

The Effect of *Motion Analysis (Coachview)* Application on the Understanding and Skills of Basic Kicking and Punching Techniques in Pencak Silat in Grade Vii Students at SMPN 2 Sumenep

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Abstract

This study aims to analyze the effect of using the motion analysis application CoachView on students' understanding and skills in basic punching and kicking techniques in pencak silat among seventh-grade students at SMPN 2 Sumenep. The background of this research lies in the low levels of understanding and performance of students in pencak silat, which is still taught through conventional methods. Therefore, there is a need for innovative technology-based learning media. This study employed a true experimental method with a Pretest-Posttest Control Group Design. The sample consisted of two randomly selected classes, each with 32 students, divided into an experimental group (using CoachView) and a control group (conventional learning). The research instruments included a skill performance test and a comprehension questionnaire on basic pencak silat techniques. The results showed a significant improvement in both comprehension and skill performance in the experimental group. The average posttest score for technical skills was notably higher than that of the control group. The t-test analysis indicated a significance value of less than 0.05, confirming a statistically significant effect of CoachView usage. Furthermore, the validity and reliability tests of the instruments showed that all instruments were valid and highly reliable ($\alpha = 0.882$ for the questionnaire and $\alpha = 0.910$ for the skill rubric). In conclusion, the use of the CoachView application is effective in enhancing students' understanding and technical skills in pencak silat. This technology provides clear visual feedback and enables students to identify and correct movement errors independently. The study recommends the integration of CoachView as an alternative learning media in physical education classes.

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1. INTRODUCTION

Education is a human interaction between teachers and students aimed at achieving maximum graduate competency through careful planning. According to Law Number 20 of 2003 concerning the National Education System, learning is the process of interaction between students, educators, and learning resources in a learning environment. Accordingly, Asmara (2019) states that learning success is largely determined by careful planning and the active involvement of all learning components to maximize graduate competency. In the context of Junior High Schools (SMP), Physical Education, Sports, and Health (PJOK) plays a crucial role in facilitating behavioral change, cognitive growth, and affective development of students through physical activity. Roesdiyanto (2020)

emphasized that Physical Education (PJOK) is inseparable from the national education system because it contributes to the development of students' character, physical fitness, and social skills. One essential topic in the PJOK curriculum is pencak silat, which is not just a sport but a martial art, a cultural heritage of Indonesia, that teaches spirituality, discipline, and self-defense skills.

However, conditions on the ground demonstrate a gap between curriculum expectations and student performance. Observations at SMPN 2 Sumenep revealed a key problem: students' low understanding and skill in practicing basic pencak silat techniques, particularly kicking and punching. According to Schmidt & Lee (2019), mastery of motor skills requires repeated practice accompanied by clear and specific feedback so that movement errors can be effectively corrected. This problem was clearly identified during the student selection process for the district-level Student Sports Week (POPDA), where even students who passed, the selection were deemed to still be very lacking in technical aspects. Basic errors that often-appeared included unstable body posture, weak kicking and punching power, and imperfect accuracy in hitting the target. This phenomenon is quite concerning, considering that SMPN 2 Sumenep has historically produced capable athletes who have represented the district at the provincial level.

A deeper analysis revealed that the problem stems from conventional learning methods, where teachers simply explain and provide examples, and then students are asked to imitate. This leads to students feeling bored, disinterested, and having minimal opportunities for independent learning. Furthermore, feedback (*feedback*) given verbally by teachers is considered insufficient to help students correct movement errors that occur very quickly. According to Muktiani (2019), effective learning must be interactive and provide opportunities for students to evaluate and reflect on their learning outcomes. The lack of technological media capable of providing detailed visualizations of movement errors is a major obstacle for students in improving their technique independently.

In the face of these challenges, integrating information technology into sports teaching is an urgent solution. The use of motion analysis applications such as *CoachView* offers features *slow-motion* and visual annotation, that allow for detailed analysis of physical movements through video recordings. With this technology, students can review their own movement recordings, compare them to ideal technique, and receive more objective feedback. According to Sari (2024), the use of video-based motion analysis applications has been proven to improve the quality of visual feedback, which is essential in evaluating sports techniques. Based on this background, this study was designed with the main objective to: Analyze the effect of using motion analysis applications (*CoachView*) on students' understanding of the concept and theory of basic kicking techniques (front, side, T) and punches (front, vertical, side) in pencak silat. Analyzing the influence of the use of motion analysis applications (*CoachView*) on students' practical skills in executing basic pencak silat kicking and punching techniques precisely. Evaluating the effectiveness of using visual technology media in providing students with the ability to correct technical errors independently compared to traditional learning methods.

