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Impact of motor education levels and circuit training on enhancing wrestling techniques among adolescent athletes

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ABSTRACT

Background Problems: Wrestling is a compulsory course that can improve physical strength, discipline, and strategic skills and student learning outcomes. However, the learning outcomes are still not optimal due to inconsistent training, limited technique understanding, and a lack of independent training opportunities. **Research Objectives**: The purpose of this study is to evaluate the effect of motor education level and circuit training on proficiency in learning wrestling martial arts techniques. **Methods**: This study used an experimental design with a pretest-posttest control group where there are two groups, the high motor ability group and the low motor ability group. The population consists of 40 students, and a sample of 20 students was selected using purposive sampling techniques based on certain criteria. Motor ability in this study is defined as an individual's ability to learn and develop motor skills, which is used to measure how quickly and efficiently a person can learn new motor movements. Data collection was done by measuring the level of motor ability and evaluating the techniques of wrestling after a period of practice. Data analysis was conducted using SPSS 23 statistical software to evaluate the learning outcomes of the basic techniques of wrestling. **Findings/Results**: The results of the data analysis showed that overall, there were no significant differences between the two groups. However, when looking closely at the level of motor skills, there are differences in the post-test scores between students with high and low motor skills. **Conclusion**: The conclusions of the study showed that although there were no significant differences between the two groups, the high motor skills group showed more consistent improvements. Future research could focus on the development of physical and mental skills such as endurance, strength, and discipline, which are important in improving wrestlers' performance.

Keywords: Level of motor educability; circuit training; learning outcomes; wrestling martial arts techniques

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INTRODUCTION

The growth and development of martial arts in Indonesia continues to increase rapidly. Wrestling martial art technique is one of the martial arts sports that requires strength, agility, and good body coordination (Barley et al., 2018; Popeska et al., 2017). The enhancement of learning outcomes in wrestling martial arts is not only determined by the physical aspect but also by the motor skills possessed by the athletes (Nindorera et al., 2021; Syahrial et al., 2020). Learning wrestling involves a series of steps to facilitate students' understanding and mastery of wrestling techniques. The process begins with a warm-up to prepare students physically and mentally, demonstrations of wrestling techniques, and feedback to students who have participated in the learning process (Aliriad et al., 2024; Volodchenko et al., 2017). However, the conditions in the area of learning outcomes still do not reach the optimal value, which can be caused by various factors, namely less consistent practice, lack of understanding of the techniques taught, and lack of opportunity to apply the techniques in independent practice. Therefore, it is important that students continue to practice and receive regular feedback in order to achieve the desired learning outcomes in wrestling.

Physical education plays an important role in the development of wrestling skills. Through physical education, students can develop the physical skills necessary for wrestling. Physical education also provides an understanding of the anatomy and physiology of the human body in the effective application of wrestling techniques (Iyakrus, 2018; Mustafa, 2022).The mental and emotional aspects are also developed through physical education, helping students to develop the mental stamina, discipline, and confidence required in wrestling martial art. Physical education provides an opportunity for students to learn the values of teamwork, sportsmanship, and personal responsibility, which are important aspects of wrestling martial art (Gustian, 2020; Pan et al., 2019).

Basic wrestling techniques include several aspects that are important foundations for wrestlers (Amin et al., 2021; Silaban et al., 2022; Supriadi et al., 2022). One of these is the pin technique, which allows an athlete to pin an opponent to the ground using a specific part of the body. In addition, throwing techniques are also an integral part of wrestling, where wrestlers use strength and technique to knock opponents to the ground. Meanwhile, stand-up technique is a skill that allows the athlete to get up quickly from a lying or sitting position, often to avoid being trapped on the ground. Positional control is also an important aspect in which the wrestler tries to maintain an advantageous position against the opponent. Finally, basic wrestling techniques include key moves such as takedowns, grappling, and submissions, which are core elements of the curriculum. Takedowns focus on techniques to knock the opponent to the mat, grappling involves close combat and positional control, while submissions aim to force the opponent to submit through locking techniques. All of these movements are essential in wrestling training and help athletes develop the skills necessary for competition (Bangun & Ginting, 2023; Gustiawan & Ali, 2021; Jahrir & Yusuf, 2022).

Circuit training has a significant relationship with wrestling martial art because it helps develop physical conditioning, including the strength, speed, endurance, and flexibility needed to execute wrestling techniques effectively. Circuit training also improves anaerobic ability and muscular endurance, exactly what is needed in an intense wrestling match (Khachenkova et al., 2021; Yudho et al., 2022). Circuit training is designed to train different physical aspects that are arranged into exercise methods (Edwarsyah et al., 2017; Kumar, 2016; Scheer et al., 2021). This exercise can develop the strength needed to better perform wrestling techniques, as well as increase the endurance and agility needed in matches (Muryadi et al., 2021; Satria, 2018). Meanwhile, the concept of motor educability refers to the ability of individuals to learn and develop their motor skills (Aliriad et al., 2023; Rawat & Bangari, 2019; Rustiawan & Rohendi, 2021). In the context of wrestling martial art, motor educability can play an important role in improving athletes' ability to master wrestling techniques. By understanding the level of motor educability of athletes (Lesmana, 2018; Pambudi & Widiyanto, 2019), instructors can design more appropriate training programmes to help them reach their maximum potential in wrestling martial art.

