Advances in Physical Education, 2026, 16(2), 17-31
https://www.scirp.org/journal/ape
ISSN Online: 2164-0408
ISSN Print: 2164-0386

Effect of Feedback Using Movies and Strobe Images on Focus of Movement for Running Long Jump in Physical Education Classes

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How to cite this paper: Azuma, A., & Matsui, K. (2026). Effect of Feedback Using Movies and Strobe Images on Focus of Movement for Running Long Jump in Physical Education Classes. *Advances in Physical Education, 16,* 17-31.
https://doi.org/10.4236/ape.2026.162002

Received: March 22, 2026
Accepted: May 24, 2026
Published: May 27, 2026

Abstract

The impact of various types of visual media on motor learning in physical education classes is not well understood. This study examined differences in learners' movement focus points when using visual media (movies and strobe images) in physical education classes for running long jump. The study involved 61 male participants aged 17 - 18. During the final phase of a running long jump unit in physical education, the participants received feedback on their performance via either movies or strobe images. After receiving the feedback, the participants were asked to rank six taught skills, five body parts, and four movement phases in order of strongest awareness using a questionnaire. Both media emphasized actions during the takeoff (takeoff angle), particularly leg movements. However, the movie's sense of speed heightened awareness of the approach run (initial velocity) even more. Furthermore, the afterimages from the strobe image fostered spatial imagery related to the use of the upper limbs and effective landing. It was suggested that these two visual media provided learners with perspectives related to dynamic and static characteristics.

Keywords

Movie, Strobe Image, Running Long Jump, Visual Media

1. Introduction

Visual media are widely used in sports and physical education, and numerous studies support the effectiveness of such feedback in motor learning (Van Wieringen et al., 1989; Weir & Connor, 2009; Kelly & Miltenberger, 2016; Matsui & Azuma, 2019; Matsui & Azuma, 2021; Azuma & Matsui, 2023; Azuma & Diaz, 2025). Notably, movies can now be easily recorded using portable devices like tablet PCs and mobile phones, moving beyond video cameras. This allows for convenient feedback in physical education classes and everyday activities like walking, running, and dancing. Movies are widely recognized as useful for motor learning (James, 1971; Van Wieringen et al., 1989) and are particularly recognized as effective for improving movement in closed-skill sports (Cooper & Rothstein, 1981).

Other visual media include sequential photographs (Whelan et al., 2016; H'mida et al., 2020) and strobe images (Matsui & Azuma, 2019; Matsui & Azuma, 2021; Azuma & Matsui, 2023; Azuma & Diaz, 2025). Sequential photographs are a series of rapidly captured images arranged frame by frame, which allows for the observation of a single pose within a movement by comparing sequential photographs. In contrast, strobe images depict motion afterimages at fixed time intervals within a single image. Compared to sequential photographs, strobe images facilitate visualization of movement continuity and have smaller file sizes, making them easier to distribute. Nowadays, students can use groupware to safely distribute them while considering personal information (Azuma & Matsui, 2023). Applications have also been developed that provide learners with feedback by delaying movie playback, even when the camera operator is absent (see the Japan Sports Agency and Okuda, M. in the References). In other words, visual media with these contrasting features—movies that provide feedback on movement and strobe images that provide feedback on frozen movement—can easily be used in motor learning.