By achieving this objective, it is hoped that the research can provide theoretical contributions to the development of technology-based PJOK learning media and practical benefits for teachers in improving the quality of instruction in schools.

2. RESEARCH METHOD

This research uses a quantitative approach with a pure experimental type (*true experimental*) and a design of Pretest-Posttest *Control Group*. The research population was

all seventh-grade students of SMPN 2 Sumenep (320 students), with a sample of 64 students divided into two classes: Experimental Group (n=32) using *Coach View* and the Control Group (n=32) using conventional methods.

The dependent variables in this study were basic technical understanding, measured by a questionnaire, and basic technical skills, measured by a practical test. The practical test instrument was assessed using a rubric covering preparation, implementation, and advanced movements. Data analysis techniques included validity, reliability, and significance tests using *t-test*, *paired* and *independent samples t-test* to compare results between groups.

To ensure the objectivity and reliability of the data, this research was carried out through several systematic stages as follows:

2.1.Preparation Stage

- a. Instrument Development: Researchers developed a practice assessment rubric for 6 basic techniques (front, side, T kicks, and front, upright, side punches) and a Likert-scale-based understanding questionnaire.
- b. Expert Validation: Validating the instrument through consultation with experts to ensure the suitability of the content before use in the field.
- c. Instrument Trial: Conducting validity and reliability tests on 32 respondents outside the research sample to ensure the consistency of the measuring instrument.
- d. Technical Preparation: Researchers train themselves in using the application features of *CoachView* (like *slow-motion* and annotations) so that the intervention process runs optimally.

2.2.Pretest Implementation Stage

- a. Initial Skill Measurement: Both groups (experimental and control) performed a practical test of 6 basic pencak silat techniques, which were recorded as initial data.
- b. Initial Understanding Measurement: Students completed a questionnaire to measure their theoretical understanding of basic techniques before receiving treatment.

2.3.Level of Intervention or Treatment

The learning process is carried out over 4 meetings (1 time per week) with different schemes:

- a. Experimental Group: Students get the material using the application of *Coach View*. The process includes recording student movements, self-analysis using the *slow-motion* feature and *frame-by-frame*, as well as visual annotations by the teacher to correct technical errors. Furthermore, this group is required to practice independently at home at least three times a week using the app.
- b. Control Group: Students received learning using conventional methods, where the teacher gave a direct demonstration, and students imitated without the aid of video-based motion analysis media.

2.4.Posttest Implementation Stage

- a. Final Skill Measurement: After 4 intervention sessions, both groups took the practice test again to see changes in physical performance.
- b. Final Understanding Measurement: Both groups completed the understanding questionnaire again to see how much their theoretical knowledge had improved.

2.5.Data Analysis and Processing Stage

- a. Gain Score Calculation: Pretest and posttest data from both groups are collected to calculate the difference value (gain score).

- b. Statistical Test: Researchers conducted analysis using *t-test paired* to see the improvement in each group, as well as the independent samples t-test to compare the effectiveness between the experimental group and the control group.
- c. Interpretation of Results: The results of the quantitative analysis are interpreted to draw conclusions regarding the influence of technology use on student learning outcomes.

3. RESEARCH RESULTS AND DISCUSSION

3.1. Research result

3.1.1. Validity and Reliability Test

Before core data collection, the instruments were tested to ensure measurement quality.

- a. Validity of the Understanding Questionnaire: using correlation *Pearson Moment product* of the 22 questions, 20 were declared valid with a value of $r_{count} > r_{table}$ (0.349).

Table 3.1 Validity Test of the Understanding Questionnaire
(Source: Personal Document, 2026)

No	Tests Conducted	Formula Used	Results	Information
1	Questionnaire Validity	$r = \frac{\Sigma(XY)}{\sqrt{(\Sigma X^2 \times \Sigma Y^2)}}$ (Product Moment Correlation)	Of the 22 grains, 20 valid items ($r_{count} > r_{table}$ 0.349), 2 items were invalid and deleted	The questionnaire stated valid

Information:

- X = item score per item
 - AND = total score of all items
 - r_{table} for $n = 32$ at $\alpha = 0.05$ is 0.349
- b. Validity of Skill Instrument: All indicators in the 6 basic techniques (18 rubric items) have a value of $r_{count} > 0.349$, so it is declared empirically valid.

