



REVIEW ARTICLE

School Strategies on Improving Students' Physical Activity Engagement During COVID-19 Pandemic Period: A Thematic Review

Victor Fello Piores^{1ABCDE}, Roxana Dev Omar Dev^{2ACDE}, Mohd Mokhtar Muhamad^{3ACDE} and Dharatun Nissa Binti Puad Mohd Kari^{3ACDE}

¹Universiti Putra Malaysia

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Corresponding Author: Victor Piores, E-mail: runnersHigh13@yahoo.com

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Abstract

Study purpose. Physical inactivity among school students was an existing health issue over the past decade. This became more alarming when the world was hit by the COVID-19 pandemic. Movement restriction that results temporary school closure significantly affect students' physical activity participation. Therefore, strategies and practices to improve active play engagement as well as to counteract its negative health-related effects on students were widely implemented by teachers and administrators in school upon its re-opening. Numerous articles have been published on the effectiveness of school-based interventions during the COVID-19 pandemic, but there is still a lack of a review paper that deals with the identification of patterns and trends about school practices in this area. Hence, this paper intends to generate impressions and identify concepts within the published articles during 2021 to 2023.

Materials and methods. Selected articles for this study were collected from the following databases: SCOPUS, Sage, ProQuest, Academic Search complete, Science Direct. Computer-assisted qualitative data analysis (ATLAS ti. 23) guided the comprehensiveness of this review. Study findings were generated and presented through quantitative and qualitative lenses.

Results. Four central themes were identified: 1) Alternative Physical Education – modifying traditional physical education subject; 2) Physical literacy focus – approach anchored to multi-dimensional foundation in physical activity engagement 3) Web-based intervention – virtual and cyberspace approach and 4) Needs-based intervention – focusing on integration of participants' attributes and specifically designed program.

Conclusions. The structure of strategies conducted by schools were greatly affected by the current community health status. Findings of this study will serve as a reference for designing future intervention approach to address the sedentary lifestyles of young populations associated to specific community health and other related issues.

Keywords: school, intervention, physical activity, ATLAS ti. 23, COVID-19.

Introduction

Sedentary lifestyle is a global issue within the past decade and still an upsetting issue at present. Sedentary behavior incidence was considerably on alarming stage globally (Carl et al., 2023). Health organizations and professionals are currently working on strategies and intervention to improve individuals lifestyle. World Health Organization (2022) keeps on disseminating information about movement guideline

recommendation to help the globe overthrow inactivity. However, the campaign to fight sedentary behavior among society was tested by another challenge. This was when the world was hit by COVID-19 – pandemic few years ago.

COVID-19 brings huge change on community lifestyle all over the world (Marenus et al., 2023). Changes comes from societal daily routine to individual activity engagement preference. Among affected by the pandemic was the children, as they are confined to the house due to movement restriction policy. Physical activity as part of kid's daily life became one of the researchers interests during COVID-19 times. Being active through movement was very important to students positive growth (Wiklund et al., 2023). This was

supported by Gilic et al., (2023) cited that being active was positively associated to being healthy. According to Swierad et al., (2021) children became substantially inactive because of the virus spread.

COVID-19 – pandemic resulted temporary closure of schools as compliance to movement restrictions. According to Marenus et al. (2023) COVID-19 provides negative impact on students as they become more inactive and over engaged to gadget. This also contributes to students' inactivity as they missed the opportunities to be engage in physical activities usually done in school. According to Gallotta et al. (2022), chance of being active are high when in school as they can do some active games and plays. Therefore, school is a considerable venue to help children improve their lifestyle for being active.

During the resumption of school operation, prominent health organizations and public officials all over the world highly recommends to consider school as a venue for promoting active lifestyle (Ram et al., 2023). According to McQuinn et al., (2022) the school set up was considerably suitable for improving and managing students behavior towards being active. Children value their time on school therefore experience within the said place is crucial for their behavioral development (Nagy-Pénzes et al., 2022). Therefore, several studies were conducted regarding strategies on promoting physical activity, as well as evaluating the intervention program for sedentary lifestyle using school as its venue.

This review was driven by the impression that despite of numerous study and intervention conducted, global inactivity percentage continues to upsurge. With the researchers best of knowledge, thematic review paper is limited pertaining on patterns and trends of school strategies promoting physical activity during COVID-19 pandemic time.

