

The Effect of the Cobra Stretch Training Method on Students' Kayang Abilities

Yoga Aziz Kurnia Anggara^{1*}, Nurman Ramadhan², Mohamad Da'i³

¹²³Physical Education, Health and Recreation, Faculty of Teacher Training and Education, Nahdlatul Ulama Sunan Giri University, Bojonegoro, Jl. A. Yani No. 10, Bojonegoro, 62115, Indonesia

Corresponding author. Email: yaanggara751@gmail.com

(Submission Track: Received: 29-12-2025, Final Revision: 20-03-2026, Available Online: 22-03-2026)

Abstrac. The bridge (kayang) is a fundamental floor gymnastics skill that requires spinal flexibility, back muscle strength, and abdominal muscle strength. However, many elementary school students experience difficulty performing the bridge due to limited flexibility and insufficient core muscle strength. Therefore, a specific stretching method is needed to improve this ability. This study aimed to examine the effect of the cobra stretch training method on students' bridge ability. This research used a quantitative approach with a one-group pretest–posttest pre-experimental design to evaluate skill improvement after a structured intervention. The participants were 20 fifth-grade students of Dahor State Elementary School selected using total sampling. The intervention was conducted for four weeks, three times per week. The instrument was a validated performance observation rubric assessing starting position, back arch, position stability, and final position. Data were analyzed using descriptive statistics, Shapiro–Wilk normality test, paired sample t-test, and Cohen's d effect size analysis. The results showed a significant improvement after the intervention ($t = -17.172$, $p < 0.05$), with the mean score increasing from 7.15 to 12.45. The effect size was very large (Cohen's $d = 3.84$), indicating a substantial practical impact. It can be concluded that the cobra stretch method is effective and practical for improving students' bridge ability and can be applied in Physical Education learning at the elementary school level.

Keywords: cobra stretch; bridge skills; floor gymnastics; spinal flexibility; flexibility training.



INTRODUCTION

Exercise in floor gymnastics is very important for improving students' motor skills, strength, flexibility, and body coordination. Kayang is a floor exercise movement that requires spinal flexibility, arm muscle strength, and ideal body balance. Floor gymnastics in Physical Education (PJOK) learning plays a crucial role in stimulating students' motor development through structured and sustainable physical activity. Properly designed physical activity has been shown to improve children's motor skills, including strength, flexibility, and movement coordination (Aliriad et al., 2023). However, field conditions indicate that many students experience difficulties in performing a backbend (*kayang*) due to insufficient abdominal muscle strength and limited spinal flexibility (Tahrur, et al., 2025). In such situations, a proper and systematic physical training approach is needed to help students improve their *kayang ability*.

Various methods have been used to improve floor gymnastics skills. Mobile learning can facilitate independent learning by allowing students to access materials anytime and anywhere (Adi et al., 2020). The demonstration method is effective in improving elementary school students' learning outcomes because it helps them understand techniques through direct examples (Asriana, 2022). Task card-based practice techniques can improve floor gymnastics skills through structured independent practice (Safrial, 2022). Peer tutoring is also effective because student interaction can enhance learning outcomes (Purnama et al., 2021). Repetitive practice has been shown to be highly effective in improving floor gymnastics skills (Husnan, 2020; Muhrisin, 2023). Interactive games can create a fun learning environment that supports movement optimization (Hafid et al., 2025). The problem-based learning model is effective in improving students' candle and bridge (*kayang*) skills (Zahra, et al., 2023). In addition, play-based methods are important for improving student learning outcomes (Nugroho, et al., 2023). Based on these studies, it can be concluded that previous research has mainly focused on learning models and instructional media. However, studies examining specific stretching techniques that directly target the dominant muscles involved in bridge (*kayang*) movements remain limited.