Previous research includes a model of arm kick skills for novice athletes, the influence of leg muscle strength, waist flexibility, and self-confidence on arm kick skills, and an examination of the physical freshness of wrestling students at SMP Negeri 30 Padang (Nur & Zalfendi, 2018; Sembiring et al., 2018; Yudi & Hernawan, 2020), but less attention has been paid to the influence of motor educability and circuit training

specifically on wrestling martial arts techniques. This research gap highlights the need for research that can provide a more comprehensive understanding of the factors that can improve learning outcomes in basic wrestling techniques. Previous research has shown that motor educability and circuit training have a positive effect on improving learning outcomes in athletes across a range of sports (Aliriad, 2023; Vala & Kasundra, 2022). However, no studies have specifically investigated the influence of these two factors in the context of wrestling techniques. The purpose of the study was to identify and analyse the effect of high and low motor educability using circuit training to improve learning outcomes of wrestling martial arts techniques. This research is expected to contribute to the development of training methods that are more effective in improving learning outcomes of wrestling techniques.

METHOD

Research Design

This study used a pseudo-experimental design with two groups, namely high and low motor skills groups, which were divided on the basis of the results of the Motor Educability Test (Iowa Brace Test) (Aliriad, 2023; Mustafa, 2022; Rawat & Bangari, 2019). The intervention, in the form of circuit training, was carried out for 8 weeks, 3 times a week, with a duration of 60 minutes per session, and included speed, strength, balance, and coordination exercises. All students underwent the same programme, with no difference in exercise intensity, and variables such as age, gender, and physical health were controlled to ensure the validity of the results. Motor skills were measured before and after the intervention using the same instrument, and the results were analysed using a t-test to identify significant changes. The analysis showed an improvement in motor skills in both groups, with the low skill group showing a greater improvement than the high skill group.

Participation

The study population consisted of 20 4th semester students who were actively involved in the physical education programme. The subjects were selected based on the criteria that they already have the basic techniques in Pencak Silat. All 20 students who participated in this study were divided into two groups based on their level of motor skills, namely the high motor skills group and the low motor skills group. The determination of the level of motor skills is done through preliminary tests that have been validated to ensure the accuracy of the grouping.The sample consisted of 20 male participants with an average age of 19 years. The participants' height ranged from 166 cm to 173 cm, with an average height of 169.95 cm. The participants' weight ranged from 66 kg to 73 kg, with an average of 69.55 kg. All participants had a body mass index (BMI) in the normal range, which was between 23.5 and 24.8. These data suggest that the study samples have similar physical characteristics, which is important when considering the generalisability of the study results.

Table 1. Research Procedure

Research Stage	Procedure Description
1. Sample Selection	The population consists of 40 students and a sample of 20 students was selected using purposive sampling techniques based on certain criteria from the Physical Education, Sports, Health, and Recreation Program, University of Makassar.
2. Initial Measurement	Assess each student's motor education level using standardized motor skills tests.
3. Group Division	Divide students into two groups based on their motor education level (high and low).
4. Intervention	Both high and low groups receive circuit training programs with equal frequency and duration over a specific period.
5. Final Assessment	Evaluate learning outcomes in wrestling martial arts techniques through practical tests and observations after the training period.
6. Data Analysis	Analyze the data using statistical software (e.g., SPSS) to assess significant differences between groups in learning outcomes.
7. Result Interpretation	Interpret the analysis results to draw conclusions regarding the impact of motor education level and circuit training on students' learning outcomes in wrestling martial arts techniques.

Inclusion criteria included adequate physical ability to complete the circuit training and availability of time to participate in the study. Physical ability will be assessed through a basic medical examination, including

fitness tests and relevant physical condition assessments, to ensure that participants can complete the training without health risks. Exclusion criteria include the presence of any physical injury or medical condition that may interfere with participation, as assessed by medical records and health assessments by medical professionals. Participants who were injured or had a medical condition that could affect their participation in the exercise were excluded from the study. The research sample was administered a motor educability test (Aliriad, 2023; Notoargo, 2017) and then grouped into high and low motor educability. The research instruments include motor educability tests and circuit exercises to improve learning outcomes of wrestling techniques.

Analysis of data obtained from learning outcomes of basic wrestling techniques using SPSS 23.0 statistical software. Data analysis was carried out using independent t-tests and descriptive statistics. The independent t-test was chosen to compare the mean between two different groups in the study, namely the high and low motor skills groups, as this method is suitable for testing significant differences between two independent groups. Before running the t-test, several assumptions are tested, including normality of the data using the Shapiro-Wilk test and equality of variance using the Levene test. The normality test ensures that the distribution of the data is close to normal, while the variance equality test ensures that the variability between the groups is equal. Descriptive statistics will also be used to summarise the results of the measurements before and after the training programme. The results of the data analysis will be used to evaluate the effectiveness of motor educability and circuit training in improving learning outcomes in wrestling martial art.

The Iowa Brace Test for Motor Educability, as outlined by Magill (1980), includes various motor skill tests such as balance, coordination, and strength, including One Foot-Touch Head, Side Learning Rest, and Full Left Turn (Narlan & Juniar, 2020; Pasaribu, 2020). Circuit training exercises, such as jumping rope, push-ups and lunges, are used to enhance strength, endurance, and flexibility (Martínková & Parry, 2016; Podrigalo et al., 2017; Popeska et al., 2017). The programme aims to improve athletes' basic martial arts skills, including pin techniques, throws, and positional control.