Table 3.2 Skill Instrument Validity Test
(Source: Personal Document, 2026)

No	Basic Techniques	Formula Used	Results	Information
1	Kicks & Punches (6 techniques)	$r = \frac{\Sigma(XY)}{\sqrt{(\Sigma X^2 \times \Sigma Y^2)}}$ (Product Moment Correlation)	All indicators (18 rubric items) have a calculated $r > 0.349$	All indicators are valid

Information:

- X = item score per item
 - AND = total score of all items
 - r table for $n = 32$ at $\alpha = 0.05$ is 0.349
- c. Reliability: Test results of *Cronbach's Alpha* shows a value of 0.882 for the understanding questionnaire and 0.910 for the skills instrument, which means both are in the very reliable category.

Table 3.3 Instrument Reliability Test Table (*Cronbach's Alpha*)
(Source: Personal Document, 2026)

N o	Instrument	Formula Used	Alpha Results	Category
1	Comprehension Questionnaire	$\alpha = (k / (k-1)) \times (1 - (\sum \sigma^2_i / \sigma^2_{total}))$	0,882	Very Reliable
2	Skill Instrument	$\alpha = (k / (k-1)) \times (1 - (\sum \sigma^2_i / \sigma^2_{total}))$	0,910	Very Reliable

Information:

- k = number of items
- σ^2_i = variance of each item
- σ^2_{total} = variance total shoes
- Interpretation of Alpha value:
 - ≥ 0.90 : Very reliable
 - 0.80–0.89: Reliable
 - 0.70–0.79: Quite reliable
 - < 0.60 : Not reliable

3.1.2. Basic Engineering Skills Results (Practical Test)

Skill improvement is measured based on the average value *gain score*. The results of the t-test for each technique are as follows:

- a. Front Kick: The experimental group recorded an average *gain score* 2.53, significantly higher than the control group's score of 1.78. The t-test significance value showed $p < 0.001$, indicating a highly significant effect.

Table 3.4 Front Kick Significance Test Results
(Source: Personal Document, 2026)

Group Statistics					
	Class	N	Mean	Std. Deviation	Std. Error Mean
Ma rk	Gainscore_Kontrol	32	1.78	.608	.108
	Gainscore_Experiment	32	2.53	.761	.135

Independent Samples Test					
t-test for Equality of Means					
	t	df	Significance One-Sided p	Significance Two-Sided p	Mean Difference
					e

Mark	Equal variances assumed	- 4.35 4	62	<,001	<,001	-.750
	Equal variances not assumed	- 4.35 4	59.11 8	<,001	<,001	-.750

- b. Side Kick: The experimental group obtained an average *gain score* 3.25, while the control group was 1.69. The t-test yielded a p-value < 0.001.

Table 3.5 Side Kick Significance Test Results
(Source: Personal Document, 2026)
Group Statistics

Class	N	Mean	Std. Deviation	Std. Error Mean
Mark Gainscore_Kontrol	32	1.69	.592	.105
Gainscore_Experiment	32	3.25	1.047	.185

Independent Samples Test
test for Equality of Means

Mark	Class	t	df	Significance		Mean Difference
				One-Sided p	Two-Sided p	
Mark	Equal variances assumed	- 7.34 6	62	<,001	<,001	-1.563
	Equal variances not assumed	- 7.34 6	48.9 90	<,001	<,001	-1.563

- c. T Kick: Average gain score. The experimental group was 3.09, and the control group was 1.69. The t-test significance value showed $p < 0.001$.

Table 3.6 T-Kick Significance Test Results
(Source: Personal Document, 2026)
Group Statistics

Class	N	Mean	Std. Deviation	Std. Error Mean
Mark Gainscore_Kontrol	32	1.69	.592	.105
Gainscore_Experiment	32	3.09	.856	.151

Independent Samples Test
t-test for Equality of Means

t	df	Significance
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				One-Sided p	Two-Sided p	Mean Difference
Mark	Equal variances assumed	- 7.64 2	62	<,001	<,001	-1.406
	Equal variances not assumed	- 7.64 2	55.1 46	<,001	<,001	-1.406

- d. Front Punch (*Jap*): The experimental group achieved *gain score*3.09, while the control was 1.91. The t-test showed $p < 0.001$.