The ability to perform a backbend (*kayang*) is based on good coordination between the elasticity of the back muscles, the strength of the abdominal muscles, and the flexibility of the spine (Tresnowati, et al., 2021). The flexibility of the spinal segments, especially in the lumbar and thoracic regions, as well as the elasticity of the surrounding muscle tissue, significantly influence the physiological performance of the bridge. Full extension in the bridge will be difficult to achieve if spinal flexibility is limited or if the back muscles are tight, and this condition may increase the risk of injury if the movement is forced. Stretching programs, both

static and dynamic, are essential for improving flexibility and joint mobility (Fachrurrazi, 2020). Static stretching involves holding muscles in a stretched position for a specific period to increase muscle fiber tolerance to tension. The cobra stretch is a form of static stretching exercise that can support the improvement of *kayang ability*, as it is performed in a prone position by pushing the body upward using the hands to create spinal extension. This movement aims to strengthen the lower back muscles while increasing flexibility in the lumbar and thoracic spine. Therefore, there is a theoretical basis for using the cobra stretch as a technique to improve *kayang ability*, as it targets spinal flexibility and the strength of supporting muscles, which are essential components of the movement.

The novelty of this study lies in its specific focus on applying the cobra stretch method to improve students' *kayang* abilities, in contrast to previous studies that focused more on media development or variations in learning strategies. Compared to conventional stretching methods, the cobra stretch method is more targeted because it directly stimulates the back and abdominal muscles, which are the most important muscles in the *kayang* movement. Furthermore, this study uses measurable and objective analytical tools to evaluate the success and improvement in students' flexibility in *kayang* movements after the training treatment. The results of this study are more empirical and can be scientifically proven thanks to the quantitative experimental approach used. This also provides an applicable contribution to developing training methods for floor gymnastics learning in Physical Education (PJOK) subjects.

The main limitation of previous research lies in the limited number of studies that specifically examine the effectiveness of targeted stretching exercises on bridge (*kayang*) performance, particularly the cobra stretch technique. Previous studies have tended to focus more on the development of learning media, such as augmented reality-based media and physical education learning media for floor gymnastics (Asrori, 2022; Zulbahri et al., 2020). In addition, many studies emphasize the use of instructional models, such as the demonstration method and practical styles using task cards and Google Forms-based assignments, which have been shown to improve learning outcomes (Asriana, 2022; Stiyapranomo, 2023). Other studies have also highlighted psychological aspects, such as students' anxiety levels during bridge learning (Hanan et al., 2023). Furthermore, the success of floor gymnastics learning is influenced not only by training methods but also by the competence of physical education teachers in designing, implementing, and evaluating the learning process, where strong pedagogical and professional competence enables teachers to create safe, effective, and student-centered learning environments (Saifuddin, et al., 2021). Therefore, this study contributes new insights into the use of the cobra stretch as a simple, practical, and applicable training technique

for teachers and coaches, as it directly targets flexibility, muscle strength, and balance, which are essential components in improving students' *kayang ability*.

This study aims to find evidence that cobra stretch exercises can improve students' flexibility, muscle strength, and bridge skills. Furthermore, it aims to offer an alternative, easy-to-use, effective, and convenient training method to help teachers and coaches teach floor gymnastics students.

METHOD

Because the purpose of this study was to determine the effect of a specific treatment on objectively measured variables, a pre-experimental design with a one-group pretest–posttest model was employed, meaning that the study involved only one group without a control group. The one-group pretest–posttest design is considered effective for measuring improvements in students' learning outcomes or skills after a structured intervention within the same group, making it suitable for practical learning research such as floor gymnastics (Ghimire et al., 2023). In this study, all fifth-grade students of Dahor State Elementary School who participated in Physical Education lessons on floor gymnastics were included as the population. The sample consisted of all 20 students due to the relatively small population size, following total sampling principles (Bulus, 2021). The sample selection criteria included students who actively participated in class activities, had no history of back or spinal injuries, and were able to perform the bridge (*kayang*) movement.

The study design consisted of three main stages: pretest, treatment, and posttest. In the pretest stage, students' initial *kayang ability* was measured to determine their baseline condition before being given the cobra stretch exercise. The treatment phase was conducted over four weeks (12 sessions), with a frequency of three sessions per week and a duration of 30 minutes per session. Each session consisted of a 5-minute warm-up, a 20-minute main cobra stretch exercise, and a 5-minute cool-down. The exercises were performed in 3–5 sets, with a holding time of 15–30 seconds and a rest period of 10–15 seconds between sets. After four weeks of training, a posttest was conducted to measure the improvement in students' *kayang ability*. The use of a pretest–posttest design is important in evaluating the effectiveness of learning or training programs aimed at improving physical skills (Almomani et al., 2024).

