfing. The developed model is systematically and structurally organized to serve as a guide for conducting surfing training. The final product includes not only a series of training activities but also implementation guidelines, training protocols, and skill assessment instruments used to evaluate participants' progress throughout the program.

During the design and development phase, the initial draft comprised 27 training variations. This draft underwent expert validation by a sports testing and measurement specialist, a sports coaching science expert, and a surfing practitioner. The validation results indicated that 24 training variations were judged suitable by all three experts, giving an S-CVI/UA of 0.89 (24 of 27 items). At the same time, three exercises were deemed unsuitable and removed based on considerations regarding biomechanical suitability, physiological load, and repetition efficiency.

Details of the final Lawe Kokohu surfing training model, consisting of 18 land-based exercises and 6 water-based exercises, are presented in Table 1.

Table 1. Lawe Kokohu Surfing Training Model Items
Lawe Kokohu Surfing Training Model for
High School Student Extracurricular Activities

Land-Based Training	
D1: Paddling Strength	1. Paddling Arch Position 2. Towel Side by Side 3. Resistance Band Paddle 4. Superman Pose 5. Gym Ball Resistance Paddle 6. Plank on Balance Disks
D2: Pop-Up/Take-Off Power	1. Slow Pop-Up/Take-Off 2. Pop-Up/Take-Off to Target 3. Knee to Elbow Mountain Climbers 4. Pop-Up and Loaded Broad Jump 5. Explosive Plyo and Rotation 6. Burpees Coordination
D3: Balancing/Riding Drills	1. Single-Leg Balance Front Foot 2. Single-Leg Balance Back Foot 3. Dynamic Balance Lunge 4. Back to Back Ball Squat Shuffle 5. Indo Board Dynamic Balance 6. Squat On Balance Disks
Water-Based Training	
L1: Paddling and Positioning	1. Head-Up Freestyle 2. Head-Up Freestyle Relay 3. Paddling and Prone to Pivot Reaction Drill
L2: Pop-Up/Take-Off and Riding	1. Push-Up Over Whitewash 2. Assisted Take-Off and Riding 3. Independent Take-Off and Riding

The field trial (implementation) was conducted with 30 students participating in the surfing extracurricular program over four weeks (16 sessions), comprising one pretest session, one posttest session, and 14 training model intervention sessions, utilizing a One-Group Pretest-Posttest Design. Data analysis included descriptive analysis, prerequisite testing, and hypothesis testing using a paired-sample t-test. The analysis results are presented below.

1. Descriptive Analysis

Descriptive analysis was employed to provide an initial overview of the research data obtained from the students' surfing ability tests. This analysis reveals data trends and distributions prior to the application of inferential statistical tests. The descriptive statistics utilized include the mean, minimum value, maximum value, and standard

deviation. The results of the descriptive analysis for the surfing skill pretest and posttest data are presented in Table 2 below.

Table 2. Results of the Descriptive Analysis of Students' Pretest and Posttest Scores

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	30	19.33	43.33	32.89	6.91
Posttest	30	30.00	48.00	42.19	3.94

Table 2 shows that 30 participants took part in both the pretest and posttest. At the pretest stage, the mean score was 32.89 with a standard deviation of 6.91; the lowest score obtained by a participant was 19.33, while the highest was 43.33. Following the training using the Lawe Kokohu surfing training model, posttest results showed a mean score of 42.19 with a standard deviation of 3.94. The lowest posttest score was 30.00, and the highest reached 48.00. These results indicate an increase in the mean score of 9.30 points, rising from 32.89 in the pretest to 42.19 in the posttest.

Additionally, the standard deviation decreased from 6.91 to 3.94, suggesting that participant ability levels were more uniform after the training compared to before. Descriptively, these results demonstrate an increase in the mean pretest and posttest scores. However, this increase requires further testing to determine whether the observed difference is statistically significant. Consequently, further analysis was conducted, involving prerequisite testing and an assessment of the effectiveness of the Lawe Kokohu surfing training model.

2. Prerequisite Test

Prior to hypothesis testing, prerequisite tests were conducted. These tests aimed to determine whether the research data met the assumptions required for parametric statistical analysis. In this study, the prerequisite testing involved normality tests on the pretest and posttest data. The normality tests were performed using IBM SPSS Statistics software, specifically the Shapiro-Wilk test, as the sample size was fewer than 50 participants. The results of the normality tests for the pretest and posttest data are presented in Table 3.

Table 3. Normality Test Results

	Kolmogorov-Smirnov Statistic	df	sig	Shapiro-Wilk Statistic	df	Sig
Pretest	.120	30	.200	.939	30	.088
Posttest	.129	30	.200	.938	30	.078

Based on the Shapiro-Wilk normality test results presented in Table 3, the p-values obtained were 0.088 for the pretest scores and 0.078 for the posttest scores. These results indicate that the p-values for both the pretest and posttest scores exceed the significance level of $\alpha = 0.05$. Consequently, it can be concluded that the null hypothesis (H_0), which states that the data are normally distributed, is accepted.

3. Hypothesis Testing

After the data were confirmed to be normally distributed, hypothesis testing was conducted using the paired-sample t-test with the aid of the IBM SPSS Statistics program. The results of the hypothesis test analysis are presented in Table 4 below.