RESULTS AND DISCUSSION

Research data collected included the Iowa-Brace Test for Motor Educability to classify the level of high and low motor educability, and then each group followed the circuit training program. The data collection was done in two stages, before the treatment (pretest) and after the treatment (posttest). The purpose of the posttest is to compare the results of the pre-test and the post-test. Thus, the data obtained include two tests, namely circuit training programs and wrestling martial arts learning outcomes, both pre-test and post-test stages. The study used the Iowa Brace test to measure the participants' motor skills, which included various tests of balance, coordination, and strength. These tests were carried out before and after the circuit training intervention, which included exercises such as jumping rope, push-ups, and squats. The parameters measured in the Iowa Brace test included scores from various motor tests. Circuit training is tailored to the level of motor skills of the participants to ensure the effectiveness and relevance of the exercises.

Table 2 shows the results of the Iowa Brace motor skills test, with scores for Test 1 and Test 2, and the total score for each sample. This table shows the scores achieved by the participants on the pre-test and post-test, which makes it possible to analyse changes in scores and assess performance improvements.

Table 2. Results Iowa-Brace Test for Motor Educability

No	Sample ID	Test 1 Score	Test 2 Score	Total Score
1	Sample 1	36	18	54
2	Sample 2	36	16	52
3	Sample 3	34	16	50
4	Sample 4	34	18	52
5	Sample 5	32	16	48
6	Sample 6	30	15	45
7	Sample 7	36	13	49
8	Sample 8	36	14	50
9	Sample 9	34	13	47
10	Sample 10	38	16	54

No	Sample ID	Test 1 Score	Test 2 Score	Total Score
11	Sample 11	36	18	54
12	Sample 12	32	12	44
13	Sample 13	30	14	44
14	Sample 14	28	16	44
15	Sample 15	28	11	39
16	Sample 16	26	14	40
17	Sample 17	30	15	45
18	Sample 18	28	13	41
19	Sample 19	26	12	38
20	Sample 20	28	13	41

The motor educability test scores in Table 2 are divided into groups based on the motor educability test scores, with the aim of understanding the difference between the high and low motor groups. The high motor group consisted of 10 samples with the highest scores, including sample 9, sample 5, sample 7, sample 3, sample 8, sample 2, sample 4, sample 1, sample 10, and sample 11. On the other hand, the low motor group consisted of 10 samples with the lowest values, including sample 19, sample 15, sample 16, sample 18, sample 20, sample 12, sample 13, sample 14, sample 6, and sample 17. This division is done to ensure that both groups have a balanced number of samples while still maintaining differences in motor levels. In this way, the study can focus more on analysing and understanding the characteristics and differences between the high and low motor groups based on the results of the tests carried out. Furthermore, the group performed the basic wrestling techniques before the circuit training treatment and after the circuit training on the results of learning wrestling. The basic technique assessed is the pin technique with the ability to control the opponent and effectively maintain the desired position. In addition, the ability to throw is assessed by the ability to take down the opponent with good control and speed. Standing technique: the ability to get up quickly after falling or being taken down by an opponent. Positional control is the ability to control and maintain your position during a wrestling match.

Table 3. Learning Outcomes of Highly Educable Motor Group Wrestling Martial Arts Circuit Training

No	Category learning outcomes wrestling	Pre-test (frequency)	Pre-test (percentage)	Post-test (frequency)	Post-test (percentage)
1	Very Good	0	0%	3	30%
2	Good	1	10%	2	20%
3	Enough	4	40%	3	30%
4	Less	5	50%	2	20%
5	Less Than Once	0	0%	0	0%

The results in Table 3 illustrate the development of learning outcomes in the high motor ability group during circuit training. Initially, none of the participants scored in the very good category in the pre-test, but after the training there was a significant improvement, with 30% of the participants scoring in this category. Although only one participant was initially in the "good" category, the post-test results showed that 20% of the participants maintained this level of performance. The enough group showed a decrease from 40% at pre-test to 30% at post-test, while the less group also decreased from 50% to 20%. There was no change in the "less than once" category, where none of the participants achieved it either before or after the training. Thus, despite the improvement in certain categories, further evaluation is still needed to understand the factors that influence the learning outcomes of wrestling in the context of circuit training in the high-functioning motor group.

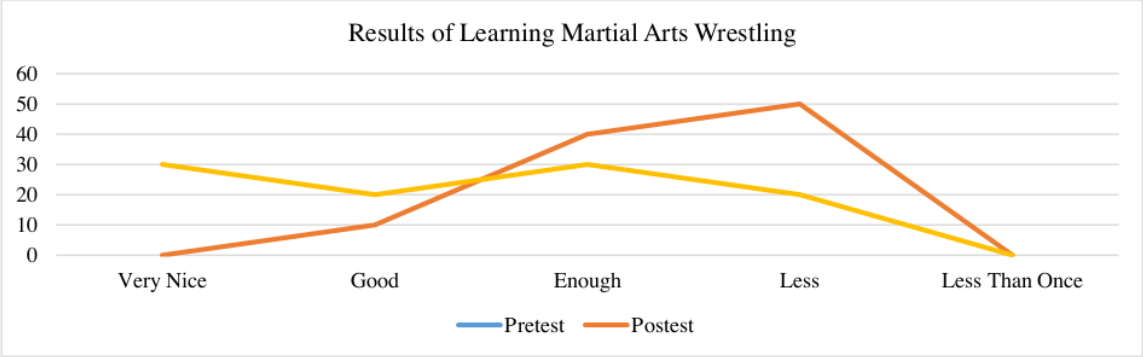

Figure 1. Learning Outcomes of Motor Group Wrestling Martial Arts High Educability on Circuit Training