Movies naturally convey a sense of speed through visual information, allowing viewers to track the movement of body parts in real time and understand their speed and timing. In contrast, strobe images allow viewers to imagine speed based on the width of the interval between afterimages, but they cannot convey a strong impression of speed. However, poses that only remain as impressions in movies are clearly depicted in strobe images through afterimages. Since afterimages are depicted at fixed time intervals, viewers can discern how postures change over time to constitute movement. Physical education classes involve various learning units, and since many class periods are not devoted to a single skill, creating effective teaching materials is crucial. Visual media are one effective means of achieving this. Running long jump is a closed-skill sport involving various phases: the approach, takeoff, flight, and landing. Strobe images facilitate visualization and instruction of movements in each phase and have been adopted in physical education to improve long jump technique (Matsui & Azuma, 2019; Matsui & Azuma, 2021; Azuma & Diaz, 2025). Additionally, studies on active learning have incorporated strobe images (Azuma, 2024). However, movies possess characteristics not offered by strobe images. Movies, enabled by playback delay technology that provides infinite feedback, are expected to facilitate efficient learning. To effectively utilize these visual media in instruction, it is essential to understand what aspects learners focus on when comparing movies, which provide feedback on motion itself, with strobe images, which offer feedback on static motion (afterimages).

Therefore, the purpose of this study was to examine differences in learners' focus points during the running long jump in physical education classes when using different visual media, such as movies and strobe images.

2. Methods

2.1. Participants

The participants were 61 healthy male students, aged 17 - 18, who were enrolled in their third year at a National Institute of Technology. Thirty of them were assigned to the video feedback group (MF group), and 31 were assigned to the strobe image feedback group (SF group). The MF and SF groups were originally separate classes. They met at different times, but at the same frequency (once a week). Physical characteristics of each group are shown in Table 1. This study was approved by the Human Research Ethics Committee of National Institute of Technology, Fukui College (Approval No. R7-2). Participants received a thorough explanation of the study's purpose and methods, and written consent was obtained for their participation and data provision.

Table 1. Physical characteristics of the participants.

Variable	Group	
	Movie Feedback (MF, n = 30)	Strobe image Feedback (SF, n = 31)
Age (yr)	17.7 ± 0.3	17.8 ± 0.3
Stature (cm)	170.0 ± 4.9	170.0 ± 6.0
Body weight (kg)	62.5 ± 10.3	57.1 ± 7.6

2.2. Experimental Procedures

Data for this study were collected during the final phase (Days 1–5) of the running long jump unit in physical education classes. Both groups received standard practical instruction aligned with the curriculum guidelines for the running long jump unit. Specifically, on Day 1, learners practiced safe landing techniques in the sandpit using the standing long jump, as well as takeoff actions with short runs of five meters or less. Days 2 - 3 involved teaching skills for transitioning from the run to takeoff and landing techniques (described later), as well as jump practice with short runs of 5 meters or more that incorporated these skills. On Day 4, participants gradually extended the approach distance to find their optimal distance. On Days 4 - 5, participants performed maximum jumps using the approach distance they selected. (see Table 2.)

The running long jump consists of four phases: the approach, takeoff, flight, and landing. However, it is difficult to thoroughly cover all phases within a single unit, so the skills related to the flight phase were barely addressed. Due to the limited class time (on Days 1 - 3 in this study), we focused on variables that significantly influence jump distance according to the oblique projection concept in physics: initial velocity at takeoff (S1), takeoff angle (S2-S5), and landing (S6)

(Fukashiro, 1983). **Table 3** shows the specific instructional content for S1 - S6 (Azuma & Matsui, 2023). We used the JAAF teaching manual (JAAF, 2020) and the supplementary textbook used by the students (Taishukan Publishing Co., Ltd., 2021) to instruct these elements.

Table 2. Lesson plan of the running long jump unit.

Day	Contents of learning and practicing
Day 1	Safe landing in the sandpit after a standing long jump and takeoff practice with a short approach-run (5 meters or less)
Day 2	Learning approach-run-to-takeoff transition movements and landing skills (S1 - S6, **Table 3**), along with jump practice over short approach runs (5 - 10 m) incorporating these skills
Day 3	Short approach-run (10 - 15 m) jump practice incorporating skills learned (S1 - S6, **Table 3**)
Day 4	Extending the approach run distance to determine the optimal approach distance and performing the maximum jump at the selected approach run distance
Day 5	Performing the maximum jump at the distance of the selected approach run

Table 3. Learning skills for the running long jump.