The research instrument used direct physical observation and measurement methods to assess students' *kayang ability*. The aspects measured included back flexibility using a back flexibility test (cobra stretch), back and abdominal muscle strength using the sit-up and back-up tests, and *kayang ability* assessed through a performance observation sheet consisting of four indicators: starting position, back arch, position stability, and final position. Each indicator was

evaluated using a Likert scale ranging from 1 to 5. To reduce observation errors and obtain a more accurate average score, measurements were conducted twice. The research instrument was developed by the researchers based on theoretical references and standard physical fitness tests. The instrument was also tested beforehand to ensure its reliability. The application of this measurement approach follows a quantitative methodology based on measurable data (Sauqi, et al., 2024).

Descriptive and inferential analyses were conducted in this study. The descriptive analysis included the calculation of the mean, standard deviation, and distribution of students' *kayang ability* scores before and after the treatment. To determine whether there was a significant difference between the pretest and posttest results, inferential analysis was performed using a paired sample t-test at a significance level of 0.05. The use of a t-test in a quantitative approach is effective for identifying significant differences in interval or ratio data (Alfaiz et al., 2023). With a p value <0.05 , it can be concluded that cobra stretch training has a significant effect on students' bridge-like ability.

The research consisted of three main stages: preparation, implementation, and analysis. The preparation stage included developing the research proposal, designing the instruments, coordinating with Physical Education teachers, and conducting a pilot test to ensure the validity and reliability of the instruments (Afandi, 2025). During the implementation stage, a pretest was conducted, followed by the administration of the cobra stretch exercise according to the predetermined schedule, and a posttest was carried out after four weeks of treatment. The analysis stage involved processing the measurement data using statistical software and interpreting the results to evaluate the effectiveness of the treatment. The findings were then compiled into a scientific report describing the effect of cobra stretch training on students' *kayang ability*.

Overall, this research methodology was systematically and measurably designed to obtain direct evidence regarding the effectiveness of cobra stretch training in improving students' *kayang ability*. Previous studies have shown that experimental methods are essential for objectively measuring changes in students' physical and psychomotor abilities (Hardiansyah, 2024; Tahrin et al., 2025; Wibowo et al., 2024). therefore, this research is expected to contribute to the field of Physical Education (PJOK), particularly by providing a practical, simple, and applicable training method to improve students' floor gymnastics skills in elementary schools.

Table 1. Kayang Skills Assessment Rubric (Scale 1–5)

Rated aspect	Score 5 (Very Good)	Score 4 (Good)	Score 3 (Enough)	Score 2 (Less)	Score 1 (Very Poor)
Starting Position	Correct position, stable, perfectly ready	Almost perfect, there are minor corrections	Quite right, there are some mistakes	Many position errors	Not ready, wrong position
Back Arch	Optimal, symmetrical curve	Good arch, slight asymmetry	Moderate curvature, not yet maximal	Less curvature	Not curved / very bad
Position Stability	Stable ≥ 5 seconds without shaking	Stable, slight correction	Quite stable, sometimes shaky	Less stable	Unstable, unable to hold
Final Position	The descent was very controlled and safe.	Down quite well, there is a minor correction	Less smooth descent	Less controlled descent	Going down very badly/need help

RESULT AND DISCUSSION

Table 2. Frequency of pretest and posttest results

pretest			post-test		
category	freq.	presentation	category	freq.	presentation
Very good	0	0%	Very good	1	5%
Good	0	0%	Good	7	35%
Enough	1	5%	Enough	12	60%
Not enough	11	52%	Not enough	0	0%
Very less	9	43%	Very less	0	0%

Based on the results of descriptive analysis, it shows a clear increase in students' kayang abilities after treatment; most students are in the Sufficient (12 students, 60%) and Very Poor (9 students, 43%) categories, while only 1 student (5%) is in the Sufficient category and no students are in the Good or Very Good categories.

