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Implementation of FITT (Frequency, Intensity, Time, Type) Training Project on Improving Learning Outcomes of Badminton Course and Anaerobic Endurance

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ABSTRACT

This study aims to analyze the effectiveness of the FITT (Frequency, Intensity, Time, and Type) Training Project on improving badminton course learning outcomes and student anaerobic endurance. The research method used was an experiment with a pretest-postest design on 148 students who took badminton courses. Measurements were made through badminton skill tests and the Running-based Anaerobic Sprint Test (RAST) to assess anaerobic endurance. The results showed a significant improvement in badminton learning outcomes, as indicated by statistically significant differences in pretest and posttest scores (p-value <0.05). Students experienced development in the aspects of technique, tactics, and game strategy. In addition, anaerobic endurance also improved based on the RAST test results, with an increase in maximal power, average power, and a decrease in fatigue level, indicating an increase in anaerobic energy system efficiency. The conclusion of this study is that the FITT Project is effective in improving students' badminton playing skills as well as anaerobic endurance. The application of this method not only has an impact on improving physical performance, but also on developing logical, systematic, and innovative thinking skills in developing data-based training programs. Therefore, the FITT Project can be used as an effective learning model to improve learning outcomes in sports courses, especially badminton.

Keywords: FITT, Learning Outcomes, Badminton, Anaerobic Endurance, RAST.

Kata kunci
Kata Kunci_1 FITT
Kata Kunci_2 Capainan Pembelajaran
Kata Kunci_3 Bulutangkis
Kata Kunci_4 Daya Tahan Anaerobik
Kata Kunci_5 RAST

Abstrak

Penelitian ini bertujuan untuk menganalisis efektivitas Proyek FITT (Frequency, Intensity, Time, and Type) Training terhadap peningkatan capaian pembelajaran mata kuliah bulutangkis dan daya tahan anaerobik mahasiswa. Metode penelitian yang digunakan adalah eksperimen dengan desain pretest-postest pada 148 mahasiswa yang mengikuti mata kuliah bulutangkis. Pengukuran dilakukan melalui tes keterampilan bulutangkis serta Running-based Anaerobic Sprint Test (RAST) untuk menilai daya tahan anaerobik. Hasil penelitian menunjukkan adanya peningkatan signifikan dalam capaian pembelajaran bulutangkis, yang ditunjukkan dengan perbedaan nilai pretest dan postest yang signifikan secara statistik (*p-value* < 0,05). Mahasiswa mengalami perkembangan dalam aspek teknik, taktik, serta strategi permainan. Selain itu, daya tahan anaerobik juga meningkat berdasarkan hasil tes RAST, dengan peningkatan power maksimal, power rata-rata, dan penurunan tingkat kelelahan, yang menandakan peningkatan efisiensi sistem energi anaerobik. Kesimpulan dari penelitian ini adalah bahwa Proyek FITT efektif dalam meningkatkan keterampilan bermain bulutangkis serta daya tahan anaerobik mahasiswa. Penerapan metode ini tidak hanya berdampak

pada peningkatan performa fisik, tetapi juga pada pengembangan keterampilan berpikir logis, sistematis, dan inovatif dalam menyusun program latihan yang berbasis data. Oleh karena itu, Proyek FITT dapat dijadikan model pembelajaran yang efektif untuk meningkatkan capaian pembelajaran dalam mata kuliah olahraga, khususnya bulutangkis.

Kata Kunci: FITT, Capaian Pembelajaran, Bulutangkis, Daya Tahan Anaerobik, RAST.

Physical education, sports and health have an important role in character building and improving students' physical fitness. One of the courses that play a role in improving skills and physical fitness is Badminton. In this course, students are expected to be able to improve their technical abilities, tactics, and physical endurance to support performance in the game. However, there are still obstacles in achieving optimal learning outcomes, especially in the aspect of anaerobic endurance which plays an important role in high-intensity activities such as badminton (Cohen et al., 2015).

In the context of sports training, structured methods based on scientific principles are needed to achieve optimal results. One method that can be applied is the FITT (Frequency, Intensity, Time, and Type) Training approach. The FITT principle provides guidelines in developing an effective training program by considering the frequency, intensity, duration, and type of exercise that suits individual needs (Wibisana & Royana, 2023). By applying FITT Training, it is expected that students can experience an increase in the learning outcomes of badminton courses as well as an increase in their anaerobic endurance.