Skill code	Contents of learning skills
S1	No deceleration at takeoff.
S2	Shorten the ground contact time at takeoff, and don't bend the knees as much as possible.
S3	Swing the lead leg up until the thigh is horizontal at takeoff.
S4	Conscious of jumping high at takeoff (Takeoff angle should be 20 - 24 degrees).
S5	Stretch up with a straight back at takeoff.
S6	Throw forward with both feet together at landing.

Participants in both the MF and SF groups performed their maximum jumps during the Day 5 session. Afterwards, they received their respective feedback. The MF group performed their maximum jump at a practice location equipped with an iPad® running a video delay playback application (Time-Shift Camera for iPad, Version 3.0 produced and modified by Okuda, 2025) and a large-screen display. After landing in the sandpit, the participants walked to the monitor location to observe their movie. The monitor displayed a 20-second delayed video of their jump with 480 pixels. After observing it, they performed the jump again. This observation-jump cycle was repeated at least twice (**Figure 1**). In contrast, on Day 5, the SF group's instructors used an iPad with a strobe image creation application (Clipstro, SPLYZA Inc., Version 3.1) to create strobe images of each participant's maximum jump (**Figure 2**). These images were then distributed electronically to each participant via groupware (Microsoft Teams®).

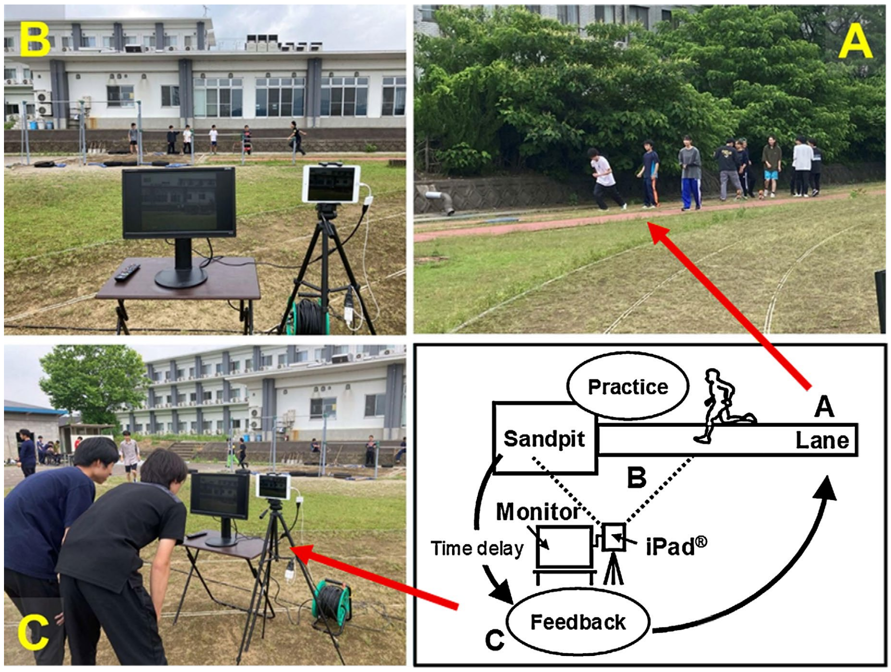

Figure 1. Practice session with feedback on movies played with delay in movie feedback (MF) group. (A) Starting point of the approach run for the running long jump, (B) Running participants in front of a camera device, (C) Observing movie feedback provided with a time delay after landing.

Figure 2. An example of the strobe image provided to the strobe image (SF) feedback group.

The MF group completed the questionnaire at the end of the Day 5 session, and the SF group completed it after receiving images after the session. The questionnaire asked participants to rank items across three categories—skills, body parts, and phases—based on their observations of the movie (MF group) or strobe image (SF group). Specifically, participants ranked the items on which they had focused most intensely within each of the following categories: Six skills (S1 - S6), five body parts (head, arms, torso, hips, and legs), and four phases (approach run, takeoff, flight, and landing). Participants assigned numerical rankings (1 for the item on which they focused the most, 2 for the item on which they focused the second most, and so on).