Consequently, the aim of this study is to generate themes according to the issues and inclinations involved in the argument and discussion within the selected published article about school strategies in promoting active lifestyle during COVID-19 pandemic (2021 to 2023).

RQ: What are the concepts and trends about strategies implemented by school to improve physical activity engagement among students identified from the literature published year 2021 to 2023.

Materials and methods

Selected published articles were identified through following data base search 1. SCOPUS, 2. Sage, 3. ProQuest, 4. Academic search Complete and 5. Science Direct. Pattern was identified through the metadata transferred to ATLAS ti. 23 from Mendeley.

Thematic analysis is the process of recognizing and identifying new themes and patterns in iterative manner until deeply understanding the subject area (Braun & Clarke, 2008). Thematic review and analysis such as theme identification guided by ATLAS ti. 23 Mohd Zairul, (2020) was implemented in this study. This paper intends to explore the literatures conducted about school base strategies to improve active lifestyle during COVID-19 pandemic time for future reference on similar and related fields of researches.

This study set the following criteria for literature selection: 1) published from year 2021 to 2023; 2) full text published and 3) written in English language. Literature searched used physical activity, school, curriculum, intervention, strategy and COVID-19 as keywords. Data base search string used in SCOPUS, Sage, ProQuest, Academic search Complete and Science Direct was shown in table 1. Searching of articles was done December 22 to 23, 2023 which produced 1,212 literatures. SCOPUS data base generates 267 papers, 102 articles was identified through Academic search complete, Science direct identified 214 papers, 271 for Sage data base and 358 research work searched in ProQuest.

Published literatures generated from data base searched were downloaded being as the main data reference for this review article. Initial search identified 1,212 articles, followed by abstract screening that results exclusion of

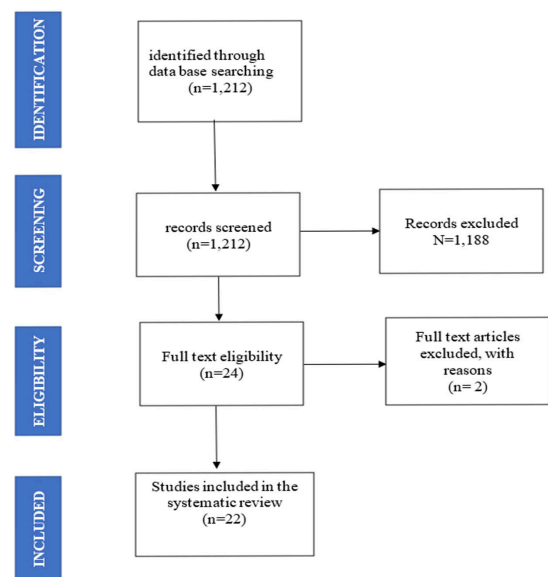


Fig. 1. Flowchart of literature selection

Table 1. Search strings from Scopus, Academic Search Complete, Science direct, Sage, ProQuest

Data Base	Search String	Result
SCOPUS	TITLE-ABS-KEY ("physical activity" "school" OR "curriculum" "covid" OR "pandemic" "strategy" OR "intervention") AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "english")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (PUBSTAGE , "final"))	267
Academic Search Complete	"Physical activity" AND "school" AND "covid 19" AND ("strategy" OR "intervention")	102
Science Direct	"Physical activity" AND "school" AND "covid 19" AND ("strategy" OR "intervention")	214
Sage	"Physical activity" AND "school" AND "covid 19" AND ("strategy" OR "intervention")	271
ProQuest	"Physical activity" AND "school" AND "covid 19" AND ("strategy" OR "intervention")	358

1,190 literatures. Hence, resulting 22 documents included based on the inclusion criteria set in this study which will be the main data reference for further investigation (Figure 1). Selected documents were uploaded to ATLAS ti. 23 for thorough analysis. Quantitative approach was used to present and discuss the patterns and numerical features of the literature articles, publication dispersal by countries and themes identified during COVID-19 pandemic time (2021-2023). Moreso, identifying themes and concept, “coding, followed by categorizing and pattern recognition” was implemented during analysis phase, thus, making the investigation rigorous (Braun & Clarke, 2008).

Results and Discussions

Concept, themes and patterns generated are presented and discussed in this section. Research dispersal by country in which it was conducted, occurrence of words used in literatures included, frequency of publication during COVID-19 time (2021-2023) was included in quantitative report section.

