

DEVELOPMENT OF VIDEO-BASED SIMULATION MEDIA FOR SHORT-DISTANCE ATHLETIC RUNNING TO IMPROVE LEARNING OUTCOMES OF FIFTH GRADE STUDENTS AT SD NEGERI 2 KAMPUNG BARU BANDAR LAMPUNG

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ABSTRACT

This study aimed to develop video-based simulation media for short-distance sprint athletics, determine its feasibility, examine students' responses, and evaluate its effectiveness in improving the learning outcomes of fifth-grade students at SD Negeri 2 Kampung Baru Bandar Lampung. This study employed a Research and Development (R&D) method using the ADDIE model. The research subjects included material experts, media experts, PJOK teachers, and fifth-grade students involved in individual, small-group, and field trials. Data were collected through interviews, expert validation sheets, student response questionnaires, cognitive learning tests using pretests and posttests, and psychomotor performance assessments. Data were analyzed using descriptive quantitative analysis, a paired-samples t-test, and N-Gain analysis. The results showed that the video-based simulation media obtained feasibility scores of 96% from material experts and 91.7% from media experts, categorized as highly feasible. Students' responses to the media reached 95.2%, indicating a very positive response. The effectiveness test showed a significant difference between pretest and posttest scores (Sig. = 0.000 < 0.05), with an N-Gain score of 0.57, categorized as moderate. Therefore, the developed video-based simulation media is effective in improving students' learning outcomes in short-distance sprint athletics.

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INTRODUCTION

Physical Education, Sports, and Health (PJOK) holds a strategic position in elementary education because it provides learning experiences through structured, enjoyable physical activities appropriate to students' developmental stages, aimed not only at developing physical fitness but also movement skills, discipline, cooperation, and healthy lifestyle habits. One important topic in elementary school PJOK is athletics, particularly short-distance running (sprinting), which requires proper mastery of starting techniques, running techniques, and finishing techniques.

Initial observations at SD Negeri 2 Kampung Baru Bandar Lampung indicated that short-distance running instruction is still dominated by direct demonstration methods and verbal explanations, while the use of digital learning media remains suboptimal. This situation causes students difficulty in observing the details of fast-paced movements and deprives them of the opportunity to repeatedly observe correct movements. Preliminary data showed that the average student learning outcomes were still below the Minimum Mastery Criteria (KKM), at 61.4 out of a KKM of 75, accompanied by suboptimal student motivation and self-confidence during practice.

The development of educational technology opens opportunities to address these issues through video-based learning media, which can present information audiovisually and is suitable for materials requiring movement observation. Videos allow students to observe movements from various perspectives, listen to narration, and repeat specific parts according to learning needs, aligning with the principles of multimedia learning (Mayer, 2021), which emphasizes that the combination of visual and verbal elements helps students understand material more effectively. Video-based simulation media is considered relevant to the characteristics of fifth-grade elementary school students, who are at the concrete operational stage and require concrete, repeatable visual examples.

Developing good learning media requires a systematic, valid, practical, and effectively tested process. The ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model was chosen because it provides a clear workflow from needs analysis to evaluating the feasibility and effectiveness of the media. Based on this description, this research aims to (1) produce video-based simulation media for short-distance running athletics for fifth-grade students; (2) determine the level of media feasibility based on assessments by subject matter experts and media experts; (3) determine student responses to the use of the media; and (4) determine the effectiveness of the media in improving students' cognitive and psychomotor learning outcomes in short-distance running athletics material.

Based on the description, the problems in this research can be identified as follows: (1) the learning media used for sprinting material is still conventional and has not optimally utilized digital media; (2) the direct demonstrations conducted by the teacher have not been fully able to show the details of movement techniques to all students; (3) student learning outcomes in sprinting material are still low and have not reached the Minimum Mastery Criteria (KKM); (4) students' motivation, participation, and self-confidence in participating in practice still need to be improved; (5) students need learning media that can display movement stages clearly, systematically, engagingly, and can be reviewed independently; and (6) there is no video-based simulation media specifically developed for this material at SD Negeri 2 Kampung Baru Bandar Lampung. To make the research more focused, the material in the video is limited to starting technique, running technique, and finishing technique, while the learning outcomes studied are limited to the cognitive and psychomotor domains.