Table 4. Results of the Effectiveness Test for the Lawe Kokohu Surfing Training Model

Pair 1: Pretest - Posttest	**Value**
Mean difference	-9.301
Std. Deviation	5.911
Std. Error Mean	1.079
95% CI of the Difference (Lower, Upper)	-11.508, -7.094
t	-8.618
df	29
Sig. (2-tailed)	<.001
Cohen’s d	1.57

Table 4 shows that the paired-sample t-test yielded a t-value of -8.618 with a significance value (Sig. 2-tailed) of < 0.001. Since the significance value is less than 0.05 ($p < 0.001$), there is a significant difference between the participants' pretest and posttest results. Furthermore, the mean difference of -9.301 indicates that the posttest scores were higher than the pretest scores, with a large effect size (Cohen's $d = 1.57$). Thus, students' surfing skills improved significantly after the implementation of the developed Lawe Kokohu surfing training model.

DISCUSSION

The findings of this study show that students' fundamental surfing skills, specifically paddling, the pop-up, and riding, improved after the implementation of the Lawe Kokohu surfing training model. This improvement is consistent with a training

model structure systematically designed by combining land-based and water-based training, grounded in sports science principles and a needs analysis. As explained by Scroggs and Simonson (2021), a needs analysis is a fundamental step in designing training programs to identify the physiological demands and sport-specific technical requirements.

Improvements in students' paddling endurance and pop-up success are likely related to the specific land-based physical strengthening interventions using resistance bands, gym balls, and balance discs. Surfing is an intermittent sport requiring a combination of aerobic cardiorespiratory capacity and anaerobic explosive power (Mejuto et al., 2024). Initial observations revealed issues such as limited paddling duration and unsuccessful pop-ups; these issues may have been addressed because the training model targeted the posterior chain and core stability while developing upper- and lower-body explosive power, although these physical components were not measured directly in this study. This aligns with Klingner et al. (2022), who found that paddling performance and relative upper- and lower-body strength are among the performance indicators that distinguish superior surfers, and with Parsonage et al. (2020), who reported that upper-body strength differentiates pop-up performance between stronger and weaker surfers. From a biomechanical perspective, balance training on stable and unstable platforms has been shown to improve surfers' control of standing posture under balance disturbance (Guo & Wang, 2022).

The training program's structure, which applies the principle of progressive overload, may also have contributed to the students' improvement. As shown by Plotkin et al. (2022), a planned progression of either training loads or repetitions stimulates muscular adaptation. In this study, students were first trained to master gross motor coordination on land, through balance exercises and simulations of the transition to a standing position, before facing the unpredictability of ocean waves. This three-stage training approach (land, simulation, and water) was considered appropriate for developing motor skills while maintaining the safety of novice surfers, consistent with the recommendations of Pérez-Gutiérrez et al. (2023). From a motor learning perspective, balance adaptations are task-specific and transfer only partially to untrained conditions (Lin et al., 2026); therefore, land-based simulation is best understood as preparing students' physical capacity before they practice directly in the water.

Physiologically, previous studies have shown that maximal upper-body strength training and high-intensity sprint paddling can improve surfers' paddling performance

(Donaldson et al., 2022), although cardiovascular and metabolic adaptations were not measured in this study. Furthermore, Santisteban et al. (2024) found that a higher level of sport specialization was associated with a greater likelihood of injury among surfers, whereas a good self-concept of technical skills may contribute to a lower likelihood of injury; this supports the emphasis on mastering fundamental movement patterns to ensure a safer and more sustainable training process. Beyond physical and technical aspects, the scientific merit of this model lies in its integration of local wisdom derived from the traditional Lawe Kokohu game of Latu Village. Transforming this local surfing tradition into a modern training module not only offers enjoyable training variety but also starts training from movement experiences that students already know from their own coast. The natural movement experiences coastal students gain from interacting with waves are enhanced through modern, sports-science-based training methods. This aligns with Komaini et al. (2024), who reported that local wisdom-based traditional game media improved students' learning interest and motor skills, Adela et al. (2023), who used traditional games to enculturate local wisdom, and Bonato et al. (2024), who identified culturally relevant pedagogy as the main enabler of traditional games in physical education. The model's viability is further supported by expert validation, confirming that the 24 final training items meet standards for instrument construction, coaching principles, and safety for novice surfers. This is consistent with Sutoro et al. (2023), who validated a sport training model through content validity and inter-rater reliability analysis before its implementation. Overall, these findings indicate that the Lawe Kokohu surfing training model is feasible and has the potential to be used as a structured guideline in the implementation of extracurricular surfing activities in high schools. However, because this study used a one-group pretest-posttest design without a control group, the improvement cannot be attributed solely to the model, as maturation, repeated testing, and wave conditions during the east monsoon may also have contributed. Future studies should therefore test the model using a control group.

CONCLUSION

The development of the Lawe Kokohu surfing training model, grounded in sports science and local wisdom, resulted in a structured training module comprising 24 final exercise variations (18 land-based and 6 water-based). Expert validation confirmed the model's validity and suitability as a guideline for high school surfing extracurricular activities (S-CVI/UA = 0.89).

Furthermore, effectiveness testing showed a significant improvement in students' basic surfing skills (including paddling, pop-up, and riding techniques) after the implementation of the Lawe Kokohu model; this was evidenced by an increase in the mean score from 32.89 in the pretest to 42.19 in the posttest ($p < 0.001$). These findings suggest that specific land-based physical conditioning integrated with traditional games has the potential to support the motor development of novice surfers before they enter the water. For future development, further research is recommended to test the model using a control group, explore the model's effectiveness regarding more complex surfing maneuvers, test its application with high-performance boards (shortboards), and expand the scope of study subjects to other coastal regions across Indonesia.

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