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The Effect of Physical Activity on Multiple Intelligences: A Literarure Review

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ABSTRACT: Sport is a meaningful context in which many young people participate, and youth sports teams can be an effective way to promote optimal development. Sport includes any form ofphysical activity that contributes to physical fitness, mental well-being and social interaction. The research objective of this literature review study is to determine the effect of physicalactivity on intelligence and to determine the effect of physical activity on multiple intelligences. This research uses a literaturereview design. The data used in this research are published articles published in international and national journals. Searchesfor published articles were carried out using several journal database websites such as Mendeley, Science Direct, Google Scholar, and PubMed. Based on the literature that has been reviewed, the results show that there are 8 studies that show the influence of physical activity on intelligence and multiple intelligences in a person. It is hoped that the results of this research can be used as a reference for other researchers to use as a reference.

KEYWORDS: physical activity, intelligence, multiple intelligences, sport, literature review

I. INTRODUCTION

Physical activity is any bodily movement produced by the contraction of multiple muscles that increases energy expenditure above the resting metabolic rate and is characterized by its modality, frequency, intensity, duration, and the context in which it is performed (Thivel et al., 2018, p. 2). Physical activity is defined as “any bodily movement produced by skeletal muscles that results in caloric expenditure” (Caspersen, C.J., in Norris et al., 2020, p. 126). Therefore, physical activity is generally described across the following four dimensions: (i) frequency – “the amount of physical activity over a specific period of time”; (ii) duration – “the time spent engaging in a single bout of physical activity”; (iii) intensity – “the physiological effort associated with participating in a specific type of physical activity”; and (iv) type of activity. Ideally, any assessment of physical activity should measure all of these dimensions and account for daily variations (Harkins et al., 2016, p. 353).

It has been suggested that participation in physical activity and achieving high levels of physical fitness are associated with improvements in brain structure and function, cognition, and academic performance through direct and indirect physiological, cognitive, emotional, and learning mechanisms (Hillman et al., 2008). Furthermore, scientific evidence presented by Howie and Pate (2012) indicates that being physically active (such as playing sports) during the school day does not negatively impact academic success or progress. Physical activity during adolescence is also associated with cognitive performance in adulthood. Adolescents who are moderately active, especially those who maintain consistent levels of physical activity, tend to demonstrate higher cognitive performance (Esteban-Cornejo et al., 2015). Therefore, it is important for teachers to create more opportunities for children to engage in physical activity during the school day.

The influence of physical activity on intelligence has garnered increasing attention in recent years. Research has demonstrated that physical activity can affect intelligence by influencing subcortical brain structures (Cadenas-Sanchez et al., 2023). Other studies support this relationship, drawing on theories of cognitive load and embodied cognition, which highlight the importance of combining motor play from an early age with the teaching of academic content through integrated physical activity (Mavilidi et al., 2019). Despite this evidence, most schools still adhere to traditional sedentary teaching models for the majority of the school day (Steele et al., 2010). Adolescents typically spend only 5% of the school day engaged in moderate-to-intense physical activity and exhibit very low levels of motor exercise during breaks and recess (da Costa et al., 2019).

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Physical activity plays a crucial role in supporting overall health and fitness. In addition to its physical benefits, engaging in regular physical activity can also provide significant mental and social advantages. Furthermore, as highlighted earlier, physical activity can influence various aspects of a person's multiple intelligences. The purpose of this literature review is to examine the impact of physical activity or sports on the development of multiple intelligences. By understanding the findings of this study, it is hoped that this review can serve as a valuable reference for individuals or institutions involved in education, particularly in physical education and sports. Encouraging increased physical activity among students can help maximize its benefits on their multiple intelligences.

II. RESEARCH METHOD

A. Research Strategy

This study employs a literature review method to investigate the relationship between physical activity and multiple intelligences. The objective of this literature review is to provide a comprehensive overview of existing research on the topic while identifying current knowledge gaps and areas requiring further exploration. The literature for this study was sourced from reputable journal databases, including Mendeley, Google Scholar, PubMed, and ScienceDirect. The search process utilized relevant keywords such as "physical activity," "multiple intelligences," and "cognitive development." Articles selected for inclusion in this review were required to align closely with the topic, emphasizing the effects of physical activity on multiple intelligences.