Theoretically, this research is expected to contribute to the field of educational technology, especially in the development of interactive digital learning media in Physical Education, Sports, and Health (PJOK), by enhancing understanding of how multimedia technology can be used effectively to improve students' motor skills and cognitive understanding, while reinforcing the application of multimedia learning principles (Mayer, 2021) and cognitive load theory (Sweller, 1988) in simulation-based and interactive media. Practically, this media is expected to be useful for students to learn independently and repeatedly (self-paced learning) so they can adjust the pace of learning to their individual abilities; for teachers to have ready-to-use learning media that reduces dependence on direct demonstrations and can be used as a visual evaluation tool; and for schools as an example of the application of educational technology in sports learning that supports digital transformation and the strengthening of a technology-based learning culture in accordance with the demands of the 21st century.

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Figure 1. Phases in Short-Distance Running (Start, Sprint, Finish)
Source: <https://brainly.co.id/tugas/4482861>, accessed 2026

METHOD

This study employs the Research and Development (R&D) method with the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The developed product is a simulation video covering the crouch start technique, sprinting or acceleration movements, and the technique for crossing the finish line, presented through visuals, narration, explanatory text, and movement repetition. Product effectiveness testing uses a pre-experimental One-Group Pretest-Posttest Design (O1 X O2), so conclusions regarding effectiveness are limited to the improvement in learning outcomes of the students participating in the product trial.

The research subjects consist of material expert validators, media expert validators, Physical Education teachers, and fifth-grade students of SD Negeri 2 Kampung Baru Bandar Lampung who were involved in the individual trial, small group trial, and field trial stages (Table 1). The selection of students for the individual and small group trials used purposive sampling, considering the variation in initial abilities, while the field trial used saturation sampling involving all fifth-grade students.

Table 1. Research Subjects

No.	Subject	Number	Role
1	Subject matter expert	2	Assess the accuracy, completeness, sequence, and suitability of the sprinting material.
2	Media expert	2	Assess the visual quality, audio, display, readability, and technical feasibility of the media.
3	Grade V Physical Education teacher	1	Provide needs data and practical input, as well as assist with implementation.
4	Individual trial students	3	Provide initial information regarding the clarity and appeal of the media.
5	Small group trial students	5	Assess the use of the media after the initial revision stage.
6	Field trial students	28	Participate in pre-test, learning, post-test, psychomotor assessment, and response questionnaire.

Source: Researcher's Processed Data, 2026

Data were collected through observation, interviews, questionnaires, tests, and performance assessments, using seven types of instruments: observation guidelines, interview guidelines, material expert validation sheets, media expert validation sheets, student response questionnaires, cognitive learning outcome tests (pre-test and post-test), and psychomotor assessment rubrics. The material expert validation sheet contains indicators of material suitability with learning objectives, concept accuracy, completeness of movement stages, presentation sequence, movement safety, and appropriateness of instructional language. The media expert validation sheet contains indicators of image quality, lighting, camera angle, audio quality, text readability, visual and narration synchronization, display consistency, ease of use, duration, and media compatibility with school devices. The student response questionnaire uses a four-point Likert scale (strongly agree, agree, disagree, strongly disagree) covering ease of use, visual and audio appeal, material clarity, learning motivation, and media usefulness. The psychomotor rubric consists of 15 indicators (five indicators for crouch start technique, six indicators for running technique, and four indicators for finish technique) with scores ranging from 1 to 4 for each indicator.