Conversely, sprint ability is known to be related to jumping ability, and a certain degree of correlation has been recognized (Azuma & Matsui, 2021a; Azuma & Matsui, 2021b). Therefore, there have been attempts to estimate running long jump performance (i.e., predicted jump distance) based on sprint ability. Substituting an individual's 50-meter run time into the linear regression equation relating 50-meter run time (X) and jumping distance (Y) within a learner group (Y = aX + b) yields the predicted value of Y. In this context, jumping ability refers to the extent to which sprint ability is utilized for jumping when sprint ability is maximally expressed and can be quantified. In this study, learners whose results calculated by this metric were 1.0 or higher were classified into the high-ability group, while those below 1.0 were classified into the low-ability group (Azuma & Matsui, 2019; Matsui & Azuma, 2019). As this classification is based on a within-group regression model, it applies only to the sample population. All participants had their 50-meter run times measured during physical education classes prior to the running long jump unit using the test items specified by Japan's Ministry of Education, Culture, Sports, Science, and Technology (MEXT).

As the feedback formats differ across groups, the duration and frequency of media use do not align. Specifically, watching one's own movements several times in the 'movie' condition is different from staring continuously at a 'strobe image' for one session. Furthermore, although the timing of the responses to the questionnaires varies, the MF group responded immediately after watching the movie and the SF group responded after viewing the strobe image, so they align in this respect.

2.3. Analysis

The ranking values provided by individuals in the MF and SF groups were averaged for each survey category. Then, items with higher average rankings (smaller means) were compared between groups. Additionally, participants within each group were divided into high and low jump ability categories as mentioned above. Items with high rankings were also compared between these ability categories.

The questionnaire presented six skills, five body parts and four situations in tabular form, categorized by type, with space provided next to each one to record rankings. These ranking scales have not been pilot-tested or undergone content validity testing. Therefore, interpretation of the results is limited to descriptive analysis.

As in the study by Bates et al. (1983), ranked survey results are not necessarily suitable for statistical analysis; therefore, we intend to present the findings of this study in a purely descriptive manner. This is because ranked survey data attempts to quantify highly subjective aspects of learning—that are phenomena that are inherently ambiguous and abstract—and we believe such data should be regarded solely as having documentary value and should be treated as practical educational resources.

2.4. Statistics

The relationship between 50-meter run time and maximum long jump distance was determined using Pearson's correlation coefficient. A linear regression equation was derived with 50-meter run time as the independent variable and maximum jump distance as the dependent variable.

A two-factor analysis of variance (ANOVA) was performed on the participants' jump distances, considering the types of feedback (movie or strobe image) and jumping ability (high or low) as the two factors. All statistical significance levels were set at 5%.

3. Results

3.1. Evaluation of Participants' Jumping Ability and Differences in Jump Distance between Groups

The correlation coefficient between 50-meter run time and maximum long jump distance was −0.622 for the MF group and −0.703 for the SF group (both $p < 0.05$). The linear regression equations, with 50-meter run time as the independent variable and maximum jump distance as the dependent variable, were $Y = -0.55X + 8.48$ and $Y = -0.69X + 9.38$ for the MF and SF groups, respectively. Substituting the participants' 50-meter run times into these equations yielded predicted jump distances. Dividing the measured jump distances by the predicted values yielded 14 participants in the MF group with values ≥ 1 (mean ± SD = 1.06 ± 0.04) and 16 participants with values < 1 (mean ± SD = 0.94 ± 0.04) (see Figure 3). In the SF group, 15 participants had a ratio ≥ 1 (mean ± SD = 1.10 ± 0.07), and 16 participants had a ratio < 1 (mean ± SD = 0.90 ± 0.05) (Figure 3).