B. Exclusion Criteria

To ensure that the literature included in this study was relevant and of high quality, several exclusion criteria were applied. Articles published in journals not indexed in reputable databases were excluded from the review to maintain credibility. Additionally, only articles published within the last five years (2019–2024) were included to ensure that the data and findings used were current and up-to-date. Articles that did not explicitly address or discuss the effect of physical activity on multiple intelligences were also excluded from the analysis. Furthermore, non-research articles, such as editorials, commentaries, or short reviews, were excluded to focus solely on empirical and scholarly studies that directly contributed to the research objectives. These criteria ensured the inclusion of high-quality and relevant literature for this review.

C. Procedure

The research procedure consisted of several key stages to ensure a systematic and thorough review. The process began with a literature search through various journal databases using predetermined keywords. The articles retrieved from this search were then screened based on their titles and abstracts to assess their relevance to the research topic. After this initial screening, the articles deemed relevant were further evaluated using inclusion and exclusion criteria to ensure their eligibility. Articles that met these criteria were collected for further analysis, which focused on the independent variable (physical activity) and the dependent variable (multiple intelligences). This analysis included examining the study design, research objectives, sample characteristics, instruments used, and main findings or results of each selected article. The results of this analysis were summarized into a comprehensive overview that presented key information from each article, such as the name of the researcher(s), year of publication, study design, and main findings related to the research topic. By following this structured procedure, the study aims to provide a clear understanding of the relationship between physical activity and multiple intelligences while identifying gaps in existing research that require further exploration. The research procedure for this study is illustrated through the following PRISMA diagram.

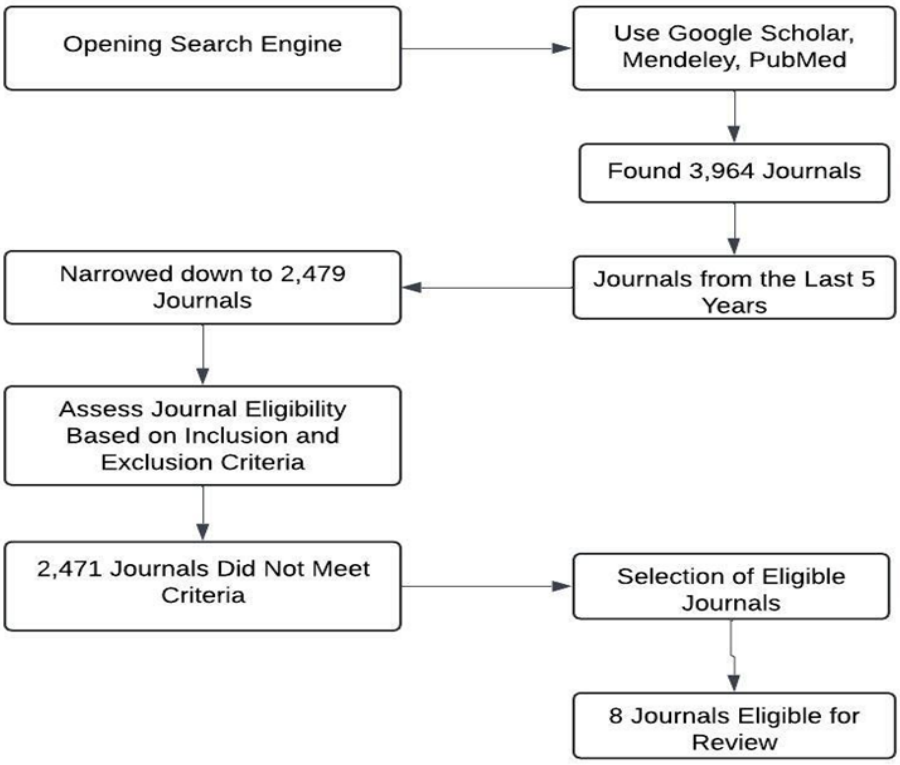

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) diagram

III. RESULT AND DISCUSSION

This literature review gathers secondary data from reputable sources such as Mendeley, Google Scholar, and ScienceDirect, as well as other reliable journal databases. The keywords used for the search include "physical activity," "sports," "intelligence," and "cognitive." The data are categorized into five key groups, which are summarized in Table 1.

