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Relationship of Physical Activity with Cognitive Performance in the Student: A Systematic Literature Review

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Abstract
Lack of physical activity is a problem of worldwide concern. Various facilities and adequate facilities cause the movement and activities of students to be increasingly limited. Lower levels of student physical activity were associated with an increased risk of developing dementia earlier. This study aimed to obtain findings regarding the relationship between physical activity and cognitive performance in students. This study uses a systematic literature review method. To obtain data, the researcher used a systematic literature review funnel. From the results of the application of search strings on 4 databases, namely Pubmed, Sciencedirect, and Taylor and Francis, and Emerald, the filtering results based on the criteria produced 21 journals to be used as final papers and analyzed. Next, the researcher extracted the data using template analysis as a thematic way to analyze the qualitative data. The data analysis tool used by the researcher is Mendeley-Dekstop-1.19.8-win32. Based on the results of this study indicate that there is a relationship between physical activity and cognitive performance in students. A person's good physical activity has a relationship with a high cognitive function score, while someone who reduces the duration and intensity of physical activity allows the process of cognitive function decline to be faster.

Keyword:
Physical Activity, Cognitive Performance, Students.

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Introduction

Lack of physical activity is a problem of worldwide concern. Schools have an important role in children's development by identifying those with low physical fitness and by promoting health behaviors such as encouraging children to be active. The most obvious benefit of physical exercise in children is an increase in physical fitness, which was shown in a study of 57 children. After seven weeks of training, there were improvements in fitness tests, agility, counter-jump tests, sprints, systolic blood pressure, fitness tests, and a reduction in fat percentage (Brunet, 2006).

Similar benefits have been shown in other studies as well. According to (Bajak, 2008) In addition to physical fitness, there is evidence that exercise affects cognitive function. A positive relationship between physical and cognitive activity and academic performance in

school-age children was reported in a meta-analysis. also aerobic fitness in children was associated with a higher measure of neuroelectric origin (P3 in brain-evoking potential), faster cognitive processing speed and better performance on tests of executive control (Ortega, 2008). In this section the author must be able to provide background on the topic or problem related to research in accordance with the development of the current situation and conditions. Explain why the researcher took up this topic and why the researcher considers this an important topic. Disclosing about previous research related to this research and gaps in this research.

The benefits of physical exercise for physical fitness as well as cognition are described in pre-adolescents. Physical exercise was also associated with a positive influence on depression, anxiety, mood, self-esteem and higher academic performance. These findings are supported by a study of 540 primary school children, who were randomly assigned to a physical exercise program or control condition for one academic year. Sub-population analysis showed that physical exercise had a positive effect on Psychosocial Quality of Life (QoL), especially in urban students and overweight students. There is little impact of a physical exercise program on overall quality of life (Omoru, 2013).

Cognition, a broad term to refer to cognitive and academic performance, is a mental function involved in acquiring knowledge and understanding. High cognition has been identified as a positive marker of health (Bandura, 2004). Likewise, variables related to cognition have been used to assess the psychological health of school-age individuals. In particular, adolescence is a critical stage for cognition, and adolescent cognition may be an important predictor of adult health. For example, poor cognition during adolescence has been associated with higher rates of morbidity and mortality, anxiety disorders, depression, psychological distress, coronary heart disease, and some cancers later in life. High cognition is associated with positively related psychological variables such as self-esteem and self-concept. A healthy lifestyle during adolescence may be important for better cognition (Slawta, 2008).

Physical activity is one strategy to reduce the risk of cognitive decline in students because it is one of the activities that can stimulate the brain (Boreham 2001). In addition to stimulating the brain, physical activity can also reduce the incidence and prevalence of chronic diseases, which is one of the risk factors for cognitive decline. Physical activity is also an important non-pharmacological activity that can be beneficial for cognitive performance and reduce the risk of cognitive impairment. Students can expect a greater chance of living the following years in good health. The amazing thing is that even the smallest amount of physical activity, especially outside the home, can improve attitudes, reduce stress and loneliness, promote better sleep, and prevent feelings of depression (Sibley, 2003).

Physical activity habits can be a major determinant of cognition during adolescence which is the period of life with the greatest decline in physical activity levels throughout life. The growing literature shows that physical activity has a clear influence on measures of cognition such as concentration, working memory, inhibition and classroom behavior during this age, aspects on which academic ability is based.

