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MEDICAL INNOVATION

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Blended learning versus online education: impact to elementary students' engagement in physical activity and Body Mass Index

Nauczanie mieszane a edukacja online: wpływ na zaangażowanie uczniów szkoły podstawowej w aktywność fizyczną i wskaźnik masy ciała

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Abstract

Examining the impacts of blended and online learning settings on children's fitness and body mass index in a sample of public elementary school pupils in the Philippines is the main objective of this study. A 16-week pre-test and post-test control group in a quasi-experimental approach. The experimental group received blended education, whereas the control group exclusively took classes online. The experimental and control groups consisted of 2 classes from an elementary school in Angeles and Mabalacat City. Anthropometrical characteristics were compared between groups using ANOVA. Pre-test and post-treatment body mass index percentiles and PA levels were compared using a paired t-test. First, there were no significant variance in the individuals' anthropometrical characteristics between the two groups before intervention. Additionally, the blended learning group outperformed the online learning group on the post-test in terms of physical activity. After intervention, the mean BMI of the blended learning group decreased, but online students showed no improvement. Last but not least, when compared to the online learning group, the BMI percentile of the students in the blended learning group is within the usual range. The benefit of blended learning on the pupils' physical composition was highlighted. Pupils' levels of physical activity and body composition have improved as an outcome of the adjustment from traditional to online and blended learning settings. For the benefit of the students, it is advisable to make the most of a blended learning strategy and, if at all possible, return to the full face-to-face method.

Keywords

blended learning, body mass index, online learning, physical activity, physical education

Streszczenie

Głównym celem tego badania jest zbadanie wpływu nauczania mieszanego (blended) oraz online na kondycję fizyczną i wskaźnik masy ciała dzieci z próby uczniów publicznych szkół podstawowych na Filipinach. Wykorzystano 16-tygodniowy test wstępny i końcowy w grupie kontrolnej w podejściu quasi-eksperymentalnym. Grupa eksperymentalna korzystała z nauczania mieszanego (blended), podczas gdy grupa kontrolna uczestniczyła wyłącznie w zajęciach online. Grupy eksperymentalna i kontrolna składały się z 2 klas ze szkoły podstawowej w Angeles i Mabalacat City. Cechy antropometryczne były porównywane między grupami przy użyciu ANOVA. Wskaźniki procentowe masy ciała oraz poziomy aktywności fizycznej (PA) przed testem i po interwencji były porównywane przy użyciu sparowanego testu t. Po pierwsze, przed interwencją nie stwierdzono istotnych różnic w cechach antropometrycznych uczestników między obiema grupami. Dodatkowo grupa uczestnicząca w nauczaniu mieszane (blended) osiągnęła lepsze wyniki niż grupa online pod względem aktywności fizycznej w teście końcowym. Po interwencji średni wskaźnik BMI w grupie uczestniczącej w nauczaniu mieszane (blended) spadł, natomiast uczniowie uczący się online nie wykazali poprawy. Co więcej, w porównaniu z grupą online, wskaźnik BMI uczniów uczestniczących w nauczaniu mieszanym (blended) mieścił się w typowym zakresie. Podkreślono korzyści z nauczania mieszanego (blended) dla składu ciała uczniów. Poziomy aktywności fizycznej i skład ciała uczniów poprawiły się w wyniku przejścia z tradycyjnego na nauczanie online i mieszane. Dla dobra uczniów zaleca się maksymalne wykorzystanie strategii nauczania mieszanego (blended) i, jeśli to możliwe, powrót do pełnego nauczania stacjonarnego.

Słowa kluczowe

nauczanie mieszane, wskaźnik masy ciała, nauczanie online, aktywność fizyczna, wychowanie fizyczne

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Introduction

In contemporary times, there has been a notable observation of a widespread phenomenon known as global epidemic of apathy in physical exercise [1]. Children at the elementary level face a heightened vulnerability to physical inactivity, as evidenced by studies conducted by scholars [2, 3]. Research findings have demonstrated that the global population has had substantial repercussions as a result of the pandemic [4, 5]. Consequently, some educational institutions have been compelled to close their physical facilities and transition to delivering courses solely through online platforms [6]. The quick adjustment to new environments has a negative impact on the physical well-being of students [7, 8]. Physical education teachers promote the cultivation of a healthy lifestyle among students beyond the confines of the classroom. A decrease in physical activity has been found to be linked to a decrease in many fitness indicators, such as strength, agility, flexibility, cardiorespiratory endurance, and body composition, as evidenced by several academic investigations [9–11].