Table 4. Descriptive Analysis of Learning Outcomes of High Educability Motor Group Wrestling Martial Arts on Circuit Training

No.	Research Sample	Pretest Learning Outcomes	Postest Learning Outcomes	Difference Pretest-Postest
1	Sample 9	84	94	10
2	Sample 5	64	90	26
3	Sample 7	64	89	25
4	Sample 3	64	86	22
5	Sample 8	60	85	25
6	Sample 2	44	82	38
7	Sample 4	44	82	38
8	Sample 1	44	80	36
9	Sample 10	52	90	38
10	Sample 11	48	80	32
	Average	**56.8**	**85.8**	**29**
	Standard Deviation	**12.899**	**4.825**	**9.140**
	Maximum	**84**	**94**	**38**
	Minimum	**44**	**80**	**10**
	Pretest-Posttest Correlation		**0.852**	
	Sig.		**0.002**	

The table gives an overview of the pre- and post-test learning scores of ten research samples. The ten samples, represented by the numbers 1 to 11, showed a significant increase in learning. The pretest scores range from 44 to 84, with a mean of 56.8 and a standard deviation of 12.899. Post-test scores showed consistent improvement, with scores ranging from 80 to 94. The post-test average was 85.8 with a standard deviation of 4.825. The difference between pretest and posttest varied from 10 to 38, with an average difference of 29 and a standard deviation of 9,140. The data analysis showed that the interventions or exercises applied to the study sample were successful in improving the overall learning outcomes. The correlation value between pretest and posttest of 0.852 indicates a strong positive correlation between the two variables. The significant value (s) is 0.002, which is less than 0.05, indicating that the relationship between pretest and posttest is statistically significant.

Table 5. Learning Outcomes ff Low Educability Motor Group Wrestling Martial Arts on Circuit Training

No	Category learning outcomes wrestling	Pre-test (frequency)	Pre-test (percentage)	Post-test (frequency)	Post-test (percentage)
1	Very Nice	0	0%	1	10%
2	Good	1	10%	1	10%
3	Enough	1	10%	6	60%
4	Less	2	20%	1	10%
5	Less Than Once	6	60%	1	10%

The pre-test results showed that the majority of participants were in the "less than" category with a percentage of 60%, followed by the "less than" category with a percentage of 20%, "sufficient" with a percentage of 10%, and "good" and "very good" with a percentage of 10% each. After the circuit training, a post-test was carried out to assess the improvement in learning outcomes. The post-test results showed significant changes. The majority of participants who were previously in the "once less" category improved, leaving only 10% in this category. On the other hand, there was a fairly significant increase in the "adequate" category, which rose to 60%. Although there are still some participants in the "less" category, the number has decreased from 20% to 10%. There was also an increase in the "excellent" and "good" categories, from 0% to 10% each. Overall, circuit training had a positive effect on learning outcomes in the low motor educability group. The increase in the number of participants moving from a low category to a higher category demonstrated the effectiveness of the circuit training method in improving participants' understanding and skills in wrestling martial art.

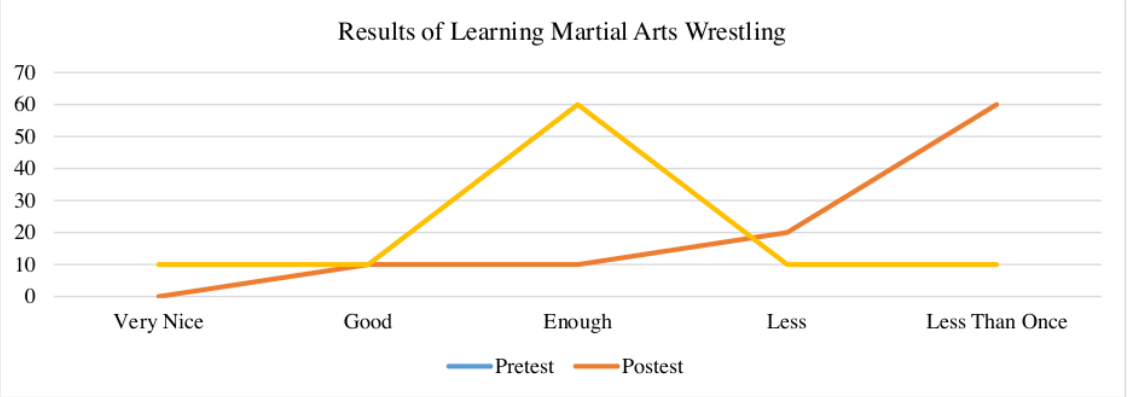

Figure 2. Low Educability Motor Group Wrestling Martial Arts Learning Outcomes on Circuit Training

Table 6. Descriptive Analysis of Learning Outcomes of Low Educability Motor Group Wrestling Martial Arts on Circuit Training