Methods

The research method used in this research is Systematic Literature Review (SLR). SLR will be very useful for synthesizing various relevant research results, so that the facts presented

become more comprehensive and balanced (Kitchenham, 2019). Systematic literature reviews address specific research questions in a transparent and reproducible manner while seeking to augment all published evidence on a particular topic and assess the quality of that evidence (Lame, 2019). The main objective of a systematic literature review is to increase transparency in each review process by relying on an explicit process. A systematic method that reduces bias in the selection and inclusion of studies, assesses the quality of those studies and summarizes them objectively (Thomé, Scavarda, & Scavarda, 2016).

Procedure

Systematic literature review must start from an interesting topic and try to answer a problem (Wahono, 2020). In this study the authors intend to examine the relationship between physical activity and cognitive performance in the student using a systematic literature review method. The decline in physical activity carried out by children, adolescents, and the elderly today and also considering the dangers of disease due to lack of physical activity on health in the elderly so that it can accelerate cognitive performance in the elderly, therefore the authors are interested in conducting research on the relationship between activities physical and cognitive performance in the elderly using a systematic literature review method. After determining the focus of the research, the researcher then formulated the research question. Research questions are an important part of a systematic literature review. Questions in research questions must be formed very accurately because the study selection process will be faced with a dichotomous decision where researchers must choose to include or exclude potential studies (Pollock & Berge, 2018). To help focus the research and clarify it, the researcher uses the PICo approach.

PICo is a framework that aims to clarify research questions, help establish criteria for entering relevant studies and filter out studies that are not relevant to research (Pollock & Berge, 2018). There are several things that must be considered in PICo such as population (P) where population is an important part of determining the scope of research and mapping the problem to be studied. After knowing the population or the problem to be studied, then determine the interest (I) where interest is the object of research which will later be investigated and developed into a research question. To facilitate the scope of research from the interest (I) that has been determined, then determine the context (Co). Context (Co) is useful for limiting interest so that the research question is not too far from the research objective. The following is the PICo framework used by the author.

Data Analysis

The process of searching, reading, defining scope, and refinding is a cycle. The possibility to carry out this cycle is very small, now after searching several databases, studies, and journals, the main problems and findings focused on this research are obtained. Next, the researcher will focus on documenting the themes, similarities and differences that exist in studies and journals. The data that will be presented is then analyzed through 3 stages (Jesson, 2015). Namely: (1) Write important conclusions in each journal; In this phase, the writing will be descriptive in the form of a conclusion. From the final paper, you will build evidence, and explain the research topic. (2) Comparing the existing final papers to find out the differences and similarities in each journal used in the final paper. From these results will be obtained comparative data. (3) Next is to make memos or notes in each journal to provide advantages

and disadvantages as well as opportunities for further research. The focus remains on the research question to keep writing relevant reviews.

Result

In this section, please describe the data that has been obtained based on the data analysis. Tables and Figures should explain the results of the data analysis. Don't re-describe what's already on the table and the figures on the new paragraph. Tables Participation in physical activity has many physiological and psychological benefits for children and adolescents (Biddle, Gorely, & Stensel, 2004; Janssen & LeBlanc, 2010; Strong et al., 2005). Nevertheless, accelerometer data from the 2007 Canadian Health Measurement Survey 2009 showed that only 7% of children and adolescents met the national recommendation of 60 minutes of moderate to vigorous physical activity (MVPA) daily (Colley et al., 2011). Children are few hours in school and for some children this is their only opportunity to be physically active (Allison & Adlaf, 2000). The Canadian Association for Health, Physical Education, Recreation and Dance (2005) reports that only 57% of schools meet provincial guidelines for minutes spent in physical activity. Previous research has shown that PA programs can be successfully implemented in a school setting (Dobbins, DeCorby, Robeson, Husson, & Tirilis, 2009; Hoelscher et al., 2001; McKenzie, Sallis, & Rosengard, 2009), but programs are often discontinued after study. (Hoelscher et al., 2001; Neumark-Sztainer, Stories, Hannan, & Rex, 2003). Teachers and administrators feel that physical activity programs are untenable when forced to compete with academic courses for time in the daily schedule (Dwyer et al., 2003; Hoelscher et al., 2001). Therefore, a better understanding of the relationship between physical activity and cognitive performance could help inform strategies for the promotion of physical and mental health in school settings. Interest in the relationship between physical activity and cognitive performance has led to a rapidly growing literature base, including meta-analyses and several review papers. First, Sibley and Etnier (2003) conducted a meta-analysis of 44 published and unpublished studies covering acute and chronic physical activity interventions. Outcome measures vary widely, including intelligent intelligence, perceptual skills, math tests, memory, and concentration. The authors found an effect size of 0.32, slightly larger than the 0.25 effect size found in a previous review by Etnier et al. repeating the same conclusion. First, they all agreed that there was a weak or no positive correlation between participation in physical activity and academic performance, and emphasized the lack of negative associations. Second, physical activity can increase cognitive efficiency, so students can learn faster while in class; so replacing academic time with physical activity should not hinder academic achievement (Keeley & Fox, 2009; Taras, 2005; Trudeau & Shephard, 2008). In contrast, removing physical activity to spend more time on academic subjects can be detrimental to health outcomes (Trudeau & Shephard, 2008). In general, Keeley and Fox (2009) conclude there is a lack of research in this area, given the policy implications, and findings are based primarily on cross-sectional studies; thus, more experimental studies are needed to better understand the complex relationship between physical activity and cognitive performance.

