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Comparing the effects of hybrid and online learning on physical activity and body mass index: A quasi-experimental investigation

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ABSTRACT

Changes in learning methods at school can affect students' learning habits and activity patterns. This study aims to investigate the effect of hybrid learning compared to online learning on fitness level and body composition, specifically focusing on body mass index (BMI). The research method used was a quasi-experiment with a pretest-posttest control group design approach. The number of research subjects was 128 students with an average age of 10.35 ± 0.67 years, a body weight of 42.05 ± 8.97 kg, and a height of 142.84 ± 7.94 cm. The results showed that the post-test BMI score in the hybrid learning group decreased significantly, $p < 0.05$, by 19.69 kg/m2, and there was an increase in physical activity of 2.94 METs. Whereas in the online learning group, there was no significant difference in BMI or physical activity variables. The results of this study are expected to be a reference for teachers in schools and other educators to apply the hybrid method compared to online learning so that students' physical activity patterns can be maintained and continuously improved, which has an impact on body composition. The findings can also help in reducing physical activity patterns in big cities on the island of Sumatera and can be a discussion for researchers to create or modify more effective and efficient learning methods.

Keywords: BMI; physical activity; hybrid learning; online learning

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INTRODUCTION

Most Indonesian communities have almost experienced two years of pandemic period. The emergence of boredom due to staying at home was used as a prod to stay active during the crisis. The pandemic forced everyone to be able to adapt to new living habits (Pavlovic et al., 2021). The new normal era was challenging in life; when facing a better life adaptation after the pandemic (Ciotti et al., 2020; Guan et al., 2020; Timpka, 2020). Lifestyle changes were felt to be an obstacle for everyone, especially in the world of education. As a result of the pandemic, an online-based learning pattern was implemented; thus, the teaching and learning process continued to reduce the risk of

being affected by the COVID-19 virus (Hyunshik et al., 2021; Mocanu et al., 2021; Nopembri et al., 2023).

Changes in learning methods also affect policy directions (Rusli et al., 2020), such as changes in the curriculum that change the learning system that is commonly carried out face-to-face to online recently. This innovation is excellent for advancing national education; thus, the ministry has issued online learning guidelines for education community members. This change in the learning system puts pressure on students internally and externally, provoking (negative) emotions, including stress, while learning from home (Fan et al., 2021). On the other side, not all subjects can be carried out through online learning, such as physical education, which requires students to be able to make movements correctly and actively; hence, they have an impact on physical health and can avoid sports injuries. Many people consider that the effectiveness of online learning does not have a significant impact (Fan et al., 2021). Consequently, it is necessary to formulate steps to overcome the deficiencies of the learning system, namely by increasing interaction with fellow friends and teachers at school and applying values for students who demand that blended or hybrid learning is necessary.

Hybrid learning is learning carried out in combination (face-to-face and online) simultaneously at one time (Camargo et al., 2020; Lestari et al., 2021; Xiao et al., 2020). This learning aims to provide opportunities for students to learn independently, sustainably, and develop throughout their lives to become more effective, efficient, and interesting (Gultom et al., 2022). Recent studies revealed that students participating in fully online learning had a significantly lower prevalence of participation in schools and sports clubs when compared to hybrid learning (Johnson et al., 2023). It will negatively impact the child's interaction patterns in real life later. When comparing students involved in full and hybrid sports lessons, it turned out that students who were fully involved in face-to-face learning had a higher level of moderate to vigorous physical activity than those who studied in a hybrid manner (Johnson et al., 2023). If sorted by gender, males were significantly more active than females in both interventions. However, students in the hybrid group were found to have higher motivation levels than full face-to-face participants, especially for intrinsic motivation (Rocamora et al., 2023).

Changes in learning methods must be accompanied by the development of the times and surrounding conditions. The use of technology should be optimized by educators to facilitate unrestricted and obstacle-free student interactions in the learning process. However, the impact of hybrid learning and online learning on the physical condition and body composition of students remains largely unexplored. Previous studies have primarily focused on aspects such as perception (Yudaparmita et al., 2023), evaluation (Yulianti et al., 2022), involvement level (Johnson et al., 2023), and students' motivation when using hybrid methods (Rocamora et al., 2023). Therefore, there is an urgent need to address this research gap.