Table 3.7 Results of the Front Strike Significance Test (*Jap*)
(Source: Personal Document, 2026)

Group Statistics

Class		N	Mean	Std. Deviation	Std. Error Mean
Mark	Gainscore_Kontrol	32	1.91	.641	.113
	Gainscore_Experiment	32	3.09	1.118	.198

Independent Samples Test
t-test for Equality of Means

		T	df	Significance One-Sided p	Significance Two-Sided p	Mean Difference
Mark	Equal variances assumed	- 5.21 5	62	<,001	<,001	-1.188
	Equal variances not assumed	- 5.21 5	49.3 83	<,001	<,001	-1.188

- e. Upright Shot (*Straight*): Experiment notes *gain score*3.06 and control 1.88. The significance of the t-test is $p < 0.001$.

Table 3.8 Results of the Significance Test of the Vertical Punch (*Straight*)
(Source: Personal Document, 2026)

Group Statistics

Class		N	Mean	Std. Deviation	Std. Error Mean
Mark	Gainscore_Kontrol	32	1.88	.492	.087
	Gainscore_Experiment	32	3.06	1.045	.185

Independent Samples Test
t-test for Equality of Means

T	df	Significance
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				One-Sided p	Two-Sided p	Mean Difference
Mark	Equal variances assumed	- 5.815	62	<,001	<,001	-1.188
	Equal variances not assumed	- 5.815	44.085	<,001	<,001	-1.188

- f. Side Punch (*Hook*): Experiments obtained *gain score* 2.78 and control 1.75. The t-test significance shows $p < 0.001$.

Table 3.9 Side Hit Significance Test Results (*Hook*)
(Source: Personal Document, 2026)

Group Statistics

Class		N	Mean	Std. Deviation	Std. Error Mean
Mark	Gainscore_Kontrol	32	1.75	.568	.100
	Gainscore_Experiment	32	2.78	1.008	.178

Independent Samples Test
t-test for Equality of Means

		T	df	Significance		Mean Difference
				One-Sided p	Two-Sided p	
Mark	Equal variances assumed	- 5.044	62	<,001	<,001	-1.031
	Equal variances not assumed	- 5.044	48.895	<,001	<,001	-1.031

Cumulatively, the increase in skills in the experimental group ranged from 2.41 to 2.63, while the control group was only 1.56 to 1.81.

3.1.3. Basic Engineering Understanding Results (Questionnaire)

The comprehension data also showed a marked difference between the two learning methods:

- a. Experimental Group: Mean *gain score* understanding reached 23.47.
- b. Control Group: Mean *gain score* understanding only 15.25.
- c. T-Test: Produces a significance value (two-tailed) of 0.009, which is less than 0.05.

Table 3.10 Significance Test Results of *t-Test* Understanding Basic Techniques
(Source: Personal Document, 2026)

Group Statistics

	Class	N	Mean	Std. Deviation	Std. Error Mean
Mark	Gainscore_Kontrol	32	15.25	12.016	2.124
	Gainscore_Experimen	32	23.47	12.472	2.205

Independent Samples Test

t-test for Equality of Means

		t	df	Significance		Mean Difference
				One-Sided p	Two-Sided p	
Ma rk	Equal variances assumed	-2.685	62	.005	.009	-8.219
	Equal variances not assumed	-2.685	61.914	.005	.009	-8.219

This proves that the application intervention of *CoachView* has a significant influence on students' conceptual understanding

3.2. Discussion

3.2.1. Effectiveness Analysis of *CoachView* Towards Basic Engineering Skills

Based on the test results of the *Independent Samples T-Test*, it was found that all the basic pencak silat techniques tested showed a significant value (2-tailed) $p < 0,001$, which is much smaller than the significance level of 0.051. This confirms that the use of the application *motion analysis CoachView* provides a very real impact compared to conventional methods.

- a. Kicking Technique: The greatest improvement was seen in the side kick, where the experimental group achieved an average gain score of 3.25, while the control group only had 1.692. This difference of 1.56 points indicates that the features of *low-motion* on *CoachView* is crucial in helping students analyze the semicircular trajectory and the position of the instep as a point of contact, which is often misunderstood in teacher demonstrations. *real-time*. In the T kick, the experimental group achieved a *gain score* of 3.09 compared to 1.69 in the control group, proving that the visual annotation feature helps students correct the hip rotation and lateral body position that are characteristic of this technique.