No.	Research Sample	Pretest Learning Outcomes	Postest Learning Outcomes	Difference Pretest-Postest
1	Sample 19	80	98	18
2	Sample 15	65	90	25
3	Sample 16	44	75	31
4	Sample 18	42	75	33
5	Sample 20	44	80	36
6	Sample 12	56	80	24
7	Sample 13	60	86	26
8	Sample 14	54	78	24
9	Sample 6	65	88	23
10	Sample 17	44	76	32
Average		**55.4**	**82.6**	**27.2**
Standard Deviation		**12.393**	**7.647**	**5.553**
Maximum		**80**	**90**	**36**
Minimum		**42**	**75**	**27.2**
Pretest-Posttest Correlation			**0.956**	
Sig.			**0.000**	

The pretest learning outcomes describe the level of understanding of the initial participants before the exercise began, while the posttest learning outcomes indicate the improvement achieved after the circuit training. The difference between the posttest and the pretest gives an idea of the change in learning outcomes in each sample. The results of the analysis showed a significant difference between pretest and posttest in each

sample. Sample 15 showed the highest difference of 25, which means a very significant increase from pretest 65 to posttest 90. Meanwhile, sample 20 had the largest difference between pretest and posttest scores, which was 36. The average posttest score was 82.6, showing a consistent improvement from the pre-test average of 55.4. A relatively low standard deviation of the posttest scores (7.647) indicates a good level of consistency in the improvement of learning outcomes. The range between the maximum (90) and minimum (75) post-test scores also reflects the variation that occurs between samples. The correlation value between pretest and posttest of 0.956 indicates a strong positive correlation between the two variables. The significant value (s) is 0.000, which is less than 0.05, indicating that the relationship between pretest and posttest is statistically significant. Therefore, it can be concluded that the correlation found is not random and has a solid basis. The students' pretest scores can be used as an effective indicator to estimate the progress made by the students in the post-test.

Table 7. Results of Paired Samples Correlations Postest Motor Educability High and Low

Pair 1	N	Correlation	Sig.
Motor Educability high and low	10	.657	.039

The research findings reveal a significant positive correlation ($r = 0.657$, $p = 0.039$) between high and low levels of motor educability in the context of circuit training interventions aimed at improving students' wrestling technique. This correlation suggests that students with higher initial levels of motor educability tended to show greater improvements in learning outcomes than those with lower levels of motor educability. These findings are important because they highlight the differential impact of interventions on students based on their level of motor educability. The findings emphasise the importance of tailored training approaches in physical education, particularly martial arts, where individualised strategies may be more effective in improving learning outcomes. This supports the notion that instructors should adapt teaching methods to accommodate varying student abilities in order to optimise skill acquisition.

The current study is consistent with previous research indicating that baseline motor skills can influence the effectiveness of physical training interventions (Chernozub et al., 2018; Nisa & Jannah, 2021). Consistent with prior findings, students with higher baseline motor skills demonstrated more consistent improvements and higher post-test scores compared to their counterparts. These consistencies confirm the relevance of individualised programming in improving learning outcomes across skill levels. Despite the positive findings, several limitations must be acknowledged. The sample size and specific demographic characteristics of the study may limit the generalisability of the findings beyond the population studied. In addition, the reliance on self-reported measures and the short-term nature of the interventions may have influenced the observed results. Future research should address these limitations to provide more robust evidence on the long-term effects of tailored training programmes.

While the current study highlights the benefits of tailored interventions, alternative interpretations might consider additional factors influencing learning outcomes, such as psychological readiness or motivational levels of participants. Exploring these variables may provide deeper insights into the multifaceted nature of martial arts skill acquisition. Building on these findings, future research could explore the integration of psychological and physiological assessments to further refine personalised training protocols. Longitudinal studies could also investigate the sustainability of learning improvements over time and assess the transferability of skills beyond controlled training environments. In addition, comparative studies across martial arts disciplines could elucidate discipline-specific factors that influence skill development and educational outcomes.

An in-depth understanding of the factors that influence learning outcomes enables the design of more specific and effective exercises (Barley et al., 2018; Chaabene et al., 2017). Analysis of the difference from the results of the study opens up the opportunity to identify individual weaknesses in the wrestling technique. By knowing the specific obstacles students face, instructors can align training to help them get through those challenges (Maulidya & Jannah, 2021; Podrigalo et al., 2017). These findings support the development of individualised programs, ensuring that each student gets the maximum benefit according to their level of ability or need.

Evaluating the effectiveness of training methods becomes more measurable by comparing the results of both groups of motor educability (Kumar, 2016; Shakty et al., 2022). This helps the instructor determine the learning method that provides significant improvement. The positive results in this study do not only reflect physical improvement but may also indicate the development of psychological aspects of students in facing the challenges of martial arts (Apriansyah et al., 2017; Maulidya & Jannah, 2021). These findings support the improvement of safety and technique in wrestling by identifying critical areas and techniques that require special attention. The presentation of positive learning outcomes can motivate students to actively participate in the exercises and create a learning environment that positively supports their development (Esminarto et al., 2016; Firdaus et al., 2023; Yulianingsih, 2019). It is important to remember that in wrestling martial art, factors such as training intensity, student motivation, and physical condition also play a role in the effectiveness of learning. Therefore, the results of these findings can be a valuable guide to refining training approaches, supporting increased learning efficiency, and achieving better progress in wrestling martial art. This information can be useful to instructors and tutors in identifying individual student needs, designing more focused learning programmes, and providing appropriate support to effectively improve student learning outcomes.