The FITT Training Method Project (Frequency, Intensity, Time, and Type) is an approach that can be used to design a physical training program that suits the needs and abilities of athletes. This method emphasizes the importance of regulating the frequency of exercise, the intensity of exercise, the duration of exercise, and the type of exercise performed. By using the FITT Training Method, it is expected that the sample can be more motivated to actively participate in PE activities and achieve better learning outcomes (Tuasikal et al., 2021). In addition, this method can also help improve students' anaerobic endurance, which is one of the important components in physical fitness.

Previous research has shown that the application of the FITT Training Method can have a positive impact on improving physical fitness and sample learning outcomes (4). However, further research is needed to test the effectiveness of this method in the context of physical education in Indonesian schools. Therefore, this study aimed to evaluate the implementation of the FITT Training Method Project on improving students' PE learning outcomes and anaerobic endurance. This research is expected to make a significant contribution to the development of more effective and efficient PE teaching methods.

In addition, research on the effectiveness of FITT Training implementation in badminton courses is still limited, especially in relation to improving anaerobic endurance (Burnet, 2020; Pinru Phytanza & Burhaein, 2019). Most of the previous studies focused more on improving the technical skills and tactics of badminton games without considering physical fitness factors more specifically. This indicates a research gap that needs to be filled with research that examines in depth the impact of the FITT Training method on learning outcomes and student anaerobic endurance.

This research is also relevant to academic and professional demands in the world of sports. Students who have an understanding and experience in applying effective training methods will be better prepared to face challenges in the world of work, both as athletes, coaches, and educators in the field of sports (Siedler, 2021). Therefore, this research not only contributes to improving learning outcomes but also provides benefits in developing students' professional competencies.

Thus, this research has high urgency in academic and practical contexts. The application of FITT Training in badminton courses is expected to be a solution in improving learning outcomes and overcoming students' anaerobic endurance constraints. Through this research, it is hoped that findings can be obtained that can be used as a basis for developing sports learning methods that are more effective and based on scientific principles.

METHOD

This study used an experimental design with a one-group pretest-posttest design approach. untuk mengukur efektivitas atau dampak suatu perlakuan (treatment) terhadap suatu kelompok dengan membandingkan hasil sebelum (pretest) dan sesudah (posttest) diberikan perlakuan (Sugiyono, 2017). The sample in this study amounted to 148 students who took badminton courses. The sample selection was carried out using random sampling technique based on active involvement in lectures. This treatment lasted for 16 meetings according to the number of meetings during one semester. Prestest and posttest measuring instruments using the RAST (Running Anaerobic Sprint Test) test instrument. The RAST instrument is a test designed to measure anaerobic power, speed, and muscle fatigue in a short time. The test involves a series of rapid sprints performed repetitively with short rest periods in between (Wibisana, 2020). Typically, participants will perform six maximal sprints of 35 meters, with a rest break of about 10 seconds between each sprint. The results of the test include various parameters such as top speed, fastest and slowest times, as well as the level of fatigue as measured by the drop in performance in each sprint. The RAST test is often used in sports that demand the ability to explode power in a short time, such as soccer, basketball, and other sports that require rapid acceleration. As well as using the badminton lecture assessment rubric. Data analysis in pre-test and post-test quantitative research experiments involves comparing the results of measurements before and after the

FITT method intervention to determine whether there is a significant change in the variable under study.

RESULT AND DISCUSSION

This research was conducted on recreational health physical education students totaling 148 respondents in badminton courses. Analysis of research data using prerequisite test results. Prerequisite tests are carried out to determine whether the data analyzed is suitable for analysis and hypothesis testing. This prerequisite test includes normality test using Kolmogorov-Smirnov test and homogeneity test using Lavene statistical test. The following are the results of statistical tests on the FITT project intervention.