This study aims to investigate the effect of hybrid learning compared to online learning on the fitness and body composition of primary school students in Jambi City, specifically the body mass index. By exploring the potential influence of these learning methods on students' physical health, this research seeks to provide valuable insights for sports teachers to effectively enhance their students' fitness levels. Additionally, the study aims to map the students' physical activity levels and body composition within the school environment. The anticipated benefits of this research include facilitating informed decision-making among educators and policymakers, leading to the implementation of appropriate technology integration strategies that promote both

academic excellence and overall physical well-being among primary school students in Jambi City.

METHOD

This research employed a quasi-experimental method with a *pretest-posttest control group design* approach. The total subjects were divided into two groups (experimental and control), and each group was given a different treatment simultaneously. This research was conducted for 16 weeks, from the first week of September 2022 to the third week of December 2022. Meanwhile, the experimental group was given a hybrid learning treatment, while the control group was given an online learning treatment. Furthermore, the parameters to be measured in this research included: age, weight, height, BMI percentage, and physical activity level. Some of these parameters were taken before and after being given the learning method treatment.

The research subjects were selected based on inclusion and exclusion criteria, where the inclusion criteria included sitting in Class 5 of primary school, aged 10-12 years old, in good health, male and female, and not currently under drug intervention or during recovery. A total of 128 students who participated in this research were divided into four classes. Each class consisted of 32 students, in which two classes from primary school 9/IV of Jambi City participated as the experimental group and two classes from primary school 16/IV of Jambi City became the control group. The average age of the students was 10.35 ± 0.67 years old, weight 42.05 ± 8.97 kg, and height 142.84 ± 7.94 cm.

Measurements and Research Procedures

Anthropometry

Age data were collected using a questionnaire distributed during physical education class hours. Meanwhile, the height was measured using the GEA manual stature mater, which the homeroom teacher directly carried out. Furthermore, weight measurements were obtained using a SECA 762 brand scale. The participants completed the data collection procedure by standing upright on the unit and placing both feet on the scales barefoot.

Percentile BMI for Children

The percentage measurement of BMI, specifically for children aged 2-20, was carried out using a metric unit, namely dividing body weight (kilograms) by height squared (meters) or BMI = kg/m^2. Furthermore, the results of BMI data were classified based on percentages as follows:

Table 1. Interpretation of BMI in children according to percentile values

No	Classification for Children	BMI	Percentile
1	Weak	<18.4 kg/m^2	<5 percentile
2	Normal Weight	18.5 – 24.9 kg/m^2	5 – 85 percentile
3	Overweight	25.0 – 39.9 kg/m^2	85 – 95 percentile
4	Obese	>40 kg/m^2	>95 percentile

Physical Activities

The Physical Activity Questionnaire for Older Children (PAQ-C) questionnaire measured the physical activity data. The instrument consisted of nine question items related to the type and frequency of participation in physical activity over the last seven days. Participants self-reported the frequency of participation from a list of activities or moments such as physical education, school breaks, lunch hours, after school, evenings, and weekends. Each answer was scored on a 5-point scale ranging from 1 to 5.

Furthermore, the average value of responses (a higher score indicated a higher level of physical activity) was calculated to calculate the physical activity index score. Recommendations for physical activity were categorized based on the scores obtained and then classified as (1) "very low", (2) "low", (3) "moderate", (4) "high", and 5 "very high" values.

Hybrid Learning and Online Learning Methods

The hybrid learning method provided to the experimental group was 50% face-to-face in class and 50% online, which was carried out through interactive virtual video conferencing platforms such as Google Meet and Zoom. Meanwhile, the online learning method was fully completed through the Google Meet and Zoom virtual video conferencing platforms. The total number of meetings in these two learning methods was carried out for 16 meetings with a duration of 90 minutes. The learning material applied in these two methods was physical education, which consisted of games and sports, fitness training, floor gymnastics, and rhythmic gymnastics.

Data Analysis

The data presented in this research were the average value and standard deviation. The anthropometric data such as age, weight, and height were tested using one-way analysis or *one-way ANOVA* to compare the two groups. Furthermore, BMI percentiles and physical activity were analyzed using a paired *t*-test to test the difference between before and after treatment in both groups. The statistical analyses employed the SPSS version 22 application with a significance level of $p < 0.05$.