Table 3. Description of pretest and posttest statistics

statistics	pretest	post-test
n	20	20
mean	7.15	12.45
standard deviation	1,631	2,038
minimum	5	10
maximum	11	18

Based on the table above, the number of research samples was 20 students in the pretest and posttest stages, as shown in the descriptive statistics table. The average (mean) score of students' abilities was 7.15 in the pretest, but increased to 12.45 in the posttest. This increase in the average score indicates that students experienced changes in their abilities after the treatment. Students' abilities after the treatment became more diverse. This is indicated by the standard deviation of 1.631 in the pretest and 2.038 in the posttest, which indicates that the variation in the data in the posttest was slightly greater than the pretest. The minimum score in the pretest was 5 and increased to 10 in the posttest. The maximum score also increased from 11 in the pretest to 18. Overall, these data show that students obtained the lowest, highest, and average scores after the treatment

Table 4. Test of normality

Shapiro-Wilk			
Statistics	df	Sig.	
0.847	20	0.053	
0.894	20	0.06	

The results of the data normality test using the Shapiro-Wilk test on the pretest and posttest kayang skill data on twenty students. The test results show a statistical value of 0.847 and a significance value (Sig.) of 0.053 for the pretest data. Meanwhile, the statistical value for the posttest data is 0.894 and a significance value of 0.060. According to the provisions for making decisions on normality tests, data is considered normally distributed if the significance value is greater than 0.05. Because the Sig. values of the pretest (0.053) and posttest (0.060) are both greater than 0.05, it can be concluded that the pretest and posttest kayang skill data are normally distributed. Therefore, the data meets the requirements for parametric statistical analysis using the ordered sample t-test.

Table 5. Paired sampels test

Paired Differences							
95% Confidence Interval of the Difference							
Mean	Standard Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
-5,30000	1,38031	0.30865	-5.94601	-4.65399	-17,172	19	0.0001

The results of the hypothesis testing, which used a paired sample t-test to determine the difference in the ability of the kayang students before and after the bridge training. The results of the analysis showed that the average difference value (mean difference) between the pretest and posttest was 5.30000, indicating that the kayang ability increased after the treatment

because the difference value was negative (the pretest was lower than the posttest). The distribution of the data appeared to be quite homogeneous, with a standard deviation of 1.38031 and a standard error of the mean of 0.30865. Furthermore, the degrees of freedom (df) were 19, the calculated t value was -17.172, and the significance value (Sig. 2-tailed) was 0.0001. There was a significant difference between the results of the kayang skills of the pretest and posttest because the significance value was less than 0.05. Therefore, the alternative hypothesis (H1) was accepted and the null hypothesis (H0) was rejected. Therefore, it has been proven that the bridge test and cobra stretch exercises have a significant effect on improving the kayang skills of students.

One of the main problems in learning floor gymnastics, particularly the bridge (*kayang*) movement, is that students often have low spinal flexibility as well as insufficient abdominal and back muscle strength, which makes it difficult to perform the movement with optimal stability and proper technique, as the ability to perform a bridge is strongly influenced by the flexibility of the abdominal muscles. In addition, muscle strength is an essential component of floor gymnastics skills (Tresnowati et al., 2021). Based on studies on the testing and measurement of floor gymnastics skills, this research utilized a bridge performance assessment instrument alongside measurements of muscle strength and flexibility (Hanan et al., 2023).

The research data showed a normal distribution after the implementation of the treatment over twelve sessions, indicating that the data met the assumptions required for parametric statistical testing in accordance with the characteristics of a one-group pretest–posttest pre-experimental design (Bulus 2021; Ghimire, et al., 2023). The results of the hypothesis testing using a paired sample t-test revealed a significant difference in students' *kayang ability* before and after the treatment. Therefore, it can be statistically concluded that the training had a significant effect on improving students' *kayang ability*. This finding supports the theoretical perspective that performing a bridge movement requires core muscle strength, spinal flexibility, and body stability. Core muscle strength and spinal flexibility are essential components in flexibility and strengthening training (Purnama, et al., 2021; Zahra, et al., 2023). Furthermore, these findings are consistent with previous research showing that increased physical activity and structured exercise contribute to improvements in students' physical abilities (Da'i et al., 2024).

Previous research has shown that exercises focused on strengthening core muscles and increasing body flexibility can improve floor gymnastics skills (Asriana, 2022; Husnan, 2020; Muhrisin, 2023). This study examined the implementation of bridge (*kayang*) exercises as part of Physical Education learning in schools and found that these exercises are effective, easy to

perform, do not require special equipment, and are relatively safe for students. These findings complement previous research on innovative approaches in floor gymnastics learning, including the use of instructional technology, play-based methods, and problem-based learning (Adi, et al., 2020; Nugroho, et al., 2023).