CONCLUSION

The study showed that circuit training significantly improved participants' motor skills, especially in the high motor skills group. The results of the study showed that the increase in scores in the "excellent" category was significant in this group compared to the low motor skills group. The main findings of the study show that circuit training is effective in improving motor skills such as balance, strength, and coordination. These results support the effectiveness of circuit training interventions in improving motor performance. These findings add to the body of knowledge in the field of physical activity by showing that circuit training can significantly improve motor skills, which has practical implications for coaches and educators. They can use circuit training to improve the performance of athletes and participants in different physical activities.Future studies should include more diverse samples and increase the duration of the intervention. Research can also explore other variables that influence outcomes, such as participant motivation and variations in exercise performance techniques. This study makes an important contribution to understanding the effectiveness of circuit training in improving motor skills. As well as providing theoretical insight, the findings also provide practical guidance for coaches and sports professionals in designing more effective training programs.

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REFERENCES

Aliriad, H. (2023). Level of Motor Educability in Floor Gymnastics Courses to Motion Skills. *JUARA Jurnal Olahraga*, *8*(1), 530-537. https://doi.org/10.33222/juara.v8i1.2807

Aliriad, H., Adi, S., Manullang, J. G., Endrawan, I. B., & Satria, M. H. (2024). Improvement of Motor Skills and Motivation to Learn Physical Education Through the Use of Traditional Games. *Physical Education Theory and Methodology*, *24*(1), 32-40. https://doi.org/https://doi.org/10.17309/tmfv.2024.1.04

Aliriad, H., Soegiyanto, S., Setijono, H., & Sulaiman, S. (2023). Effect of the Project-based Learning Model, Age, and Motor Educability on Fundamental Motor Skills in Early Children. *Health Education and Health Promotion*, *11*(1), 125-131. https://doi.org/10.58209/hehp.11.1.125

Amin, N., Setiyawan, U. J., Priyadi, D., & Mulyo, H. (2021). Hubungan Status Gizi dengan Kekuatan Otot (Lengan, Tungkai, dan Perut) Atlet Gulat. *Nutrizione: Nutrition Research And Development Journal*, *1*(2), 43-50. https://doi.org/10.15294/nutrizione.v1i2.52137

Apriansyah, B., Sulaiman, & Mukarromah, S. B. (2017). Kontribusi Motivasi, Kerjasama, Kepercayaan Diri terhadap Prestasi Atlet Sekolah Sepakbola Pati Training Center di Kabupaten Pati. *Journal of Physical Education and Sports, 6*(2), 101-107. https://doi.org/10.15294/jpes.v6i2.17358

Bangun, S. Y., & Ginting, G. (2023). Pengembangan Teknik Dasar Menggunakan Video Tutorial pada Atlet Pelajar Ekstrakurikuler Olahraga Gulat. *Musamus Journal of Physical Education and Sport(MJPES), 5*(2), 252-261. https://doi.org/10.35724/mjpes.v5i02.5436

Barley, O. R., Chapman, D. W., & Abbiss, C. R. (2018). Weight Loss Strategies in Combat Sports and Concerning Habits in Mixed Martial Arts. *International Journal of Sports Physiology and Performance*, *13*(7), 933-939. https://doi.org/10.1123/ijspp.2017-0715

Chaabene, H., Negra, Y., Bouguezzi, R., Mkaouer, B., Franchini, E., Julio, U., & Hachana, Y. (2017). Physical and Physiological Attributes of Wrestlers: An Update. *The Journal of Strength & Conditioning Research*, *31*(5), 1411-1442. https://doi.org/10.1519/jsc.0000000000001738

Chernozub, A., Korobeynikov, G., Mytskan, B., Korobeinikova, L., & Cynarski, W. J. (2018). Modelling Mixed Martial Arts Power Training Needs Depending on the Predominance of the Strike or Wrestling Fighting Style. *Ido Movement for Culture. Journal of Martial Arts Anthropology*, *18*(3), 28-36. https://doi.org/10.14589/ido.18.3.5

Edwarsyah, E., Hardiansyah, S., & Syampurma, H. (2017). Pengaruh Metode Pelatihan Circuit Training Terhadap Kondisi Fisik Atlet Pencak Silat Unit Kegiatan Olahraga Universitas Negeri Padang. *Jurnal Penjakora*, *4*(1), 1-10. https://doi.org/10.23887/penjakora.v4i1.11749

Esminarto, E., Sukowati, S., Suryowati, N., & Anam, K. (2016). Implementasi Model STAD dalam meningkatkan Hasil Belajar Siswa. *BRILIANT: Jurnal Riset dan Konseptual*, *1*(1), 16-23. https://doi.org/10.28926/briliant.v1i1.2

Firdaus, N. F., Da'i, M. D., & Olivia, O. D. C. (2023). Pengaruh Media Audio Visual Terhadap Hasil Belajar Keterampilan Teknik Dasar Bola Futsal. *Citius : Jurnal Pendidikan Jasmani, Olahraga, dan Kesehatan*, *2*(2), 109-113. https://doi.org/10.32665/citius.v2i2.1153