Generating codes and identifying themes as well as concepts was guided by qualitative approach. Codes were identified within the selected literature during preliminary analysis. Accordingly, comparisons and links between the initial codes were further assess and analyze. Codes that were closely associated and share same concept with other codes were merge and recoded. After rigorous evaluation of preliminary codes, four main themes as well as concept and trends were identified using ATLAS ti 23 (Table 2).

Table 2. Thematic review of school practices to improve active lifestyle status of students during COVID-19 time (2021-2023)

Year	Alternative Physical Education	Physical literacy focus	Web based intervention	Needs based intervention	Total
2021	1	-	-	-	1
2022	3	1	2	1	7
2023	4	4	2	13	23
Total	8	5	4	14	31

Quantitative Report

Part of the review analysis was recognition of most word used in the paper selected in this study. This process offers preliminary notion about the concepts deliberated in the included articles for review. Text cloud using ATLAS ti. 23 generated the following words as most frequent used; “physical” (1,490) for most used by the literatures, then “school” which was mentioned 1,324 time, followed by “health”, “activity” and “intervention” with word count of 1,279, 1,184 and 1,123 respectively (figure 2).

Also included in quantitative report was the publication dispersal by countries conducted during COVID-19 pandemic time (2021-2023) as shown in figure three. Fifteen nations conducted and published their research about practices or interventions that aims to improve physical activity status of school students within the year 2021 to 2023. Six publications by the United States of America

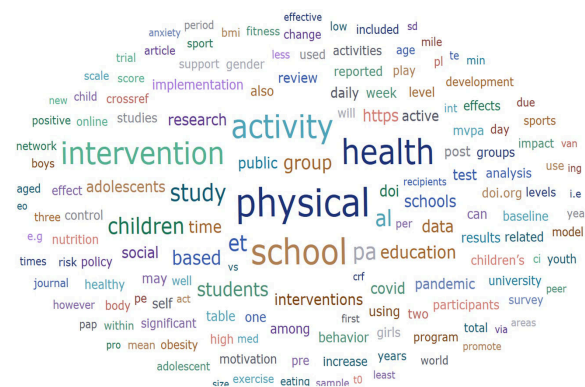


Fig. 2. Text cloud from the 22 articles included in the review

were the highest as per record, followed by Ireland and Italy conducting 2 researches, then single publication for the following nations; Hungary, Indonesia, China, Croatia, Germany, India, Netherland, Portugal, Sweden, Turkey, United Kingdom and Australia.

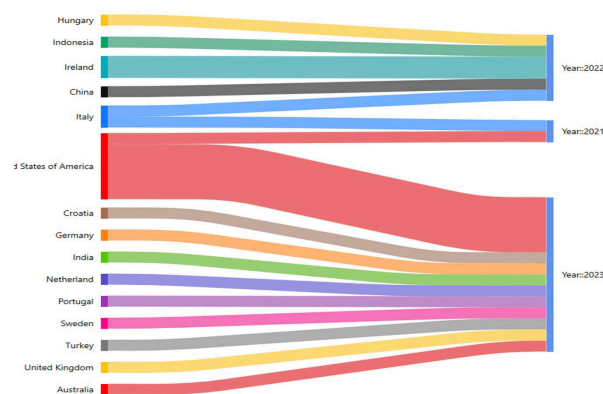


Fig. 3. Publication dispersal by countries conducted during COVID-19 pandemic time (2021-2023)

Practices implemented by schools during COVID-19 time was presented in table 2. Four main themes were generated in this paper through qualitative method. “Needs based intervention” was the most strategy used and evaluated by the researchers (14 times), followed by “alternative physical education” conducted 8 times, then activities that “focus on physical literacy” and web-based intervention being administered 5 and 4 times respectively. It is quite understandable that year 2023 has the most research conducted as schools around the globe during this year was back to its full operations.

Quantitative part of this study also involved the literature inclination to periodical in which it was published (table 3). *Frontiers in Public Health* has the greatest number of papers published within the period coverage having 3 acceptances. Followed by *International Journal of Behavioral Nutrition and Physical activity* and *International Journal of Environmental Research and Public Health* having 2 publications. Remaining periodicals published single literature within COVID-19 pandemic time duration. It was year 2023 that researchers conducted numerous studies regarding intervention using school as venue for change.