This study cannot compare the effectiveness of the bridge test with other types of training due to several limitations, including the use of a pre-experimental design without a control group and a limited sample size. Consequently, the results cannot be broadly generalized, and further research is needed with better experimental designs and various training methods.

CONCLUSION

This study aimed to evaluate the effect of cobra stretch training on students' *kayang ability*, and the results indicate an improvement following the intervention. These findings provide preliminary empirical indications of the potential effectiveness of cobra stretch training in improving spinal flexibility, core muscle strength, and overall *kayang ability*, which are important components in floor gymnastics. Previous studies have examined flexibility, spinal extension, and core strength in relation to bridge (*kayang*) performance (Husnan, 2020; Muhrisin, 2023) however, the application of specific stretching techniques such as cobra stretch has received relatively limited empirical attention in Indonesian elementary Physical Education contexts. From a methodological perspective, the use of a pre-experimental quantitative design with objective performance measurements provides measurable evidence of improvement after the training program, although causal conclusions should be interpreted with caution. Practically, cobra stretch training can be considered a simple, safe, and applicable alternative exercise for Physical Education teachers and coaches to support the development of students' *kayang ability*. However, this study has several limitations, including the absence of a control group, a relatively small sample size, and the use of a single training method; therefore, future research is recommended to employ more rigorous experimental designs, involve larger and more diverse samples, and compare cobra stretch training with other flexibility and strengthening interventions to obtain more comprehensive and generalizable findings.

REFERENCE

- Adi, S., & Fathoni, A. F. (2020). Mobile Learning sebagai Fasilitas Belajar Mandiri Pembelajaran Senam Lantai pada Mahasiswa Jurusan Ilmu Keolahragaan. In *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan* (Vol. 5, Nomor 8, hal. 1158). State University of Malang (UM). <https://doi.org/10.17977/jptpp.v5i8.13946>
- Afandi, H. A. (2025). Penerapan Pembelajaran Dengan Metode Problem Based Learning (Pbl) Melalui Media Berbasis Android Integrasi Teknik Responsi Pretest Dan Postest. In *Journal Creativity* (Vol. 3, Nomor 1, hal. 310–324). Madrasah Aliyah Mambaul Ulum