Discussion

Based on the results of the research and discussion, the researchers concluded from the results of this study as follows:

Participation in physical activity has many physiological and psychological benefits for children and adolescents.

Children spend a few hours at school and for some children this is their only chance to be physically active.

Therefore, a better understanding of the relationship between physical activity and cognitive performance could help inform strategies for the promotion of physical and mental health in school settings.

Conclusion

The only cognitive process affected by acute physical activity in this study was planning. Planning is associated with children's ability to solve problems and self-regulate their behavior. Thus, these results suggest that in academic settings, teachers may wish to plan complex activities after physical activity. In addition, students with cultural behavior disorders may benefit from having time to be physically active throughout the day. To accommodate time constraints, research has shown that incorporating academic concepts into physical activity may be effective (Bartholomew & Jowers, 2011; Kibbe et al., 2011). From a mental health perspective, a temporary increase in planning performance can improve a child's ability to interact with his environment, promote long-term cognitive development (Tomporowski et al., 2011; Trudeau & Shephard, 2010), as well as the ability to adapt to new conditions that require planned behavior. goal-directed (Pesce, 2009). Davis et al. (2007) found higher planning scores after a chronic exercise intervention with overweight children, following a dose e response, suggesting that improvements to repeated short-term planning yield sustained benefits. In addition, short-term improvements in planning and problem solving may indirectly benefit other dimensions of mental health, such as self-efficacy and self-concept (Bandura, 1997; Meltzer, 2007). Our research signals that, at a time when children are not able to be efficiently active, physical activity may become an important part of the school curriculum for the promotion of physical and mental health.In this section, explain clearly the main conclusions that are the highlights of the study.

Based on the results of this study indicate that there is a relationship between physical activity and cognitive performance in students. A person's good physical activity has a relationship with a high cognitive function score, while someone who reduces the duration and intensity of physical activity allows the process of cognitive function decline to be faster.

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References

Allison, K. R., & Adlaf, E. N. (2000). Structured opportunities for student physical activity in Ontario elementary and secondary schools. Canadian Journal of Public Health, 91, 371e375.

Bajak M: Exercise is brain food: effects of physical activity on cognitive function. Neurorehab Dev 2008, 11:236 – 240

Bandura, A. (1997). Self-efficacy: The exercise of control. New York, NY: W.H. Freeman and Company.