RESULTS AND DISCUSSION

The data showed that the two groups of anthropometric values before starting treatment indicated no significant differences in age, weight, and height (see Table 2).

Table 2. Anthropometric data of the two groups before being given treatment

No	Variable	Total (N=128)	Group		p-value
			Experiment (n=64)	Control (n=64)	
1	Age (years)	10.35 ± 0.67	10.35 ± 0.69	10.36 ± 0.65	0.908
2	Weight (kg)	42.05 ± 8.97	42.09 ± 7.67	42.01 ± 10.17	0.961
3	Height (cm)	142.84 ± 7.94	142.85 ± 6.74	142.70 ± 9.04	0.982

Furthermore, changes in physical activity data and BMI percentiles observed during the intervention are summarized in Table 3. These results indicated that the post-test results of physical activity levels of students in the experimental group using the hybrid learning method had higher METs scores when compared to the post-test results of the online learning group (experiment, 2.94 METs vs. control, 2.56 METs). After the treatment, the BMI value of students in the hybrid learning group experienced a significant decrease in $p < 0.05$ of 19.69 kg/m^2. Meanwhile, the online learning group did not show any significant changes.

Table 3. Data outcomes before and after being given treatment

No	Variable	Hybrid Learning		Online Learning	
		Pre	Post	Pre	Post
1	BMI (kg/m^2)	20.61 ± 3.32	19.69 ± 2.47*	20.45 ± 3.71	20.33 ± 3.63
2	PA (METs)	2.65 ± 0.80	2.94 ± 0.71*	2.67 ± 0.83	2.56 ± 0.81

*Significant average difference $p<0.05$,
PA = Physical Activity METs = Metabolic Equivalents

Tables 4 and 5 reveal that the BMI percentile of students in the hybrid learning group with the normal category (5-85 percentile) was 42, while in the online learning group, there were 36 students. It implied that the hybrid learning group significantly positively impacted maintaining students' body composition.

Table 4. Distribution of BMI percentile values in the hybrid learning group

No	Classification for children	N	Post-test (%)
1	Weak (<5 percentile)	15	23.4
2	Normal Weight (5 – 85 percentile)	42	65.6
3	Overweight (85 – 95 percentile)	5	7.8
4	Obese (>95 percentile)	2	3.2

Table 5. Distribution of BMI percentile values in the online learning group

No	Classification for children	N	Post-test (%)
1	Weak (<5 percentile)	20	31.3
2	Normal Weight (5 – 85 percentile)	36	56.3
3	Overweight (85 – 95 percentile)	7	10.9
4	Obese (>95 percentile)	1	1.5

This research discovered a phenomenon in the field where the level of physical activities in the group of students using the hybrid learning method increased compared to online. Therefore, it aligned with previous research (Rocamora et al., 2023). The *Body Mass Index* (BMI) of the hybrid group decreased compared to the online group, where the BMI percentile for the hybrid group in the normal category was higher than the online group. This evidence was also supported by several previous research (Adamakis, 2021; Hennessy et al., 2023; Mocanu et al., 2021; Xiao et al., 2020). The pandemic required everyone to adapt to new living habits (Besser et al., 2022). Changes in learning methods also affected the direction of policy stakeholders (Rusli et al., 2020), such as curriculum changes, curriculum integration, and credit systems that allowed a student to take courses in other study programs or universities. This sudden change put pressure on students internally and externally, thus provoking (negative) emotions, including stress, while learning from home (Fan et al., 2021).

A study explained that online learning also encouraged student-centered learning and was easy to manage during pandemic conditions (Mukhtar et al., 2020). Indeed, in the past, when online learning was undeniable, many benefits were obtained, such as distance learning, which was realized, comfortable, and easily accessible, while its limitations involved inefficiency and difficulty maintaining academic integrity (Mukhtar et al., 2020). The biggest challenge was internet connectivity (Kapasia et al., 2020), while there were still obstacles to understanding the content or learning content (Chung et al., 2020). One of the ways to maintain academic integrity is understanding the content or learning content (Chung et al., 2020; Mukhtar et al., 2020), which can be considered difficult for primary school students. In addition, the assessment method must change to be easier, resulting in a decrease in integrity for teachers, followed by a decrease in the quality of students (Grunt et al., 2020). A study in Nepal provided a solution to the problem of ineffective online learning models, making blended learning recommendations surface, indicating that online classes could be an alternative to traditional educational facilities. Therefore, hopefully, implementing blended learning could be more effective and successful (Paudel, 2020).