Expert validation scores and student responses were analyzed using the feasibility percentage $P = (\Sigma X / \Sigma X_i) \times 100\%$, where ΣX is the total obtained score and ΣX_i is the total maximum score, with categories 81-100% very feasible, 61-80% feasible, 41-60% fairly feasible, 21-40% less feasible, and 0-20% not feasible. Psychomotor scores were converted to a 100-point scale by dividing the total score by the maximum score (60) and multiplying by 100. The normality test for the difference between pre-test and post-test scores used Shapiro-Wilk because the number of field test subjects was less than 50, with the criterion $\text{Sig.} \geq 0.05$ indicating normally distributed data. If the data were normally distributed, hypothesis testing continued using the Paired Sample T-Test at a significance level of 0.05 with the formula $t = \bar{d} \div (\text{SDd} \div \sqrt{n})$, while the effect size was calculated using the Cohen's d formula $d = \bar{d} \div \text{SDd}$, with criteria $d = 0.2$ (small), $d = 0.5$ (medium), and $d \geq 0.8$ (large). The improvement in learning outcomes was analyzed using Normalized Gain (N-Gain) referring to Hake's criteria with the formula $g = (\text{post-test score} - \text{pre-test score}) \div (\text{maximum score} - \text{pre-test score})$, with categories $g \geq 0.70$ high, $0.30 \leq g < 0.70$ medium, and $g < 0.30$ low. The media was declared successful if it achieved a minimum feasibility of 61% (feasible category), a minimum student response of 61% (positive category), a significant difference between pre-test and post-test, and an average N-Gain of at least 0.30 (medium category).

RESULT AND DISCUSSION

This research resulted in a video-based simulation media product titled "Short Distance Running Techniques," with a duration of 3 minutes and 46 seconds. It covers three main sections: starting technique, running technique, and finishing technique. The video was developed through the stages of Analysis (identifying student needs and characteristics), Design (preparing a storyboard, narrative script, and instruments), Development (video production through pre-production, production, and post-production), Implementation (staged trials), and Evaluation (analyzing feasibility, response, and effectiveness).

During the Analysis stage, observations and interviews were conducted with fifth-grade Physical Education (PJOK) teachers to identify actual learning conditions, challenges in delivering the material, and media development needs. Observations revealed that the school has a multipurpose field but lacks a standardized track or starting block. Each classroom is equipped with a simple projector and loudspeakers that can be used to display video media. A summary of the teacher interviews is presented in Table 2.

Table 2. Results of Interviews with Physical Education Teachers

No	Topics	Teacher's Answers
1	Teaching and Learning Process	The teacher's explanation and demonstration of the movements, followed by a limited practice period, meant that not all students were able to observe and refine their movements to the fullest extent.
2	Student Difficulties	Difficulties with the crouching starting position, hand-foot coordination while running, and maintaining speed until the finish line.
3	Media Used	It is still limited to books and simple illustrations the use of video is not yet routine in athletics instruction.
4	Expectations for the Media	The media should be engaging, easy to use, tailored to the characteristics of elementary school students, and supportive of hands-on learning.

Source: Researcher's Processed Data, 2026

The product was validated by two material experts and two media experts before being tested on students. The validation results are presented in Table 3.

Table 3. Validation Results of Material Experts and Media Experts

Validator	Field	Score	Percentage	Category
Validator 1	Subject Matter Expert	115/120	96,0 %	Highly Recommended
Validator 2	Subject Matter Expert	115/120	96,0 %	Highly Recommended
Validator 3	Media Expert	108/120	90,0 %	Highly Recommended
Validator 4	Media Expert	112/120	93,3%	Highly Recommended

Source: Researcher's Processed Data, 2026

The average feasibility percentage from the material experts was 96% and from the media experts was 91.7%, both in the very feasibility category. Both media experts suggested minor revisions, namely aligning the narrative/text with the visuals, improving the font size and type, and aligning the institutional logo, all of which were corrected before the field trial. After the revisions, the product was tested in stages through individual trials and small group trials, which aimed to determine media readability, ease of use, and student feedback before being implemented in a larger-scale field trial. The results of both trials are presented in Table 4.

Table 4. Trial Results

Trial Stage	Number of Student	Avarage Percentage Response Category	Category
Individual Trial	3	90,0%	Very Good
Small Group Trial	5	91,5%	Very Good

Source: Researcher's Processed Data, 2026

During individual trials, students provided feedback that explanatory text in some parts of the video should be shown longer for easier reading, that technical movements, such as the squat start, be shown more closely (close-ups), and that certain movements be repeated. This feedback served as the basis for minor refinements to the media before it was tested in small groups. In the small group trials, feedback included the need for additional practice time after watching the video and adjusting the playback duration to align with the learning practice time. Based on the results and feedback from these two stages, the media was declared ready for use in a field trial with 28 fifth-grade students.