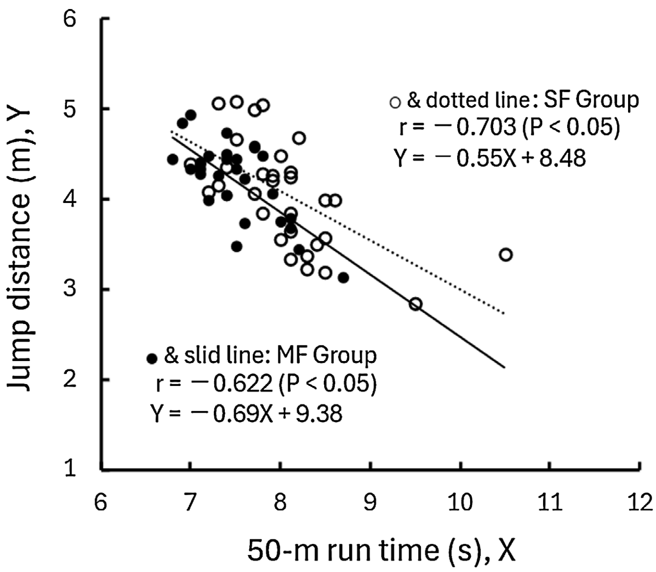

Figure 3. Relationship between 50-meter run time and jump distance in MF and SF group.

The results of a two-way ANOVA with feedback type (movie or strobe image) and jumping ability (high or low) as the factors are shown in Table 4. The main effect of feedback was not significant (F = 2.17, P > 0.05), but the main effect of jumping ability was significant (F = 33.39, P < 0.05). Furthermore, the interaction was not significant (F = 1.73, p > 0.05).

Table 4. Low- and high-ability group means and standard deviations in jump distance for the movie feedback (MF) and strobe image feedback (SF) group and two-way ANOVA results.

Group	L-ability	H-ability	Main effect	
			Group	Ability
MF (m)	4.08 ± 0.39	4.47 ± 0.29	ns	P < 0.05
SF (m)	3.70 ± 0.43	4.46 ± 0.47		

L- and H-ability indicate Low-ability group and High-ability group respectively.

3.2. Overall Characteristics of Ranked Groups in Each Category

Focusing on the top two positions in the average ranked scores (Tables 5-7), both groups ranked S4 highest for skills related to center of gravity height and jump angle during takeoff. However, the next highest skill for the MF group was S1, or the ability to not decelerate before takeoff, while the next highest skill for the SF group was S6, or the ability to control landing movement (Table 5). Regarding body parts, the legs ranked highest for both groups. However, the waist ranked second for the MF group and the arms ranked second for the SF group (Table 6). Regarding phases, takeoff ranked highest for both groups. The approach run ranked second for the MF group and the aerial phase ranked second for the SF group (Table 7). The average rankings for takeoff (2.10) and aerial movements (2.13) were very close in the SF group.

Table 5. Average rank for skill category in the movie feedback (MF) and strobe image feedback (SF) groups.

Skill Code	MF Group			SF Group		
	Total	L-ability	H-ability	Total	L-ability	H-ability
S1	2.87 (1)	2.56 (1)	3.21 (2)	3.29 (3)	3.81 (4)	2.73 (1)
S2	3.77 (5)	4.13 (5)	3.36 (3)	4.29 (5)	4.19 (5)	4.00 (5)
S3	3.70 (4)	3.63 (4)	3.79 (5)	3.42 (4)	3.69 (3)	3.13 (3)
S4	3.00 (2)	2.88 (2)	3.14 (1)	2.48 (1)	2.13 (1)	2.87 (2)
S5	4.20 (6)	4.31 (6)	4.07 (6)	4.29 (5)	4.19 (5)	4.40 (5)
S6	3.47 (3)	3.50 (3)	3.43 (4)	3.23 (2)	3.00 (2)	3.47 (4)

The numbers in parentheses represent the average ranked. L- and H-ability indicate Low-ability group and High-ability group respectively.