Not only school students but sports undergraduate students are also required to understand the material during practical lectures and object if lectures requiring practical participation in sports were replaced with online theoretical classes (Mocanu et al., 2021). Active participation in physical education is hard to come true, especially for students in primary schools. Educators and policymakers must jointly work to bring

innovative research and media development with the aim of helping online learning be effective and efficient. At the same time, the situation is still shrouded in the COVID-19 virus storm (Radu et al., 2020). Referring to a study in Nepal, a solution to the problem of ineffective online learning models was obtained; blended learning recommendations appeared, indicating that online classes could be an alternative to traditional educational facilities. Hence, hopefully, implementing blended learning could be more effective and successful (Paudel, 2020). In this case, blended learning is another term for hybrid learning. When the pandemic was over, and it changed to hybrid mode, adaptation needed to be done again. Some studies mentioned that perceptions in sports learning became even easier to apply if hybrids were implemented (Yudaparmita et al., 2023) because they could solve problems that were previously difficult to find solutions on online mode.

Hybrid learning aims to provide opportunities for students to learn independently, sustainably, and develop throughout their lives to become more effective, efficient, and interesting (Gultom et al., 2022). Several studies revealed that students who fully participated in online learning had a much lower prevalence of participation in schools and sports clubs when compared to hybrid learning (Johnson et al., 2023). It will trigger a negative impact on the interaction patterns of children in real life later. The encouragement of sports education teachers to prioritize social interaction, non-competitive play, and professional or practitioner support from motoric and psychological aspects was another key factor in increasing interaction between non-disabled students and students with special needs (de Boer et al., 2012), because many schools, especially in Indonesia, have implemented inclusive schools. Thus, it is more appropriate to recommend applying hybrid methods in school learning, especially physical education subjects. Although, indeed, the data indicated a comparison between students who were involved in full and hybrid sports lessons, turning out that students who were fully involved in face-to-face learning had a higher level of moderate to vigorous physical activity than the group of students who studied in a hybrid manner (Johnson et al., 2023).

Additionally, males were significantly more active than females in the full face-to-face and hybrid interventions. However, students in the hybrid group had higher motivation levels than the full-face participants, especially for intrinsic motivation (Rocamora et al., 2023). Face-to-face sports activities could cause it frequently carried out, triggering students to experience boredom. It could be caused by monotonous variations in the types and forms of learning sports in schools. Therefore, applying hybrid learning patterns for physical education must be implemented to help create a feeling of wanting to be involved longer. On the other side, the teacher should also be given time to explore various games to be applied during class.

CONCLUSION

The conclusion of this study indicates that the implementation of the hybrid learning method has a positive impact on changes in children's physical activity patterns and body composition. Therefore, it is recommended to maximize the use of the hybrid method and, if it is possible, reconsider the adoption of full face-to-face learning, especially in Physical Education classes, to provide greater benefits for students. The findings of this research are expected to serve as a valuable reference for teachers and educators to opt for the hybrid method over online learning, as it can help maintain and continuously improve students' physical activity patterns, consequently affecting their body composition positively.

The recommendations from this study include replicating the research with a larger sample size to enhance the reliability and generalizability of the findings. Long-term studies are also encouraged to gain deeper insights into the sustained effects of hybrid learning on students' physical activity patterns and body composition. It is suggested to involve different locations in future research to obtain a broader perspective on the impact of hybrid learning in various educational settings. Additionally, incorporating different age groups in the study can provide insights into potential developmental differences.

The contribution of this research lies in providing evidence of the positive impact of the hybrid learning method on children's physical activity patterns and body composition. The findings underscore the potential benefits of implementing hybrid learning, especially in Physical Education classes, to enhance students' overall well-being. The insights gained from this study can guide educators, policymakers, and researchers in developing more effective strategies to improve students' physical activity levels and body composition, ultimately contributing to better health and academic outcomes. It is hoped that these findings will provide a foundation for broader implementation of the hybrid learning method in various educational environments to strengthen the positive relationship between physical activity and students' body composition.

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CONFLICTS OF INTERESTS

The authors declare that they have no competition.

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