Changes in educational policies can be impacted by changes in teaching methodologies, namely the transition from primarily in-person instruction to a progressively digital pedagogical approach [12, 13]. As a result of this paradigm shift in the educational system, students may encounter a range of adverse emotions, including but not limited to tension, even as they engage in their academic tasks within the confines of their own residences [14, 15]. Nevertheless, there exist certain fields of study that are not conducive to online instruction. One such example is physical education, a discipline that plays a crucial role in promoting students' physical well-being and safeguarding against sports-related injuries by focusing on the cultivation of proper and energetic movement patterns [16]. The value of online education is sometimes underestimated due to the prevailing perception that it lacks effectiveness. Consequently, it is imperative to devise strategies that effectively tackle the deficiencies within the educational system. These strategies may involve promoting increased engagement between students and their peers and instructors within the school environment, as well as implementing guiding principles for proponents of blended or hybrid education, which is deemed crucial for the present generation of learners.

The blended learning model is distinguished by the concurrent integration of face-to-face and online training [17, 18]. To optimize students' long-term productivity and efficiency, this educational approach prioritizes the provision of opportunities for self-directed and sustainable learning [19–21]. Recent study findings have revealed that students who only participated in online education exhibited notably diminished levels of engagement in extra-curricular pursuits and school when compared to their peers who were enrolled in a blended learning approach [22–24]. The potential social skills of the child would be negatively impacted as a result. Based on the research conducted, it was discovered that students who participated in both online and in-person aspects of a sports course demonstrated significantly elevated levels of moderate to intense physical activity in comparison to individuals who pursued a mixed format [25, 26]. These data suggest that the face-to-face component of the course offers more benefits in terms of learning outcomes in comparison to the online component. Upon categorizing the participants according to gender, it becomes apparent that men shown a greater frequency of engagement in both programs. Additionally, it was noted that students who were part of the blended group exhibited greater levels of motivation in comparison to their peers in the conventional face-to-face setting, particularly with regards to their intrinsic motivation [27, 28].

As societal dynamics and various influencing elements undergo transformation, it becomes imperative for our educational methodologies to adapt accordingly. Educators must to effectively utilize technology in order to facilitate students' participation in meaningful and unhindered collaborative activities pertaining to their educational pursuits. Until recently, there has been a lack of exploration into the effects of online and blended education on the health and fitness levels of students, particularly in the context of the Philippines. Prior research has mostly concentrated on the examination of student perceptions regarding the use of a blended instructional strategy [29]. Additionally, investigations have been conducted to assess the effectiveness of this approach [30, 31], as well as to explore student engagement levels [26] and motivation [27, 28]. Given the urgency of this matter, it is imperative that this investigation be expeditiously undertaken. The main objective of this study is to conduct a comparative analysis of blended and online learning settings in order to assess their impact on the physical fitness levels, body composition, and body mass index of students attending public elementary schools in the Philippines.

Materials and method

Participants

The present study employed a quasi-experimental approach, utilizing a control group design that incorporated both pre- and post-test assessments. The entire number of individuals was evenly divided into two groups, namely the experimental group and the control group, and subjected to distinct treatments simultaneously. The study spanned a total of 16 weeks, commencing from February-May 2022. The control group engaged in instruction that was exclusively conducted online, whereas the experimental group received a combination of online and in-person instruction. In this study, measurements were taken for age, weight, height, body mass index (BMI), and exercise level. Certain characteristics were assessed both prior to and during exposure to the training protocol. The recruitment process involved the selection of participants based on certain inclusion and exclusion criteria. Inclusion requirements were that participants be enrolled in the fifth grade of elementary school, aged between 10 and 12, in good physical condition, and of both genders. Additionally, participants were required to not be currently undergoing drug intervention or rehabilitation. The study consisted of a total of 128 student volunteers, who were divided into four distinct groups. The experimental group consisted of two classes from an elementary school in Angeles City, including a total of 32 children. Conversely, the control group was composed of two classes from an elementary school in Mabalacat City. The average age of the students was (M = 10.35 SD = 0.67) years, their average weight was (M = 42.05 SD = 8.97) kg, and their average height was (M = 142.84 SD = 7.94) cm.

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Measurement and research procedures

Anthropometry measurements

A questionnaire was handed out during physical education classes to gather information about students' ages. Meanwhile, the teacher-adviser personally measured everyone's height and weight using DETECTO 339. Standing erect on the device, the participants barefooted placed both feet on the scales to finish the data collection procedure.