Table 6. Average rank for bogy parts category in the movie feedback (MF) and strobe image feedback (SF) groups.

Part	MF Group			SF Group		
	Total	L-ability	H-ability	Total	L-ability	H-ability
Head	3.93 (5)	3.63 (5)	4.29 (5)	4.68 (5)	4.81 (5)	4.53 (5)
Arms	3.47 (4)	3.38 (3)	3.57 (4)	2.61 (2)	2.44 (3)	2.80 (2)
Trunk/Back	2.90 (3)	2.81 (2)	3.00 (3)	2.65 (3)	2.25 (2)	3.07 (3)
Hip	2.87 (2)	3.38 (3)	2.29 (2)	3.35 (4)	3.63 (4)	3.07 (3)
Legs	1.83 (1)	1.81 (1)	1.86 (1)	1.71 (1)	1.88 (1)	1.53 (1)

The numbers in parentheses represent the average ranked. L- and H-ability indicate Low-ability group and High-ability group respectively.

Table 7. Average rank for phase category in the movie feedback (MF) and strobe image feedback (SF) groups.

Phase	MF Group			SF Group		
	Total	L-ability	H-ability	Total	L-ability	H-ability
Approach-run	2.37 (2)	2.31 (2)	2.43 (2)	2.71 (3)	2.63 (4)	2.80 (3)
Takeoff	1.90 (1)	2.13 (1)	1.64 (1)	2.10 (1)	2.06 (3)	2.13 (1)
Flight phase	2.63 (3)	2.50 (3)	2.79 (3)	2.13 (2)	2.00 (2)	2.27 (2)
Landing	3.10 (4)	3.06 (4)	3.14 (4)	3.06 (4)	1.88 (1)	2.80 (3)

The numbers in parentheses represent the average ranked. L- and H-ability indicate Low-ability group and High-ability group respectively.

3.3. Differences in Group Rankings Based on Jumping Ability across Categories

The group with low jumping ability showed higher rankings for S4 and S6, which is consistent with the overall trend. However, the group with high jumping ability deviated from this trend by ranking S1 higher than S4. In the MF group, regardless of jumping ability, S1 and S4 were ranked higher, which matched the overall trend. The top-ranked skill for the group with high jumping ability was S4, while the top-ranked skill for the group with low jumping ability was S1 (see **Table 5**). Regarding body part rankings, the legs were the top-ranked skill for both groups, regardless of jumping ability. However, while the upper body/back was the next highest ranked for the low-jump ability SF and MF groups, the arms were the next highest ranked for the high-jump ability SF group and the waist was the next highest ranked for the high-jump ability MF group (**Table 6**). In the MF group, both the high- and low-jump ability groups ranked the takeoff as the top priority and the approach run as the second priority for the leg region. In the SF group, however, the high-jump ability group ranked the takeoff as the top priority and the aerial phase as the second priority, while the low-jump ability group ranked them in reverse order. Nevertheless, the average rankings were very close (takeoff: 2.06 vs aerial phase: 2.00) (**Table 7**).

4. Discussion

4.1. Participant Performance and Jumping Ability

No statistically significant difference in maximum jump distance was observed between the MF and SF groups in this study. This suggests that responses to different feedback were compared within equivalent, homogeneous groups. Furthermore, the results of the two-way ANOVA revealed clear differences in performance based on jumping ability, indicating that individuals capable of effectively utilizing their sprinting ability were more frequently found among those with higher performance.

4.2. Skill

Although there are subtle differences in the duration and frequency of visual media use, as well as in the timing of the responses to the questionnaires, across the groups, the impact on the focus point is considered to be minimal since feedback and questionnaires were provided at equivalent opportunities and timings within the lesson unit.