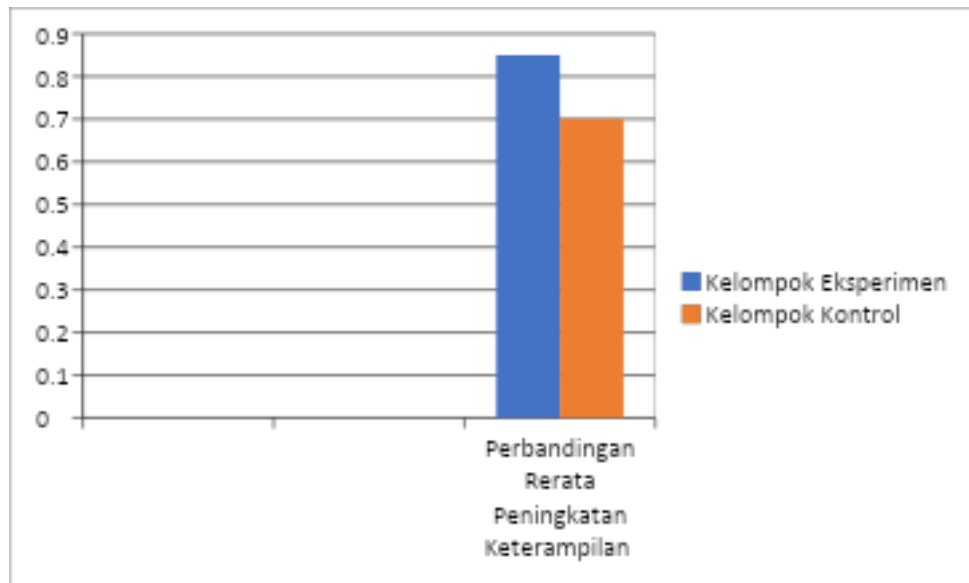


Figure 3.1 Rerata Gain Score Kicking Technique
(Source: Personal Document, 2026)

- b. Hitting Technique: In the forehand technique (*jap*), the experimental group showed an average increase of 3.09, while the control group showed only 1.914. Through analysis *frame-by-frame*, students can observe whether the shoulder and hip thrust are optimally engaged, rather than relying solely on arm strength. A similar thing happened with the upright and side strokes, where the experimental group consistently recorded *gain score* above 2.7, far exceeding the control group, which only ranged from 1.5 to 1.8.

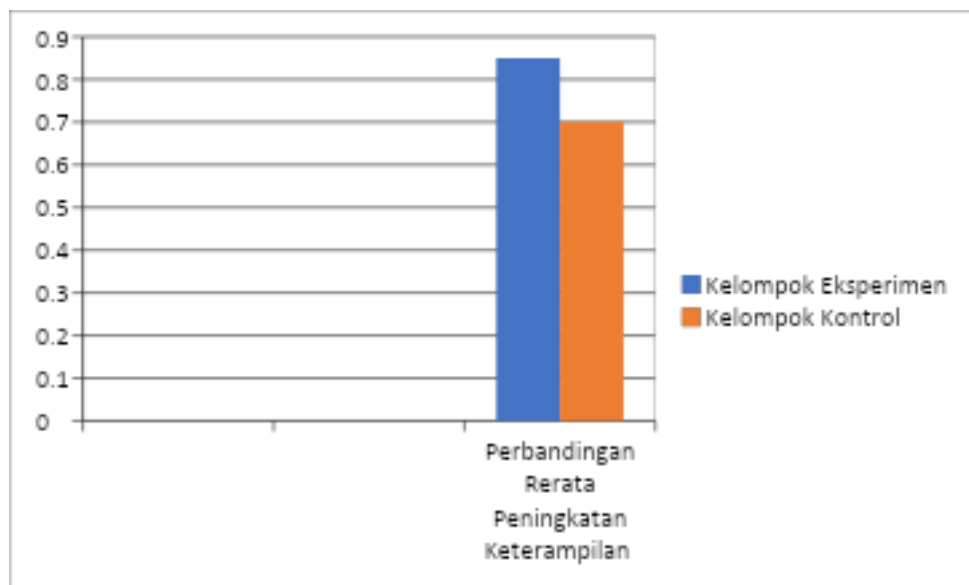


Figure 3.2 Rerata Gain Score Punching Technique
(Source: Personal Document, 2026)

Cumulatively, the success rate of students' skills in the experimental group reached 100% in the "Good" and "Very Good" categories for all hitting

techniques at the end of the posttest session, while the control group still had students in the "Enough" category.