Table 1. Descriptive Statistic Badminton Course Grades

	Descriptive statistic				
Component	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	148	50	79	65,45	8,97
Posttes	148	55	98	77,42	10,20
Valid N (listwise)	148				

Source: data analysis

The table above presents descriptive statistics of the pretest and posttest results of 148 students in badminton courses. From the data, it can be described that the total sample was 148 students who took part in the pretest and posttest, The lowest score in the pretest was 50, while in the postest it increased to 55. The highest score achieved by students in the pretest was 79, while in the postest it increased to 98, indicating that some students experienced a significant improvement in their performance. The average pretest score was 65.45, while in the postest it increased to 77.42. This indicates an increase in students' understanding and skills after attending the lecture. The standard deviation on the pretest was 8.97, while on the posttest it increased to 10.20. This increase in standard deviation indicates a greater variation in scores in the posttest, which could be due to differences in the level of improvement between students. Overall, these results indicate a significant increase in scores after students attended badminton lectures, which is reflected in the increase in minimum, maximum, average scores, as well as a wider spread of scores..

Table 2. Normality Badminton Course Grades

Data	N	Std. Deviation	Mean	Sig	Keterangan
Badminton Course Grade	148	10,20	77,42	0,0502	Normal

Source: data analysis

These results show that the distribution value is p-value 0.0502 (> 0.05), so the data is normally distributed.

Table 3 Homogenity Badminton Course Grades

Data	N	Std. Deviation	Mean	Sig	Keterangan
Badminton Course Grade	148	10,20	77,42	0,3579	Normal

Source: data analysis

The conclusion of the homogeneity test shows a p-value of 0.357962 (> 0.05), which means normal.

Table 4. Descriptive Statistic Anaerobic Endurance

	Descriptive Statistic				
Component	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	148	201	495	352,72	88,16
Postest	148	120	466	294.96	88,41
Valid (listwise)	148				

Source: data analysis

The table above illustrates the changes in fatigue levels based on the RAST test before and after treatment in 148 samples. At pretest, the minimum fatigue score was 201 watts, while at posttest it decreased to 120 watts, indicating an increase in resistance to fatigue. The maximum score at pretest was 495 watts, while at posttest it decreased to 466 watts, indicating that even individuals with the highest fatigue levels experienced a decrease in fatigue. The average fatigue level at pretest was 352.72 watts, and decreased to 294.96 watts at posttest. This indicates that overall, participants experienced increased resistance to fatigue after the intervention. The pretest standard deviation was 88.16, while the posttest increased slightly to 88.41, indicating that although there was a general decrease in fatigue levels, the variation between participants remained relatively the same. In conclusion, these results indicate an improvement in fatigue endurance following the exercise program or intervention.

Table 5. Normality Anaerobic Endurance

Data	N	Std. Deviation	Mean	Sig	Keterangan
Anaerobic Endurance	148	88,41	294.96	0,0508	Normal

Source: data analysis

These results show that the distribution p-value is 0.0508 (> 0.05), so the data is normally distributed.

Table 6. Homogenity Anaerobic Endurance

Data	N	Std. Deviation	Mean	Sig	Keterangan
Anaerobic Endurance	148	88,41	294.96	0.710468	Normal

Source: data analysis

The conclusion of the homogeneity test shows a p-value of 0.710468 (> 0.05), which means normal.

Tabel 6. T-test results for badminton scoring and anaerobic endurance

Data	t-statictic	p-value	Keterangan
Badminton course grade	-33,386	1,67	Significant
Anaerobic Endurances	-38,755	4,67	Significant

Source: data analysis

There was a significant improvement in badminton scoring and anaerobic endurance after the training or intervention provided.

DISCUSSION

Improving Badminton Course Grades with Learning Outcomes through FITT Project

The increase in grades in badminton courses indicates the development of student skills in the aspects of technique, tactics, and understanding of game strategies. Based on the results of statistical tests, there is a significant increase between pretest and posttest scores, which reflects the effectiveness of the learning methods applied. One of the approaches used in the learning process is the FITT Project (Frequency, Intensity, Time, Type), which focuses on improving physical performance and badminton playing skills in a systematic and structured manner (Demmelmaier, 2021; Wibisana, 2020).

In the FITT project, students are required to apply logical and systematic thinking in exercise planning. They must be able to analyze the physical needs in badminton games, set the optimal training frequency, determine the intensity that suits the individual's physical condition, and manage the most effective duration and type of training. Through this approach, students can develop data analysis-based training patterns that support sustainable performance improvement.

The FITT project allows students to innovate in developing training programs that suit their physical condition and skill level (Brooke, 2022). For example, by utilizing technology such as fitness monitoring apps, students can measure the development of endurance, speed and agility that contribute to improved performance in badminton. In addition, they can adopt the latest training methods, such as scenario-based match simulations or the use of drills that are more specific to individual weaknesses.