Due to feedback, both the MF group and the SF group demonstrated a strong awareness of jumping high during takeoff (S4). Furthermore, both groups recognized the importance of maintaining momentum during the approach run (S1). However, the SF group with low jumping ability showed stronger awareness of the landing action (S6), as reflected in the overall SF group average. The third-ranked factor in the SF group average was S1 (3.29), only slightly lower than S6 (3.23). S1 and S4 are skills related to initial velocity and takeoff angle, respectively. These are factors associated with viewing takeoff as projectile motion in physics (Fukashiro, 1983). The MF and SF groups with high jumping ability recognized the importance of these factors regardless of the type of feedback. However, the SF group with low jumping ability did not demonstrate high awareness of S1, which is related to initial velocity. Observation of strobe images among those with low jumping ability suggests that improvement in skills unrelated to power (S6) was emphasized over initial velocity, which relates directly to power. Extending the legs forward upon landing (S6) brings the center of gravity closer to the ground during the final phase of parabolic flight, resulting in increased forward distance (**Figure 2**). The static afterimages in the strobe images reveal postures that are not visible in movies and could provide individuals with low jumping ability with perspectives beyond power and takeoff angle. Unlike the strobe images, the MF group cannot observe the landing moment as a freeze frame.

4.3. Body Parts

Both types of feedback confirmed that the leg region was the most critical. However, the group with lower jumping ability consistently demonstrated the second-strongest awareness of the upper body/back region using both feedback methods. For those with lower jumping ability, feedback from strobe images and movies both highlighted that their upper body and back were not sufficiently extended upward. The trunk segment is large in terms of weight (Winter, 1990), and its relatively stable movement may have prevented significant differences in awareness from being revealed by visual feedback. Awareness of the hips was the second-highest focus for the MF group with low jumping ability, while awareness of the arms was the second-highest focus for the SF group. Consequently, these respective tendencies determined the overall patterns for each group. The importance of the arms is emphasized during the upward swing motion at takeoff, specifically in the attempt to pull the body upward. In strobe images, the use of the arms during takeoff is immediately apparent as a static afterimage. In contrast, movies only momentarily capture the arm movement during takeoff, leaving merely an impression in consciousness. This may explain why the arms were strongly emphasized by the advanced SF group, those with high jumping ability, who aimed to achieve an effective takeoff. Meanwhile, the waist, in an integrated position with the legs, which are the most consciously focused area, may have been prioritized as the primary power-generating region for the high-jumping MF group (Azuma & Matsui, 2021a; Azuma & Matsui, 2021b). While the arms play a crucial role in lifting the body during takeoff, they are peripheral areas with significant movement variability and are difficult to observe clearly in movies. Therefore, in the factors of initial velocity and takeoff angle in oblique projection, the afterimage effect of strobe images may have provided insights related to the latter.

4.4. Phases

In the MF group, takeoff was ranked the highest, followed by approach run. These two rankings remained consistent regardless of jumping ability. In contrast, for the SF group, takeoff and flight were the top two overall rankings on average. However, the rankings differed between the high- and low-jumping ability groups. However, the average difference in the latter rankings was negligible, suggesting no discernible difference in jumping ability. The MF group focused primarily on the initial phase of running long jump, from the approach run to the takeoff, while the SF group emphasized the core phase, from the takeoff to the flight phase. In both groups, takeoff was the highest-ranked phase, leaving no doubt that it is the most critical phase in the long jump. In the MF group, however, the approach run was emphasized after the takeoff, while in the SF group, the flight phase was emphasized after the takeoff. The movies strongly emphasize the sense of speed during the approach run and takeoff, highlighting the acceleration and impact force. After the jump, the body decelerates during the airborne phase and comes to rest during the landing phase, causing the dynamic elements to disappear. In other words, movies have the potential to strongly convey the idea that elements such as acceleration and impact force determine performance. In contrast, strobe images clearly visualize the post-jump trajectory through afterimages and may strongly associate the body's parabolic path with the takeoff event. In other words, strobe images may link kinematic and spatial elements with performance in participants' consciousness.