Bandura, A. (2004). Health promotion by social cognitive means. Health Education & Behavior,
31, 143-164.
Bartholomew, J. B., & Jowers, E. M. (2011). Physically active academic lessons in elementary children. Preventive Medicine, 52(Suppl.), S51eS54.
Biddle, S. J. H., Gorely, T., & Stensel, D. J. (2004). Health-enhancing physical activity and sedentary behaviour in children and adolescents. Journal of Sport Sciences, 22, 679e701
Boreham, C., & Riddoch, C. (2001). The physical activity, fitness and health of children. Journal
of Sports Sciences, 19, 915-929.
Brunet, M., Chaput, J. P., & Tremblay, A. (2006). The association between low physical fitness and high body mass index or waist circumference is increasing with age in children: the 'Québec
en Forme' Project. International Journal of Obesity, 31(4), 637-643.
Colley, R. C., Garriguet, D., Janssen, I., Craig, C. L., Clarke, J., & Tremblay, M. S. (2011). Physical activity of Canadian children and youth: accelerometer results from the 2007 to 2009 Canadian Health Measures Survey. (Statistics Canada Catalogue number 82-003-XPE). Health Reports, 22, 1e9.Hadi, S. T. (2020). *Systematic Literature Review*.
Dobbins, M., DeCorby, K., Robeson, P., Husson, H., & Tirilis, D. (2009). School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6e18 (review). Cochrane Database of Systematic Reviews, 3. doi:10.1002/14651858.CD007651, Art. No.: CD007651
Dwyer, J. J. M., Allison, K. R., Barrera, M., Hansen, B., Goldenberg, E., & Boutilier, M. A. (2003). Teacher's perspective on barriers to implementing physical activity curriculum guidelines for school children in Toronto. Canadian Journal of Public Health, 94, 448e452
Hoelscher, D. M., Kelder, S. H., Murray, N., Cribb, P. W., Conroy, J., & Parcel, G. S. (2001). Dissemination and adoption of the child and adolescent trial for cardiovascular health (CATCH): a case study in Texas. Journal of Public Health Management Practice, 7, 90e100.
Jill K Jesson, Taylor J, Lydia Matheson Fiona M Lacey (2012). Doing Your Literature Review - Traditional and Systematic Techniques. doi: 10.7748/nr.19.4.45.s7. PMID: 27712345.
King MC. "The race" to clone BRCA1. Science. 2014 Mar 28;343(6178):1462-5. doi: 10.1126/science.1251900. PMID: 24675952.
Kitchenham. (2019). Service function chaining across openstack and kubernetes domains. *DEBS 2019 - Proceedings of the 13th ACM International Conference on Distributed and Event-Based Systems*, 240–243. https://doi.org/10.1145/3328905.3332505
Lame, G. (2019). Systematic literature reviews: An introduction. *Proceedings of the International Conference on Engineering Design, ICED, 2019-August*(July), 1633–1642. https://doi.org/10.1017/dsi.2019.169
Meltzer, L. (2007). Executive function in education: From theory to practice. New York, NY: Guilford Press
Naglieri, J. A. (2005). The cognitive assessment system. In D. P. Flanagan, & P. L. Harrison (Eds.), Contemporary intellectual assessment: Theories, tests, and issues (pp. 441e460). New York: The Guilford Press
National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development Network. (2003). Frequency and intensity of activity of third-

grade children in physical education. Archives of Pediatrics & Adolescent Medicine, 157, 185e190.
Oliver, K., Boaz, A. Transforming evidence for policy and practice: creating space for new conversations. *Palgrave Commun* **5,** 60 (2019). https://doi.org/10.1057/s41599-019-0266-1
Omorou YA, Erpelding ML, Escalon H, Vuillemin A. Contribution of taking part in sport to the association between physical activity and quality of life. Qual Life Res. 2013 Oct;22(8):2021-9. doi: 10.1007/s11136-013-0355-3. Epub 2013 Jan 24. PMID: 23345023.
Ortega FB, Ruiz JR, Castillo MJ, Sjöström M: Physical fitness in childhood and adolescence: markers of strong health. Int J Obes (Lond) 2008, 32:1 – 11.
Pesce, C., Crova, C., Cereatti, L., Casella, R., & Bellucci, M. (2009). Physical activity and mental performance in preadolescents: effects of acute exercise on free-recall memory. Mental Health and Physical Activity, 2, 16e22
Pollock, A., & Berge, E. (2018). How to do a systematic review. *International Journal of Stroke*, *13*(2), 138–156. https://doi.org/10.1177/1747493017743796
Sibley BA, Etnier JL: Relationship between physical activity and cognition in children: a meta-analysis. Practice Pediatr Sci 2003, 15:243 – 256.
Slawta J, Bentley J, Smith J, Kelly J, Syman-Degler L: Promoting healthy lifestyles in children: the Be a Fit Kid pilot program. Health Promotion Practice2008, 9:305 – 312.
Thomé, A. M. T., Scavarda, L. F., & Scavarda, A. J. (2016). Conducting systematic literature review in operations management. *Production Planning and Control*, *27*(5), 408–420. https://doi.org/10.1080/09537287.2015.1129464
Tomporowski, P. D., Lamourne, K., & Okumura, M. S. (2011). Physical activity interventions and children's mental function: an introduction and overview. Preventive Medicine, 52(Suppl.), S3eS9.
Trudeau, F., & Shephard, R. J. (2010). Relationships of physical activity to brain health and academic performance of schoolchildren. American Journal of Lifestyle Medicine, 4,
wahono. (2020). Systematic Literature Review. *International Journal of Innovation in the Digital Economy*, *12*(1), 1–26. https://doi.org/10.4018/ijide.2021010101