3.2.2. Effectiveness Analysis *CoachView* Towards Understanding Basic Techniques

Data shows that the application *CoachView* not only improves physical performance, but also students' cognitive understanding of motion theory. The average gain score. The experimental group's understanding was 23.47, which was significantly higher than the control group's 15.25 ($p = 0.009$).

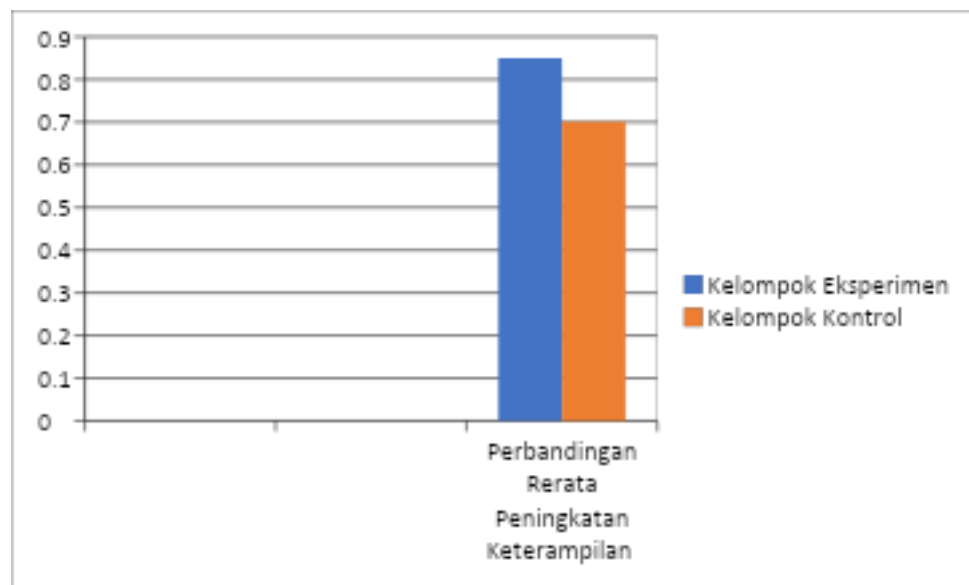


Figure 3.3 Rerata Gain Score Technical Understanding
(Source: Personal Document, 2026)

This improvement is due to the application's ability to provide concrete visual feedback. In conventional methods, students often "don't understand" or only "understand" (only 12.5% understand when *pretest*) because it is difficult to visualize technical details quickly. After the intervention, 100% of students in the experimental group fell into the "Understand" to "Very Understand" category, while in the control group, there were still 6.2% of students in the "Quite Understand" category. This finding supports constructivist theory, where data visualization strengthens students' procedural memory through the process of self-analysis (*self-review*).

3.2.3. Comparison of Advantages with Conventional Methods

Comparative data shows that the average skill improvement for the experimental group was above 85%, while the control group only saw a gain of 70-75%. Key advantages of *CoachView* located in the video comparison feature (*video comparison*), which allows students to compare their movement recordings with the ideal technique of a teacher or professional athlete.

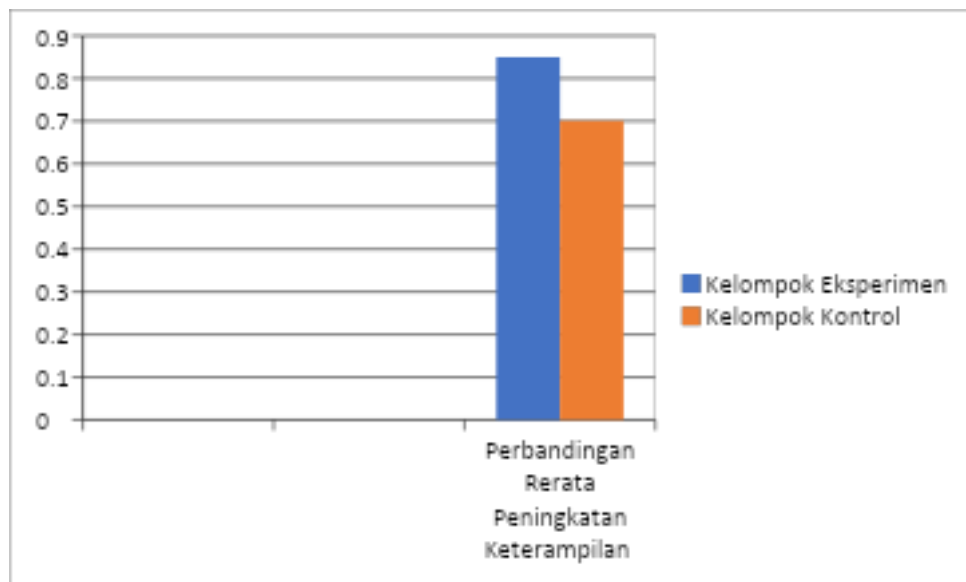


Figure 3.4 Comparison Average Skill Improvement
(Source: Personal Document, 2026)