Percentile Body Mass Index

The body mass index (BMI) of individuals was determined by dividing a person's weight in kilograms by the square of their height in meters. Moreover, the distribution of BMI values can be categorized based on percentage in the following manner:

Table 1. Demographic characteristics

No	Classification	Body Mass Index [kg/m^2]	Percentile
1	W	< 18.4	< 5
2	NW	18.5 – 24.9	5 – 85
3	OW	25.0 – 39.9	85 – 95
4	O	> 40	> 95

Note: W – Weak, NW – Normal Weight, OW – Overweight, O – Obese

Physical Activities

Data on physical activity was gathered using the Physical Activity Questionnaire for Older Children (PAQ-C). The survey instrument included a total of nine questions about respondents' physical activity habits throughout the previous week. Students rated their own participation in a variety of physical and mental activities during PE, recess, lunch, after school, and on weekends. Each response was assigned a score between 1 and 5 on a scale of 1 to 5. Furthermore, the physical activity index score was calculated by taking the average of the response values, with a higher score indicating a greater amount of physical activity. After tabulating the results, the physical activity recommendations were ranked from lowest to highest: (1) very low to (5) very high.

Methodologies for blended and online learning

The experimental group was given a blended learning experience consisting of 50% traditional classroom time and 50% Google Meet-based online instruction. Meanwhile, Google Meet served as the backbone of an effective online education strategy. A total of 16 meetings, each lasting 90 minutes, were held using one of these two pedagogical approaches. Physical Fitness, Games and sports, and Rhythm and dance all made up the physical education used in these two pedagogical approaches.

Data analysis

Both the mean and the standard deviation were provided in this study's data. The age, weight, and height of the subjects were compared between the two groups using one-way analysis or one-way ANOVA. Furthermore, a paired t-test was used to compare pre- and post-treatment BMI percentiles and levels of physical activity in both groups. A significance level of $p < 0.05$ was used in the statistical analyses performed in SPSS version 27.0.

Ethical considerations

All participants were briefed on the experiment's goals, as well as any instruments or tests that would be used to evaluate their progress and output. The positive effects that this investigation will have on primary educational institutions and the scientific community as a whole have also been outlined.

Results

There were no statistically significant differences between the two groups in terms of age, weight, or height in their baseline anthropometric measurements taken before treatment began as illustrated in Table 2.

Table 2. Anthropometric data before treatment

No	Variable	Total (N = 128)		Experiment blended Learning (N = 64)		Control Online Learning (N = 64)		
		Mean	SD	Mean	SD	Mean	SD	p-value
1	Age [years]	10.35	0.67	10.35	0.69	10.36	0.65	0.91
2	Weight [kg]	42.05	8.97	42.09	7.67	42.01	10.17	0.96
3	Height [cm]	142.84	7.94	142.85	6.74	142.70	9.04	0.98

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Table 3 provides a comprehensive summary of the data pertaining to the observed enhancements in physical activity levels and reductions in body mass index percentiles that were documented during the intervention period. The post-test results indicated that students belonging to the blended learning group reported significantly greater levels of physical activity compared to students in the online learning group (2.94 METs versus 2.56 METs, respectively). After the intervention, there was a significant decrease of 19.69 kg/m2 in the average body mass index (BMI) among students in the blended learning group. In contrast, the online learners did not demonstrate any discernible advancement throughout the specified period.

Table 3. Results before and after intervention

		Hybrid learning				Online learning			
		Pre		Post		Pre		Post	
No	Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
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; MET = Metabolic Equivalents

Based on the data shown in Tables 4 and 5, it can be observed that the BMI percentile of students belonging to the blended learning group, falling within the normal range of 5-85 percentile, was recorded as 42. In comparison, the online learning group exhibited a matching figure of 36. The blended learning group was emphasized due to its potential positive impact on students' body composition.