Tabel 1. Table 1 Results of national and international journal data synthesis

Author and year	Research Methods and Types	Content	Research Objectives	Research Result
José Luis Ubago-Jiménez , Félix Zurita-Ortega, Silvia San Román-Mata, Pilar Puertas-Molero dan Gabriel González-Valero (2020)	Descriptive, cross-sectional, and non-experimental design.	Relationship between physical activity, diet (specifically the Mediterranean Diet), and multiple intelligences in university students.	To establish relationships between the practice of physical activity and the various types of intelligences and to determine the relationship between diet, particularly adherence to the Mediterranean Diet, and different types of intelligence among university students.	The results of the study indicate significant gender differences in both physical activity and adherence to the Mediterranean Diet among university students. Women showed a higher adherence to the Mediterranean Diet, while men had higher scores in physical activity levels. When examining multiple intelligences, men exhibited higher indices in Bodily-kinesthetic, Interpersonal, Logical-mathematical, Musical, and Spatial intelligences. In contrast, women demonstrated higher levels in Linguistic, Intrapersonal, and Naturalistic intelligences.
Sara Jochumsen, Tine Brink Henriksen, Morten Søndergaard	The research utilized a cohort study, an observatio	The study investigates the link between maternal physical activity during pregnancy and the intelligence	The primary objective was to determine if maternal physical activity during pregnancy is associated with lower risk of low intelligence	The study found that higher maternal physical activity during pregnancy was linked to a reduced risk of low intelligence scores in sons. Sons of active women had significantly lower odds of scoring in the lowest 10%, with adjusted odds ratios of 0.66 for light, 0.46 for

Lindhard, Hanne Kristine Hegaard, dan Line Rode (2019)	nal study method.	scores of their sons in early adulthood.	scores in sons. The study also adjusted for factors like maternal BMI, education, and smoking to ensure accurate results.	moderate to heavy activity, and 0.50 to 0.62 for those engaged in sports. This suggests that increased maternal activity benefits offspring's cognitive development.
Wang, K.; Li, Y.; Zhang, T.;Luo, J. (2022)	The study used a cross-sectional survey method, which is a type of quantitative research	Relationships between physical exercise, self-efficacy, emotional intelligence, and subjective well-being among college students, focusing on how these factors interrelate and collectively influence subjective well-being, with an emphasis on the mediating roles of self-efficacy and emotional intelligence.	To analyze the factors influencing college students' subjective well-being and to understand the path mechanisms linking physical exercise, self-efficacy, and emotional intelligence to subjective well-being.	The study found that physical exercise is positively correlated with self-efficacy, emotional intelligence, and subjective well-being. It directly enhances subjective well-being and indirectly does so through self-efficacy and emotional intelligence. A chain mediation effect involving self-efficacy and emotional intelligence was also identified, highlighting the importance of emotional management and application in improving students' life satisfaction and happiness.
Real-Pérez MGavala-González JSilva MFernández-García J (2022)	This research employed a correlational study method, a type of quantitative research	The research investigated the relationships between motor capacity, academic performance, and intelligence in children.	The primary objective was to assess the existence of significant relationships between motor capacity, academic performance, and intelligence in pre-adolescent children and to determine whether participation in sports influences these relationships.	The study found significant correlations between motor capacity and intelligence but not with academic performance. Children who participated in sports showed better motor capacity and intelligence test results compared to those who did not, suggesting that intense physical activity and sports may contribute to improved academic performance.
Nofi Marlina Siregar, Eka Fitri Nofita Sari, dan Dinan Mitsalina (2023)	This study used action research with a sequential exploratory design, incorporating both quantitative and qualitative analysis	Relationship between physical activity and mathematical logical intelligence in early childhood. It specifically investigates how game-based physical activity can enhance cognitive skills in children, focusing on improving logical	The main objective was to determine the effect of physical activity on the enhancement of mathematical logical intelligence in early childhood. The study aimed to assess the improvement in cognitive abilities through structured physical activities and games.	The study found a significant increase in logical mathematical intelligence among children in Jakarta Kindergartens. The average intelligence score rose from 28 in the initial assessment to 57 after the first cycle and further to 78 after the second cycle, indicating that game-based physical activity effectively enhances cognitive development in young children. Future research should expand on these findings with a larger sample size.