Conventional methods dominated by one-way lectures and demonstrations have proven ineffective in facilitating self-correction. In contrast, this technology integration allows for personalized learning, allowing each student to see their specific errors, such as elbow position on a punch or foot placement on a kick, which are often overlooked in mass teacher evaluations in the classroom.

3.2.4. Validation through Previous Research

This finding is consistent with the research of Artawijaya (2023) and Mukaromah & Semarayasa (2024), which stated that video tutorials with detailed visual feedback effectively improve pencak silat learning outcomes. The significant effect ($p < 0.001$) in this study also supports Wirawan's (2021) study, which emphasized that audiovisual media can increase student motivation and engagement because they feel more involved in the process of evaluating their own movements.

Overall, the data proves that the application of *motion analysis* not just an additional tool, but an essential instrument in the transformation of modern physical education in secondary schools.

4. CONCLUSION

Based on the results of data analysis, the following conclusions can be drawn:

- Application utilization of *CoachView* has a statistically significant effect on improving basic kicking and punching skills in pencak silat ($p < 0.001$). The average increase (*gain score*) the experimental group reached 2.41 to 3.25, far exceeding the control group (1.56-1.91)
- Utilization of the application also significantly improved students' understanding of basic techniques ($p = 0.009$). 100% of students in the experimental group achieved the "Understand" to "Very Understand" category.
- This application effectively facilitates student independence in correcting movement errors through detailed visual feedback.

It is recommended for PJOK teachers to integrate the technology of motion *analysis* in the sports curriculum to create more interactive and effective learning.

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6. BIBLIOGRAPHY

- Ahmad, F., & Akutansi, S. I. (2024). Transformasi Digital Dalam Pendidikan Olahraga: Integrasi Teknologi Untuk Peningkatan Kinerja Atlet. *Ilmudata.Org*, 4(3), 2024–2025.
- Aljabar, M. R. (2016). Pengembangan Sumber Belajar Materi Pencak Silat Untuk Pemula Berbasis Android. *Universitas Negeri Yogyakarta*.
- Amroin, Y. S., & Indahwati, N. (2021). Peningkatan Keterampilan Tendangan Dalam Pencak Silat Melalui Variasi Gerak Dasar Tendangan “T” dan Tendangan Depan Pada Siswa Kelas V SDN Pinggir Papas 1. *JISIP (Jurnal Ilmu Sosial Dan Pendidikan)*, 5(3), 282–287. <https://doi.org/10.36312/jisip.v5i3.2084>
- Artawijaya, I. P. E. (2023). Pengembangan Media Pembelajaran Video Tutorial Materi Teknik Dasar Pencak Silat. *Jurnal Ilmu Keolahragaan Undiksha*, 11(1), 37-44.
- Asmara, H. (2015). *profesi kependidikan*. Alfabeta.
- Burn, B. (2018). Pengembangan Multimedia Teknik Dasar Pencak Silat. *Universitas Negeri Yogyakarta*.
- Halbatullah, K., Astra, I. B., & Suwiwa, I. G. (2019). Pengembangan model latihan fleksibilitas tingkat lanjut dalam pembelajaran pencak silat. *Jurnal Ika*, 17(2), 136–149.
- Hamdani. (2014). Evaluasi IMT & Kondisi Atlet PELATNAS Pencak Silat SEA Games Tahun 2013. *Tesis Tidak Diterbitkan, Surabaya : PPsUniversitas Negeri Surabaya.*, 31–32.
- Hariyadi, R. K. S. (2003). *Teknik Dasar Pencak Silat Tanding*. Dian Rakyat.
- Kavita, V., Sharma, J. P., & Tiwari, R. K. (2018). Use of Information Technology in Physical Education and Sport. *International Journal in Multidisciplinary and Academic Research*, 2(4), 6.
- Kriswanto, E. S. (2015). *Pencak Silat*. Pustakabarupress.
- Lubis, Johansyah dan Wardoyo, H. (2014). Pencak Silat Edisi Kedua. *JMP Online*, 4(No. 3 Maret (2020)), 99–113.
- Lubis, J. (2014). *Pencak Silat Panduan Praktis*. Rajagrafindo Persada.
- Maksum, A. (2018). *Metodologi Penelitian dalam Olahraga* (Edisi Kedu). Unesa University Press.