Gustian, U. (2020). Permainan Tradisional: Suatu Pendekatan dalam Mengembangkan Physical Literacy Siswa Sekolah Dasar. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran*, *6*(1), 199-215. https://doi.org/10.29407/js_unpgri.v6i1.14252

Gustiawan, A., & Ali, M. (2021). Survei Program Latihan Atlet Gulat Kabupaten Kerinci. *Indonesian Journal of Sport Science and Coaching*, *3*(2), 53-59. https://doi.org/10.22437/ijssc.v3i2.15623

Iyakrus, I. (2018). Pendidikan Jasmani, Olahraga dan Prestasi. *Altius: Jurnal Ilmu Olahraga dan Kesehatan*, *7*(2). https://doi.org/10.36706/altius.v7i2.8110

Jahrir, A. S., & Yusuf, A. (2022). Kontribusi Kekuatan dan Kelincahan Terhadap Bantingan Pinggang Olahraga Gulat. *Jurnal Olahraga dan Kesehatan Indonesia (JOKI)*, *2*(2), 71-76. https://doi.org/10.55081/joki.v2i2.592

Khachenkova, K. Y., Dyatlova, K. D., & Arakelyan, G. L. (2021). Circuit Training as a Mean af Improvementof Pre-Professional Physical Training of Police Officers. In *Physical Culture. Sport. Tourism. Motor Recreation, 6*(2), 90-97. https://doi.org/10.47475/2500-0365-2021-16214

Kumar, V. (2016). Effect of Circuit Training Program on Selected Motor Abilities among University Male. *International Journal of Physical Education, Sports and Health*, *3*(4), 255-257. https://doi.org/10.21275/sr23302210033

Lesmana, H. S. (2018). Peran Motor Educability di dalam Meningkatkan Keterampilan Olahraga pada Pembelajaran Penjas. *Halaman Olahraga Nusantara: Jurnal Ilmu Keolahragaan*, *1*(1), 115-125. https://doi.org/10.31227/osf.io/2sc6f

Yudi, M., & Hernawan. (2020). Model Keterampilan Bantingan Lengan Olahraga Gulat untuk Atlet Pemula. *GLADI Jurnal Ilmu Keolahragaan*, *11*(02), 188-203. https://doi.org/10.21009/gjik.112.10

Martínková, I., & Parry, J. (2016). Martial Categories: Clarification and Classification. *Journal of the Philosophy of Sport*, *43*(1), 143-162. https://doi.org/10.1080/00948705.2015.1038829

Maulidya, N., & Jannah, M. (2021). Hubungan Psychological Capital dengan Mental Toughness pada Atlet Beladiri. *Character: Jurnal Penelitian Psikologi*, *8*(6), 106-116. https://doi.org/10.26740/cjpp.v8i6.41967

Muryadi, A. D., Rahayu, T., Setijono, H., & Rahayu, S. (2021). Effect of Circuit Training and Fartlek Training on Cardiorespiratory Endurance Football School Athletes. *6th International Conference on Science, Education and Technology (ISET 2020)*, 467-471. https://doi.org/10.2991/assehr.k.211125.087

Mustafa, P. S. (2022). Football Skills: Training Methods and Motor Educability. *Jurnal Ilmiah Wahana Pendidikan*, *8*(9), 68-80. https://doi.org/10.5281/zenodo.6629984

Narlan, A., & Juniar, D. T. (2020). *Pengukuran dan Evaluasi Olahraga (Prosedur Pelaksanaan Tes dan Pengukuran dalam Olahraga Pendidikan dan Prestasi)*. Deepublish.

Nindorera, F., Nduwimana, I., Thonnard, J. L., & Kossi, O. (2021). Effectiveness of Walking Training on Balance, Motor Functions, Activity, Participation and Quality of Life in People with Chronic Stroke: a Systematic Review with Meta-Analysis and Meta-Regression of Recent Randomized Controlled Trials. *Disability and Rehabilitation*, *44*(15), 3760-3771. https://doi.org/10.1080/09638288.2021.1894247

Nisa, K., & Jannah, M. (2021). Pengaruh Kepercayaan Diri Terhadap Ketangguhan Mental Atlet Bela Diri. *Character: Jurnal Penelitian Psikologi*, *8*(3), 36-45. https://doi.org/10.26740/cjpp.v8i3.41165

Notoargo, D. A. (2017). *Pengaruh Metode Pembelajaran dan Motor Educability Terhadap Keterampilan Futsal: Studi Eksperimen pada Siswa Ekstrakurikuler Futsal SMP Negeri 3 Lembang*. Universitas Pendidikan Indonesia.

Nur, H., M, M., & Zalfendi. (2018). Tinjauan Tingkat Kesegaran Jasmani pada Siswa Putera yang Mengikuti Ekstrakurikuler Gulat di SMP Negeri 30 Padang. *Jurnal Menssana*, *3*(1), 67-76. https://doi.org/10.24036/jm.v3i1.67

Pambudi, Y., & Widiyanto, W. (2019). Football Skills: Training Methods and Motor Educability. *6th International Conference on Educational Research and Innovation (ICERI 2018)*, 68-71. https://doi.org/10.2991/iceri-18.2019.67

Pan, Y.-H., Huang, C.-H., Lee, I.-S., & Hsu, W.-T. (2019). Comparison of Learning Effects of Merging TPSR Respectively with Sport Education and Traditional Teaching Model in High School Physical Education Classes. *Sustainability*, *11*(7), 2057. https://doi.org/10.3390/su11072057

Pasaribu, A. M. N. (2020). *Tes dan pengukuran olahraga*. Yayasan Pendidikan dan Sosial Indonesia Maju (YPSIM). Banten.