4.5. Relationships among Survey Groups and Categories

In the MF group, the high ranking of skill S1 (maintaining momentum during the approach run) may be correlated with the strong focus on the approach run phase. Skills emphasized by the MF group, such as S1 and S4, along with the approach run and takeoff phases, involve power-generating elements like running and jumping. This may have led to a heightened awareness of the lower back and legs as power-generating resources in the body part analysis.

In the SF group, the high awareness of the arms in the body part analysis may be related to the takeoff phase, when the body is lifted, and the flight phase, when the body moves in a parabolic trajectory due to this lift. However, the SF group, which had lower jumping ability, focused intensely on the landing action (S6). Yet, landing did not rank highly in their phase selection. This may appear contradictory, but it could be due to a lack of skills related to aerial movements in their skill options (a limitation of the instructional unit), with the landing action being the only skill directly connected to aerial movement. Extending the legs forward before landing (S6) is a kinematic technique that lowers the body's center of gravity, thereby increasing jump distance. In other words, this aspect may have been implicit in the SF group's strong focus on the flight phase. In other words, parabolic motion is visible as an afterimage, so the idea that landing posture can extend jump distance may have been derived from this spatial phase.

Several studies have demonstrated that movies are superior to still images for learning human motor skills (Höffler & Leutner, 2007; H'mida et al., 2020). However, these studies compared movies to simple images, not strobe images. Unlike movies, strobe images provide feedback on a stationary "arrow" state that cannot be observed. This concept is similar to the paradox proposed by the philosopher Zeno: "The flying arrow is at rest" (Hager, 1987). Nevertheless, it is possible to perceive a stationary afterimage dynamically because the feedback image depicts the participant themselves. Thus, the stationary afterimage can be recognized as a moment of movement, capable of evoking perceptions of force, intensity, and speed. Therefore, even as a still image, the strobe image strongly emphasizes skills (S4), body parts (legs), and phases (takeoff) that require speed and power. This aligns with the top feedback items from movie-based feedback. In other words, both types of visual media can provide key feedback for the running long jump. While strobe image feedback improves learners' performance in hurdle running and long jump physical education classes (Azuma & Matsui, 2023; Azuma & Diaz, 2025), providing feedback from both media, if time permits within a lesson unit, may offer complementary perspectives tailored to learners' readiness and ability.

Finally, our research aims to quantify highly subjective aspects of learning, i.e. phenomena that are inherently ambiguous and abstract. Capturing these subjective and practical aspects is an extremely complex task. At times, revising the research framework may be the most effective way to ensure the results reach the intended beneficiaries. Therefore, rather than being classified as quantitative research involving standardized continuous variables and statistical analysis, this study has documentary value and should be considered a practical educational resource.

5. Conclusion

This study examined how college students performing the running long jump in physical education classes focused on their movements when provided with feedback using two visual media: movies and strobe images, which allowed for objective viewing of their jumps. The results showed that both types of media provided strong awareness of leg movements, specifically the takeoff angle, which is the most critical event in the long jump. However, movie feedback tended to increase awareness of power generation skills and the physical resources (e.g., lower back and legs) that produce that power during the initial phase of long jump performance (e.g., approach run and takeoff). In contrast, strobe image feedback emphasized spatial or kinematic perspectives, such as arm movement during takeoff and the takeoff and flight phases, as well as landing skills. These results suggest that the speed perception inherent in movies directs attention toward power-related aspects from the approach run to takeoff. In contrast, the static afterimage effect of strobe images fosters spatial awareness of movements related to the takeoff angle and the body's trajectory after the jump.

Acknowledgements

An overview of this study was presented orally at the 2025 World Congress of Kinesiology and Sports Science (Jeju, Korea). And this work was supported by JSPS KAKENHI (Scientific Research (C)) Grant Number 25K06559.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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