- Mukaromah, A. M., & Semarayasa, I. K. (2024). Metode Pembelajaran Berbantuan Video Tutorial Untuk Meningkatkan Hasil Belajar PJOK Materi Teknik Dasar Pencak Silat Tendangan Lurus. *Jurnal Ilmu Keolahragaan Undiksha*, 12(1).
- Muktiani, N. R. (2014). Identifikasi Kesulitan Belajar Dasar Gerak Pencak Silat Pada Mahasiswa PJKR Bersubsidi Di FIK UNY. *Jurnal PJOK Indonesia.*, 10(1).
- Mulyana. (2013). *Pendidikan Pencak Silat*. PT. Remaja Rosdakarya.
- Naharsari, D. N. (2008). *Olahraga Pencak Silat*. JMP Online Vol. 4 No. 3 Maret (2020).
- Nugroho, A. (2005). *Skripsi: Identifikasi Skor Prestasi Teknik Pencak Silat Pada Katagori Tanding*. FKIP Universitas Negeri Yogyakarta.
- Pilus, A. M., Norafif, M., Amin, M., & Muhammad, N. (2017). The effect of sport technology on student athletes' Petanque Skill Performance. *In International Journal of Applied Engineering Research*, 12. <http://www.ripublication.com>
- Rahadian, A. (2019). Aplikasi Analisis Biomekanika (Kinovea Software) Untuk Mengembangkan Kemampuan Lari Jarak Pendek (100 M) Mahasiswa PJKR Unsur. *Journal of SPORT (Sport, Physical Education, Organization, Recreation, and Training)*, 3(1), 1–8. <https://doi.org/10.37058/sport.v3i1.752>
- Ramadhanti*, D., Kuswanto, H., Hestiana, H., & Azalia, A. (2021). Penggunaan Analisis Video Gerak Kucing Melompat Berbantuan Aplikasi Tracker Sebagai Kegiatan Praktikum Mandiri Materi Gerak pada Peserta Didik SMP. *Jurnal Pendidikan Sains Indonesia*, 9(3), 459–470. <https://doi.org/10.24815/jpsi.v9i3.20547>
- Roesdiyanto. (2017). *Kompetensi Profesional Guru Pendidikan Jasmani, Olahraga, dan Kesehatan (Dalam Kompetensi Inti Pemahaman Tujuan Pembelajaran dan Memilih Materi Pembelajaran Sesuai dengan Tingkat Perkembangan Peserta Didik*. 1(1), 624–630.
- Rosdiani, D. (2014). *Perencanaan Pembelajaran Dalam PJOK Dan Kesehatan*. Alfabeta.
- Sari, M., & Akutansi, S. I. (2024). Peran Teknologi Dalam Peningkatan Prestasi Atlet: Penerapan Sistem Informasi Dalam Pendidikan Olahraga. *Ilmudata.Org*, 4(3), 2024–2025.
- Subagyo. (2012). *Pencak Silat*. Unesa University Press.
- Subroto, T., Yudianta, Y., & Hidayat, Y. (2016). *Penulisan Penelitian Tindakan Kelas Dalam PJOK, Olahraga dan Kesehatan*. FPOK UPI.
- Sugiono. (2016). *Metode Penelitian Pendidikan*. ALFABETA.
- Suryani, N. L. P. S., & Abadi, I. B. G. (2022). Pengembangan Media Pembelajaran Video Tutorial Teknik Dasar Pencak Silat. *Jurnal Pendidikan Jasmani Indonesia*, 18(2), 215–226.
- Taqwim, R. I., Winarno, M. E., & Roesdiyanto, R. (2020). Pelaksanaan Pembelajaran Pendidikan Jasmani, Olahraga, dan Kesehatan. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, 5(3), 395. <https://doi.org/10.17977/jptpp.v5i3.13303>
- West, D. M. (2013). Mobile Learning: Transforming Education, Engaging Students, and Improving Outcomes. *Center for Technology Innovation at Brooking*, 17.
- Wirawan, G. C. (2021). Penggunaan Media Audiovisual untuk Meningkatkan Efektivitas Pembelajaran Tendangan Sabit dalam Pencak Silat. *Universitas Negeri Yogyakarta*.