Table 4. BMI distribution in the blended learning group

No	Classification for children	(Post-test %) N
1	W < 5 percentile	(23.4%) 15
2	NW 5–85 percentiles	(65.6%)42
3	OW 85–95 percentiles	(7.8%) 5
4	O > 95	(3.2%) 2

Note: W – Weak, NW – Normal Weight, OW – Overweight, O – Obese

Table 5. BMI distribution in the online learning group

No	Classification for children	(Post-test %) N
1	W < 5 percentile	(31.3%) 20
2	NW 5–85 percentiles	(56.3%) 36
3	OW 85–95 percentiles	(10.9%) 7
4	O > 95	(1.5%) 1

Note: W – Weak, NW – Normal Weight, OW – Overweight, O – Obese

Discussion

This study revealed a phenomenon within the discipline, indicating that students who employed the blended learning approach had a greater level of physical activity in comparison to their counterparts who engaged in online learning. Consequently, the aforementioned outcome aligns with the conclusions established in a previous investigation conducted by Rocamora et al. [27]. While the blended group exhibited a higher BMI percentile in the normal range compared to the online group, the latter group achieved a greater overall weight loss. Multiple previous research have also provided support for this evidence [32–34]. The epidemic has necessitated a widespread need for individuals to modify their lives [35–37]. The priorities of policymakers were influenced by curriculum changes, curriculum unification, and the implementation of credit systems, which facilitated the transfer of earned credits between different academic programs [38, 39]. The sudden transition resulted in significant psychological and emotional strain for students who had previously been engaged in remote learning. As previously indicated, the abrupt change in circumstances resulted in heightened levels of both internal and external stress among students, leading to adverse effects on their homeschooling endeavors [14, 15].

In addition to being manageable even in the midst of a pandemic, a recent study found that online education fostered student-centered learning [40, 41]. There is no denying that in the past, when online learning was undeniable, many benefits were

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acquired, such as remote learning, which was realized, pleasant, and easily available [42, 43], despite its shortcomings, which included inefficiency and the difficulties of maintaining academic integrity [44–46]. The lack of access to the internet was the main barrier to learning [47,48], while problems with comprehension and retention persisted [49]. As mentioned by previous scholars, understanding the material is essential for maintaining academic integrity [44–46], but this might be challenging for elementary school students. Teachers' integrity will suffer as a result of the simplified assessment process, and pupils' quality will follow suit [50]. Blended learning recommendations emerged from various studies, suggesting that online classes could be a viable alternative to conventional educational modalities [51–53]. As a result, blended education has the potential to be more efficient, fruitful, and sustainable.

Undergraduates in sports, like high schoolers, are expected to pay attention and learn during practical lectures, and they would be dissatisfied if those lectures were supplanted by online theoretical sessions [54, 55]. For elementary school kids specifically, active participation in physical education is a rarity. In order to make online education more efficient and productive, educators and policymakers must collaborate on new forms of research and media. Concurrently, the situation is still clouded by the COVID-19 virus storm. By referencing previous research papers cited in this paper, emergence of blended learning may be viable compared to a more conventional approach [51–53]. Blended learning is a synonym for hybrid education in this context. After the epidemic subsided and it switched to blended mode, adaptability was once again required. Blended learning, according to a few studies, can help with issues that were previously challenging to find answers to when using an online mode of instruction for sports, making its application that much simpler [24, 56, 57].

The primary objective of blended education is to facilitate the development of students into individuals who possess the ability to engage in continuous learning and enhance their competencies and passions [19–21]. Multiple investigations have indicated that full-time online learners exhibit considerably lower rates of school and extracurricular club participation compared to blended learners [22–24]. The potential consequences of this phenomenon on the future social behaviors of pupils are likely to be detrimental. Furthermore, it is worth noting that some educational institutions, particularly in the Philippines, have successfully adopted inclusive schooling practices. This approach has prompted sports education instructors to place greater emphasis on fostering social contact, promoting non-competitive play, and seeking professional or practitioner assistance in addressing motoric and psychological components [58, 59]. Hence, it is more justifiable to endorse the implementation of blended methodologies in the field of physical education. In light of the available data, a comparison was made between students who partook in full and blended sports lessons. Surprisingly, the findings indicated that the cohort of students who received instruction in a blended format exhibited lower levels of physical activity compared to their counterparts who received face-to-face instruction [25, 26].

In addition, men participated more actively than women did in both the traditional and blended forms of the intervention. Students in the blended group were more motivated than those in the full-face condition, especially in terms of their intrinsic drive [27]. Direct competition in sports could lead to pupils being bored with the activity if it were routinely practiced. It may be due to the lack of novelty in the methods by which students study sports in school. Therefore, it is important to employ blended learning patterns for physical education in order to foster a desire for sustained participation. On the contrary hand, educators need time to experiment with new classroom games.

Conclusion

Both pupils' levels of physical activity and their overall body composition have improved as a result of the shift from traditional classrooms to online and blended learning environments. Maximizing the use of the blended approach, and if at all feasible reverting back to the full face-to-face approach, is preferable, particularly in physical education learning, so that students may reap the greatest possible benefits.

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