	(Mix Method)	mathematical intelligence in a kindergarten setting in Jakarta.		
Kusriyanti dan Pamuji Sukoco (2020)	This research utilized a research and developm ent (R&D) method, combining both quantitativ e and qualitative approache s.	Developing and validating a model of physical activities based on the surrounding nature to enhance naturalistic intelligence in elementary school students.	The main objectives were to create a model of physical activities based on the surrounding nature aimed at improving naturalistic intelligence in elementary students and to evaluate the effectiveness of this model through expert assessments and field trials.	The study successfully developed a learning model documented in a VCD and guidebook, consisting of four nature-based physical activities. Expert assessments concluded that the model is suitable for physical education in lower elementary grades. The model was found to be effective in enhancing naturalistic intelligence among students in the tested schools.
Ainun Rofiqoh, Lilis Madyawati, dan Rasidi (2021)	Correlatio nal research method, a type of quantitativ e research	Relationship between students' sports abilities and their participation in marching troop extracurricular activities with their kinesthetic intelligence.	Determine the correlation between sports ability and participation in marching troop extracurricular activities with the kinesthetic intelligence of elementary school students.	The study found significant correlations between both sports ability and extracurricular marching activities with kinesthetic intelligence. The coefficients for sports ability and marching activities with kinesthetic intelligence were 0.530 and 0.624, respectively, indicating a positive relationship. The results suggest that both factors are associated with higher levels of kinesthetic intelligence in students.
Wu R Jing L Liu Y Wang H Yang J (2022)	The study used a cluster sampling method, a type of quantitativ e research	Impact of physical activity on regulatory emotional self-efficacy, resilience, and emotional intelligence among nurses and explains the interactions between these factors.	The main objective of this study is to examine the influence of physical activity on nurses' regulatory emotional self-efficacy, resilience, and emotional intelligence, and to explain how these factors interact to alleviate the physical and mental stress experienced by nurses.	The results showed positive correlations between physical activity and resilience, resilience and regulatory emotional self-efficacy, and emotional intelligence and regulatory emotional self-efficacy. The positive impact of physical activity on emotional regulation self-efficacy is fully mediated by emotional intelligence and resilience, with stronger explanatory power (R2 = 0.49) than previous studies. Physical activity-generated positive emotions are key in enhancing emotional regulation self-efficacy, emotional intelligence, and resilience.

Based on the table above, the research findings indicate that physical activity has a significant impact on various types of intelligence. First, the study by Ubago-Jiménez et al. (2020) highlights the relationship between physical activity, diet (specifically the Mediterranean diet), and multiple intelligences among university students. The results reveal significant gender differences, with men scoring higher in bodily-kinesthetic, interpersonal, logical-mathematical, musical, and spatial intelligences, while women excel in linguistic, intrapersonal, and naturalistic intelligences. Second, the research by Jochumsen et al. (2019) demonstrates that maternal physical activity during pregnancy reduces the risk of low intelligence scores in male offspring during early adulthood. This finding underscores the long-term cognitive benefits of maternal physical activity. Third, the study

by Wang et al. (2022) finds a positive relationship between physical exercise, self-efficacy, emotional intelligence, and subjective well-being among college students. Physical activity directly enhances subjective well-being and indirectly influences it through self-efficacy and emotional intelligence. Fourth, research by Real-Pérez et al. (2022) identifies significant correlations between motor capacity and intelligence in children actively participating in sports. The results suggest that intensive physical activity contributes to improved intelligence levels.

Moreover, the study by Siregar et al. (2023) reveals that game-based physical activities significantly enhance logical-mathematical intelligence in early childhood. Structured physical activities led to an increase in intelligence scores from 28 to 78 after two intervention cycles. Research conducted by Kusriyanti and Sukoco (2020) shows that nature-based physical activities effectively improve naturalistic intelligence among elementary school students. Similarly, the study by Rofiqoh et al. (2021) identifies a positive correlation between sports ability and kinesthetic intelligence through participation in extracurricular activities. Lastly, the research by Wu et al. (2022) demonstrates that physical activity enhances emotional self-efficacy, resilience, and emotional intelligence among nurses. These findings emphasize the crucial role of physical activity in managing physical and mental stress.

Overall, the research highlights the significant benefits of physical activity on various types of intelligence, both directly and indirectly. These findings reinforce the importance of integrating physical activity into educational curricula and professional practices to optimize cognitive and emotional development.

IV. CONCLUSIONS

The findings from this literature review confirm the significant role of physical activity in enhancing various types of intelligence across different age groups and contexts. Physical activity not only directly improves cognitive, emotional, and motor skills but also contributes indirectly through mechanisms like self-efficacy, resilience, and emotional intelligence.

The research highlights that game-based activities effectively enhance logical-mathematical intelligence in early childhood, while nature-based physical activities promote naturalistic intelligence among elementary students. In adults, physical activity improves emotional intelligence, resilience, and subjective well-being. Additionally, maternal physical activity during pregnancy is shown to have long-term positive effects on the cognitive development of offspring. Gender differences in intelligence types associated with physical activity were also noted, emphasizing the diverse impacts of these activities.

These results underline the necessity of incorporating physical activity into educational and professional settings as a strategic approach to foster cognitive, emotional, and social development. Future research should explore longitudinal studies and diverse sample populations to better understand the causal relationships and further broaden the application of these findings.

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