In order to achieve optimal improvement, students are required to integrate science and technology in their training process. The use of video analysis methods, for example, helps students to evaluate their stroke techniques, footwork, and game strategies. This approach not only improves students' understanding of technical aspects, but also provides greater insight into effectively strategizing matches.

In addition to improving technical skills, the FITT project also encourages students to apply humanities values in badminton learning. This includes aspects of teamwork, sportsmanship, discipline, and ethics in playing and competing. Students are taught to respect opponents, understand match regulations, and apply a professional attitude in every training session and match (Rajpoot et al., 2012).

Anaerobic Endurance Improvement through RAST Test in Badminton Course with FITT Project

Anaerobic endurance is one of the important components in badminton, especially in maintaining a high intensity of play during long rallies and facing critical moments in the match. Based on the results of statistical tests using the Running-based Anaerobic Sprint Test (RAST), there was a significant increase between the pretest and posttest values. This shows that the training method applied, namely the FITT Project (Frequency, Intensity, Time, Type), is effective in increasing students' anaerobic endurance.

Badminton is a sport that requires a combination of speed, strength, and endurance, especially in fast-paced game situations that require players to make explosive jumps, sprints, and changes in direction (Borrie, 2016; Cohen et al., 2015). Anaerobic endurance is necessary to maintain optimal performance during matches, reduce the risk of premature fatigue, and allow players to remain aggressive in attack and defense.

The FITT (Frequency, Intensity, Time, Type) approach in badminton courses is applied by adjusting the frequency of training, intensity of training, duration of training, and type of training focused on increasing students' anaerobic capacity. Frequency (Frequency of Exercise). Students undergo an anaerobic training program at least 3-4 times a week with specific training sessions aimed at increasing muscle endurance and anaerobic energy systems. Intensity The intensity of the exercise is gradually increased with the high-intensity interval training (HIIT) method, repeated sprint training, and game-based exercises that require students to move quickly in a short duration. Time (Exercise Duration) Each exercise session is focused on 20-30 minutes of anaerobic exercise, with optimal work-rest interval settings. For example, exercises are performed in durations of 6-10 seconds of sprinting followed by 30-40 seconds of rest, resembling the energy patterns that occur in badminton matches. The types of exercises used include: 6x35 meter sprints to simulate the high intensity of the game. Shuttle runs with minimal rest intervals to enhance anaerobic recovery (Kochanowicz, 2024; Siedler, 2021; Vaccari, 2020). Shadow badminton drills with high intensity to mimic movements in the game. Explosive jumping exercises such as plyometrics to improve leg muscle endurance.

The results of measuring anaerobic endurance with the Running-based Anaerobic Sprint Test (RAST) showed significant improvements in key indicators such as maximal power, average power, and decreased fatigue. Maximal Power Improvement. After the FITT program was implemented, students were able to produce greater power in repeated sprints, indicating an increase in their anaerobic capacity. Increased Average Power The students' ability to sustain power in each sprint increased, meaning they could maintain the intensity of the game for longer without experiencing a drastic drop in performance. Decreased Fatigue Level. Data showed that students experienced a significant decrease in fatigue percentage, signaling increased energy efficiency and better anaerobic recovery (Kaufmann, 2022; Wibisana, 2018).

Through the FITT project, students not only improved their anaerobic endurance, but also learned to apply logical and systematic thinking in designing and evaluating the effectiveness of their

training programs. By analyzing data from the RAST test, students were able to understand how their bodies respond to anaerobic exercise and make the necessary adjustments to achieve optimal performance.

CONCLUSION

Based on the results of research on the application of the FITT (Frequency, Intensity, Time, and Type) Training Project to improve learning outcomes in badminton and anaerobic endurance courses, it can be concluded that this method is effective in improving student performance. Statistical test results showed that there was a significant increase in badminton course grades after implementing the FITT project. Students' anaerobic endurance also improved significantly based on the Running-based Anaerobic Sprint Test (RAST) results. Key parameters such as maximal power, average power, and fatigue level showed positive changes after the implementation of the FITT project.

The FITT project can be used as an effective learning strategy to improve learning outcomes in badminton courses and increase students' anaerobic endurance. The implementation of this approach is expected to continue to be developed to improve the quality of learning and physical performance of students in sports.

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