Podrigalo, L. V, Volodchenko, A. A., Rovnaya, O. A., & Stankiewicz, B. (2017). Analysis of Martial Arts Athletes' Goniometric Indicators. *Physical Education of Students*, *21*(4), 182-188. https://doi.org/10.15561/20755279.2017.0406

Popeska, B., Dimkov, T., & Jovanova-Mitkovska, S. (2017). Students Interests for Wrestling and Other Martial Arts and Possibilities for Their Implementation in Physical and Health Education Primary School Curriculum. *Research in Kinesiology*, *45*(2), 148-151.

Rawat, B., & Bangari, D. (2019). Association of Impulsive Behavior with Motor Ability, Motor Educability and Kinesthetic Perception among Players of Individual, Team and Combat Sports. *Int. J. Physiol. Nutr. Phys. Educ*, *4*, 1892-1895.

Rustiawan, H., & Rohendi, A. (2021). Kontribusi Motor Educability dalam Low Rope Circuit Activity pada Kegiatan Outbound. *Jurnal Keolahragaan*, *7*(1), 40-47. https://doi.org/10.25157/jkor.v7i1.5303

Satria, M. H. (2018). Pengaruh Latihan Circuit Training Terhadap Peningkatan Daya Tahan Aerobik Pemain Sepakbola Universitas Bina Darma. *Jurnal Ilmiah Bina Edukasi*, *11*(01), 36-48. https://doi.org/10.33557/jedukasi.v11i01.204

Scheer, A., Shah, A., Ito Ramos de Oliveira, B., Moreno-Suarez, I., Jacques, A., Green, D., & Maiorana, A. (2021). Twelve Weeks of Water-Based Circuit Training Exercise Improves Fitness, Body Fat and Leg Strength in People with Stable Coronary Heart Disease: A Randomised Trial. *Journal of Physiotherapy*, *67*(4), 284-290. https://doi.org/10.1016/j.jphys.2021.08.012

Sembiring, H. M. S. B., Tangkudung, J., Yusmawati, & Widiastuti. (2018). Pengaruh Kekuatan Otot Tungkai, Kelentukan Pinggang dan Percaya Diri Terhadap Keterampilan Bantingan Lengan. *Multilateral Jurnal Pendidikan Jasmani dan Olahraga*, *17*(1), 6-12. https://doi.org/10.20527/multilateral.v17i1.5035

Shakty, A. M. O., Muhtar, T., & Sudrazat, A. (2022). The Relationship of Motor Educability and Motor Ability to Self Esteem in Physical Education Learning. *JUARA: Jurnal Olahraga*, *7*(3), 538-546. https://doi.org/10.33222/juara.v7i3.2270

Silaban, E. H., Iyakrus, I., & Bayu, W. I. (2022). Survei Kondisi Fisik dan Keterampilan Teknik Dasar Atlet Gulat Sekolah Olahraga Negeri Sriwijaya. *Bima Loka: Journal of Physical Education*, *2*(2), 48-54. https://doi.org/10.26740/bimaloka.v2i2.21230

Supriadi, D., Schiff, N. T., & Karisman, V. A. (2022). Analisis Teknik Gulat: Kategori Greco Roman dan Freestyle. *Musamus Journal of Physical Education and Sport (MJPES)*, *5*(01), 1-10. https://doi.org/10.35724/mjpes.v5i01.4750

Syahrial, D., Sudijandoko, A., & Priambodo, A. (2020). Pengaruh Permainan Kecil Berdasarkan Tingkat Motor Educability Terhadap Motivasi dan Keterampilan Passing Permainan Futsal. *Jurnal Ilmiah Mandala Education*, *6*(1), 195-203. https://doi.org/10.58258/jime.v6i1.1251

Vala, S., & Kasundra, P. M. (2022). Effects of Playometric and Circuit Training on Motor Educability's Back Roll Component. *Research Review International Journal of Multidisciplinary*, *7*(12), 72-75. https://doi.org/10.31305/rrijm.2022.v07.i12.012

Volodchenko, O., Podrigalo, L., Aghyppo, O., Romanenko, V., & Rovnaya, O. (2017). Comparative Analysis of a Functional State of Martial Arts Athletes. *Journal of Physical Education and Sport*, *17*(3), 2142-2147. https://doi.org/10.15561/20755279.2017.0406

Yudho, P. K., Hartono, M., & Sumartiningsih, S. (2022). The Effect of Mental Exercise and Muscle Endurance on the Shots of Archery Athletes. *JUARA Jurnal Olahraga*, *7*(3), 658-672. https://doi.org/10.33222/juara.v7i3.2406

Yulianingsih, I. G. P. (2019). Peningkatan Hasil Belajar Kebugaran Jasmani melalui Penerapan Model Pembelajaran Kooperatif STAD. *Jurnal Ilmiah Pendidikan Profesi Guru*, *2*(2), 204-215. https://doi.org/10.23887/jippg.v2i2.19189

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