- Bata-Bata. <https://doi.org/10.62288/9qx9pd23>
- Alfaiz, R. D., Nu'man, A. H., & Bachtiar, I. (2023). Perancangan Tata Letak Pabrik dengan Pendekatan Kuantitatif Menggunakan Metode Algoritma Craft. In *Bandung Conference Series: Industrial Engineering Science* (Vol. 3, Nomor 1). Universitas Islam Bandung (Unisba). <https://doi.org/10.29313/bcsies.v3i1.7021>
- Aliriad, H., Da'i, M., S, A., & Apriyanto, R. (2023). Strategi Peningkatan Motorik untuk Menstimulus Motorik Anak Usia Dini melalui Pendekatan Aktivitas Luar Ruangan. In *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini* (Vol. 7, Nomor 4, hal. 4609–4623). Universitas Pahlawan Tuanku Tambusai. <https://doi.org/10.31004/obsesi.v7i4.4149>
- Almomani, E., Sullivan, J., Saadeh, O., Mustafa, E., Alinier, G., & Pattison, N. (2024). A26 Evaluating a learner-centred reflective learning conversations debriefing model: a mixed methods pretest-posttest comparative study. In *Journal of Healthcare Simulation*. Zoom Health Ltd. <https://doi.org/10.54531/wokq6317>
- Asriana, A. (2022). Meningkatkan Hasil Belajar Senam Lantai dengan Menggunakan Metode Demonstrasi Siswa Kelas III SD Negeri 2 Cakranegara. In *ANWARUL* (Vol. 2, Nomor 2, hal. 180–191). Darul Yasin Al Sys. <https://doi.org/10.58578/anwarul.v2i2.370>
- Asrori, N. (2022). Media Pembelajaran Olahraga Senam Lantai Dengan Augmented Reality Berbasis Android. In *Jurnal Informatika dan Rekayasa Perangkat Lunak* (Vol. 2, Nomor 4, hal. 559–569). Universitas Teknokrat Indonesia. <https://doi.org/10.33365/jatika.v2i4.1613>
- Bulus, M. (2021). *Sample Size Determination and Optimal Design of Randomized/Non-equivalent Pretest-posttest Control-group Designs*. Center for Open Science. <https://doi.org/10.35542/osf.io/k5ey8>
- Da'i, M., Ramadhan, N., & Rohman, A. (2024). Comparison of Physical Fitness Levels between Boarding School Students based on Islamic Boarding School and Formal School Students. In *Journal Coaching Education Sports* (Vol. 4, Nomor 1, hal. 140–152). Universitas Bhayangkara Jakarta Raya. <https://doi.org/10.31599/em36vx19>
- Fachrurrazi, S. (2020). Aplikasi Pengolahan Data Pariwisata Dan Kepemudaan Pada Dinas Pariwisata Pemuda Dan Olahraga Kabupaten Aceh Tamiang. In *Jurnal Teknologi Terapan and Sains 4.0* (Vol. 1, Nomor 1). LPPM Universitas Malikussaleh. <https://doi.org/10.29103/tts.v1i1.3244>
- Ghimire, B., Acharya, A., & Upadhyay, H. P. (2023). Effectiveness of Structured Teaching Programme on Knowledge Regarding Arterial Blood Gas Analysis among Nursing Students in Chitwan, Nepal A Pre-experimental One Group Pretest Post-test Design. In *Journal of National Heart and Lung Society Nepal* (Vol. 2, Nomor 2, hal. 103–108). Nepal Journals Online (JOL). <https://doi.org/10.3126/jnhls.v2i2.59783>
- Hafid, F., Huda, I. A., & Rahman, D. A. (2025). Pemberian Permainan Interaksi Untuk Optimalisasi Gerakan Senam Lantai. In *Jurnal ABDIMAS: MURI* (Vol. 5, Nomor 1). STKIP Muhammadiyah Kuningan. <https://doi.org/10.33222/jmuri.v5i1.4038>
- Hanan, H. I., Lusiana, L., Zahra, S., & Purnama, Y. (2023). Tingkat Kecemasan pada Pembelajaran Senam Lantai Kayang. In *Indonesian Journal of Kinanthropology (IJOK)* (Vol. 2, Nomor 2, hal. 89–94). Universitas Negeri Surabaya. <https://doi.org/10.26740/ijok.v2n2.p89-94>
- Hardiansyah, F. (2024). Upaya Meningkatkan Kemampuan Senam Lantai Guling Depan Dengan Menggunakan Metode Pendekatan Jigsaw Pada Siswa Kelas IX C SMP Negeri 22 Semarang Tahun Pelajaran 2023/2024. In *Jurnal Riset Sosial Humaniora dan Pendidikan* (Vol. 3, Nomor 2, hal. 10–29). UNTAG Semarang. <https://doi.org/10.56444/soshumdik.v3i2.1604>
- Husnan, H. (2020). Meningkatkan Hasil Belajar PJOK Materi Senam Lantai dengan Metode Latihan Berulang pada Siswa Kelas IV SDN 3 Kopang Tahun Pelajaran 2018 / 2019. In