In the field trial, students participated in a pre-test, learning using the media, a post-test, a practical assessment (psychomotor), and a response questionnaire. The pre-test results showed an average score of 68.07 (SD = 7.98), while the

post-test results increased to 87.50 (SD = 10.28). The distribution of pre-test and post-test result categories is presented in Table 5.

Table 5. Distribution of Pre-test and Post-test Result Categories

Category	Score Range	Pre-Test (N)	Pre-Test (%)	Post-Test (N)	Post-Test (%)
Very good	90 – 100	0	0,0%	13	46,4%
Good	80 – 89	1	3,6%	9	32,1%
Fair	70 – 79	15	53,6%	5	17,9%
Poor	< 70	12	42,9%	1	3,6%

Source: Researcher's Processed Data, 2026

The Shapiro-Wilk test for normality of the difference between post-test and pre-test scores yielded a W statistic of 0.967 with a Sig. of 0.506 (>0.05). The data were declared normally distributed, and hypothesis testing was continued using a Paired Sample T-Test. The test results showed a t-value of 7.389, $df = 27$, and Sig. (2-tailed) = 0.000 (<0.05), thus rejecting H_0 and concluding that there was a significant difference between students' cognitive learning outcomes before and after media use. Cohen's d effect size of 1.40 was considered large, indicating that the improvement in learning outcomes was practically meaningful, not just statistically.

The N-Gain analysis yielded an average score of 0.57, which falls within the moderate category. A summary of the N-Gain categories for all students is presented in Table 6.

Table 6. Summary of N-Gain Categories

Category	N-Gain Range	Number Of Students	Percentage
High	$g \geq 0,70$	13	46,4%
Medium	$0,30 \leq g < 0,70$	7	25,0%
Low	$g < 0,30$	8	28,6%

Source: Researcher's Processed Data, 2026

In terms of psychomotor skills, the average post-learning student skill score was 88.46 (SD = 5.46), with all students (100%) achieving the good to excellent category. However, because the practical assessment was conducted only once (post-learning) without baseline score data for comparison, these results are descriptive and cannot be tested for improvement using N-Gain. The student questionnaire responses showed an average score of 95.2%, with all students (100%) in the very positive category, indicating that the media was well-received in terms of ease of use, attractiveness, and usefulness.

Improved cognitive learning outcomes can be explained through several mechanisms. First, video media allows students to observe the entire sequence of techniques in a complete and repetitive manner, something that is difficult to achieve through short, live demonstrations, in line with the principles of self-paced learning. Second, the use of text/captions accompanying the movement visuals utilizes the principle of dual coding, conveying information through visual and verbal channels simultaneously, which theoretically strengthens understanding and retention of the material. Third, the procedural and sequential nature of short-distance running material is highly suitable for presentation through video media, as the movement stages can be visualized sequentially and concretely, in line with the characteristics of elementary school students who are at the concrete operational stage (Piaget, as cited in (Desmita, 2009)).

The conceptual framework of this research is based on the gap between the conventional conditions of short-distance running learning and the need for media that can display movement techniques visually, clearly, and reproducibly, as depicted in Figure 2.