- JISIP (Jurnal Ilmu Sosial dan Pendidikan)* (Vol. 4, Nomor 1). Lembaga Penelitian dan Pendidikan (LPP) Mandala. <https://doi.org/10.58258/jisip.v4i1.1027>
- Muhrisin, M. (2023). Meningkatkan Hasil Belajar Pjok Materi Senam Lantai dengan Metode Latihan Berulang pada Siswa Kelas IV SDN Penimpoh Tahun Pelajaran 2020/2021. In *JUPE : Jurnal Pendidikan Mandala* (Vol. 8, Nomor 1, hal. 221). Lembaga Penelitian dan Pendidikan (LPP) Mandala. <https://doi.org/10.58258/jupe.v8i1.4901>
- Nugroho, W., & Dewi, R. (2023). Meningkatkan Hasil Belajar Senam Lantai dengan Metode Bermain untuk Siswa Kelas IV SDN 137698 Kota Tanjungbalai. In *JSH: Journal of Sport and Health* (Vol. 4, Nomor 1, hal. 34–45). Universitas Mercu Buana Yogyakarta. <https://doi.org/10.26486/jsh.v4i1.3096>
- Purnama, Y., Lusiana, L., & Hidayah, D. F. (2021). Upaya Peningkatan Hasil Belajar Kayang Senam Lantai melalui Metode Pembelajaran Tutor Sebaya. In *Jurnal Porkes* (Vol. 4, Nomor 1, hal. 8–13). Universitas Hamzanwadi. <https://doi.org/10.29408/porkes.v4i1.3354>
- Safrial, B. (2022). Memaksimalkan kompetensi senam lantai melalui metode practice style dengan card task di SMAN 1 Bungo. In *Jurnal Tunas Pendidikan* (Vol. 4, Nomor 2, hal. 135–142). LP3M STKIP Muhammadiyah Muara Bungo. <https://doi.org/10.52060/pgsd.v4i2.638>
- Saifuddin, H., Priadana, B. W., & Ramadhan, N. (2021). Kompetensi Guru Pendidikan Jasmani Kesehatan dan Olahraga di Bojonegoro. In *Physical Activity Journal* (Vol. 3, Nomor 1, hal. 65). Universitas Jenderal Soedirman. <https://doi.org/10.20884/1.paju.2021.3.1.4814>
- Sauqi, S. A., Murdjito, M., & Rosyid, D. M. (2024). Analisis Risiko Instalasi Penurunan PLEM dengan Pendekatan Metode Semi Kuantitatif. In *Jurnal Teknik ITS* (Vol. 13, Nomor 3). Lembaga Penelitian dan Pengabdian kepada Masyarakat ITS. <https://doi.org/10.12962/j23373539.v13i3.147781>
- Stiyapranomo, D. A. (2023). Peningkatan Hasil Belajar Senam Lantai Menggunakan Metode Demonstrasi dan Penugasan Berbasis Google Formulir. In *JSH: Journal of Sport and Health* (Vol. 3, Nomor 2, hal. 70–82). Universitas Mercu Buana Yogyakarta. <https://doi.org/10.26486/jsh.v3i2.2965>
- Tahrin, R. A., Rusli, M., & Maruka, A. (2025). Hubungan Fleksibilitas Otot Perut dengan Kemampuan Kayang pada Senam Lantai. In *Journal Olympic (Physical Education, Health and Sport)* (Vol. 5, Nomor 1, hal. 24–31). Universitas Halu Oleo. <https://doi.org/10.36709/jolympic.v5i1.129>
- Tresnowati, I., Panggraita, G. N., & Ramadiansyah, A. T. (2021). Korelasi Kekuatan Otot Lengan dan Power Otot Tungkai Dengan Keterampilan Senam Lantai. In *Jendela Olahraga* (Vol. 6, Nomor 2, hal. 78–87). Universitas PGRI Semarang. <https://doi.org/10.26877/jo.v6i2.8911>
- Wibowo, U. K., Kresnapati, P., & Juwahir, J. (2024). Upaya Meningkatkan Hasil Belajar Psikomotorik Materi Meroda Pada Pembelajaran Senam Lantai Dengan Pendekatan Pembelajaran Berdiferensiasi Di Kelas Viii Smpn 2 Semarang. In *Journal of Physical Activity and Sports (JPAS)* (Vol. 5, Nomor 3, hal. 124–131). YLPK Mahardhika. <https://doi.org/10.53869/jpas.v5i3.231>
- Zahra, H., Maulana, F., & Nugraheni, W. (2023). Teknik Dasar Senam Lantai: Bagaimana Model Problem Based Learning Dapat Meningkatkan Sikap Lilin dan Kayang Siswa Sekolah Dasar. In *Jurnal Educatio FKIP UNMA* (Vol. 9, Nomor 3, hal. 1236–1244). Universitas Majalengka. <https://doi.org/10.31949/educatio.v9i3.5395>
- Zulbahri, Z., Astuti, Y., E., P., & D. (2020). Pengembangan Media Belajar Pjok Pada Materi Senam Lantai (Artistik). In *Jurnal Ilmu Keolahragaan Undiksha* (Vol. 8, Nomor 2, hal. 86). Universitas Pendidikan Ganesha. <https://doi.org/10.23887/jiku.v8i2.30253>