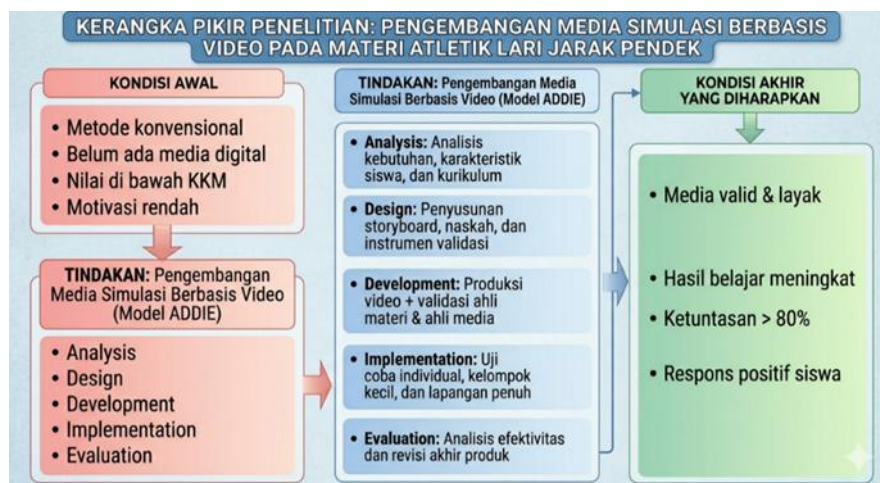


Figure 2. Research Framework

Source: Researcher assisted by AI, 2026

Although the average N-Gain was in the medium category, 13 of the 28 students (46.4%) achieved the high category individually, while 8 students (28.6%) were in the low category, including several students with negative N-Gain scores. This variation indicates that the effectiveness of the media is not uniform across all students and may be influenced by factors other than the media, such as students' concentration levels during the post-test or differences in individual learning styles. In terms of psychomotor skills, high post-learning skill scores are relevant to modeling or observational learning theory (Bandura, 1977), which states that individuals can learn a motor skill through observing a model, without having to resort to trial and error alone. High student response is also important to consider because acceptance of learning media is a prerequisite for its continued use in the classroom.

This finding is consistent with similar research showing that video and digital media are consistently effective in improving elementary school students' learning outcomes, both in the cognitive and psychomotor domains, with N-Gain ranging from fair to high (Rahmat & Ikhsan, 2021; Hartono & Sari, 2023; Rosti et al., 2025). However, this study has a novelty in the form of a comprehensive focus on a single media unit for all phases of short-distance running (start, acceleration, and finish) in the context of SD Negeri 2 Kampung Baru Bandar Lampung which has never been studied before, as well as a development approach that combines the principles of Cognitive Load Theory (Sweller, 1988) and Multimedia Learning (Mayer, 2021) explicitly and systematically.

This study has several limitations that require attention when interpreting the results. First, the study design used a One-Group Pretest-Posttest Design without a control group, so that the improvement in learning outcomes cannot be fully attributed to the media without considering the possible influence of other factors, such as the testing effect or student maturity. Second, the psychomotor assessment was only conducted once after the learning process without initial score data, so the magnitude of the improvement in motor skills cannot be measured quantitatively. Third, the limited number of field test subjects in one class (28 students) in one school limits the generalizability of the findings to other elementary school contexts with different characteristics. These limitations are the basis for recommendations for further research to use an experimental design with a control group, measure initial and final psychomotor scores, and expand the scope of research subjects to several schools.

CONCLUSION

A video-based simulation media for short-distance athletics was systematically developed using the ADDIE model. This began with a needs analysis due to low student learning outcomes (61.4 out of a minimum standard of 75) and conventional learning. This was followed by storyboard and instrument design, product development through pre-production

and post-production, phased implementation, and evaluation, resulting in a final product aligned with field needs, the curriculum, and the characteristics of elementary school students.

The developed media was declared highly suitable for use based on validation results from material experts (96% and 91.7%, respectively) (average overall suitability of 93.85%), and received a very positive response from students, with an average percentage of 95.2%. This indicates that the media was well-received and able to increase student interest, motivation, and engagement in learning. The media also proved effective in improving students' cognitive learning outcomes, as demonstrated by a significant difference between pre-test and post-test scores ($\text{Sig.} = 0.000 < 0.05$), an increase in the average score from 68.07 to 87.50, and an N-Gain value of 0.57, which falls into the moderate category with a Cohen's d effect size of 1.40 (large category). In the psychomotor domain, the practical assessment results showed an average score of 88.46, with all students (100%) achieving the good to excellent category, although the improvement could not be statistically tested due to limited initial data. Overall, the developed video-based simulation media was deemed valid, feasible, received positive feedback, and was effective for use in teaching short-distance running in Physical Education (PJOK).

Based on these conclusions, it is recommended that PJOK teachers consistently utilize this media, combine it with hands-on practice, and utilize the replay feature to provide individual feedback to students who are still experiencing difficulties. Schools are advised to provide adequate supporting facilities such as projectors, speakers, and video players to ensure optimal and sustainable media utilization. Future researchers are advised to expand the scope of the trial to several schools with more diverse student characteristics, add a control group to strengthen the experimental design, measure initial psychomotor scores for comparison, and develop video simulation media for other athletic materials or combine it with other interactive technologies such as augmented reality to further enhance the effectiveness of motor skills learning.

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