Table 3. Numbers of published paper per periodical (2021-2023)

Periodicals	2021	2022	2023	Total
Annals of Applied Science	-	-	1	1
BMC Public Health	-	-	1	1
Children	-	-	1	1
Dialogues in Health	-	-	1	1
Frontiers in Public Health	-	2	1	3
Frontiers in Sports and Active Living	-	-	1	1
Health Education Journal	-	1	-	1
Health Education Research	-	-	1	1
Health Promotion Practice	1	-	-	1
International Journal of Behavioral Nutrition and Physical activity	-	-	2	2
International Journal of Environmental Research and Public Health	-	1	1	2
Journal of Physical Education and Sport	1	-	-	1
Journal of School Nursing	-	-	1	1
Nutrients	-	-	1	1
Physical Education Theory and Methodology	-	1	-	1
Pilot and Feasibility Studies	-	1	-	1
PLoS ONE	-	-	1	1
Public Health and Nutrition	-	-	1	1
Total	2	6	14	22

Qualitative Report

Theme identification was performed through rigorous qualitative investigation. Identifying and sorting of themes, trends and concepts regarding school practices to improve the active lifestyle status of the school students during COVID-19 pandemic time were shown in figure 4. Preliminary coding generates 25 codes. Further evaluation of initial codes was performed, after thorough analysis, codes that links and share similar impression to other codes were merged and rename if necessary. After an in depth analysis of codes, 4 main themes were identified.

What are the concepts and trends about strategies implemented by schools to improve physical activity engagement among students identified from the literature published year 2021 to 2023?

Theme 1: Alternative Physical Education

Alternative Physical education was one of the central themes identified after rigorous analysis as shown in figure 5 depicting theme network and some selected quotation for presentation purpose. Seven literatures conducted and evaluated an approach to improve students' physical activity engagement performed in schools during pandemic (COVID-19) time.

COVID-19 provides major transformation in students daily life. Not only in some countries but across the globe (Marenus et al., 2023). Movement restriction and social

distancing hinders physical activity engagement. Also, school closure contributes to inactivity of children which is considered as a problem (Samsudin et al., 2022). Hence, campaign against sedentary lifestyle of the students was put into consideration by the school upon its resumption. However, due to the changes brought by COVID-19, school curriculum and instruction were affected. Therefore, alternative approaches that is suitable to the needs of current situation was put into consideration.

Several activities and program were conducted by the researcher in coordination of school. Children spends most of their time within the school, therefore it was noteworthy to consider its effectiveness as the venue for intervention regarding sedentary behavior. According to (Ram et al., 2023), curriculum and instruction is a significant factor for intervention as it is designed for students. Physical education subject was one of the key factor researchers are looking into. Thus, to fit into the current global situation, approach was made some modification.

"Physical education on the beach" was one among the alternative approach conducted and evaluated. According to Gallotta et al. (2022) outdoor activities can motivate students to engage in physical activity because "open space" can lessen that possibility of the virus spread during the activity. Similarly, physical activity engagement was evaluated through the concept of "schoolyard". School open space provides increase physical activity among students (Hazlehurst et al., 2023). Furthermore, study about "urban outdoor education" was reported to have significant impact on kids active behavior (Borgogni & Agosti, 2021). Outdoor education provides enjoyment and captures students interest even during COVID-19 pandemic time. Another activity concept that categorizes as alternative physical education was promoting active lifestyle through "real-world" context. However, measure of success of this study was reported to be affected by COVID-19 restrictions. Lastly, "games-based" approach by Murphy et al. (2022) which was alternatively performed during break specifically at lunch which concluded to have positive impact on students well-being.

Alternative physical education as an approach to improve student's active lifestyle was a promising idea. It gains the interest of the children, therefore being motivated to participate. However, crafting and designing of the program or activities must consider all of the factor concerning health and other risk aspect by the participants. Moreso, it was suggested that physical activity must be comprehensive to attain greater result (Gallotta et al., 2022). Sustainability was also emphasize in terms of strategies or intervention to be conducted (Ram et al., 2023).

Theme 2: Physical literacy focus

Physical literacy is a complex foundation of an individual from awareness and understanding to know-how of physical activity engagement as part of life cited by (Gilic et al., 2023). Physical literacy can be the major goal of physical educators and be included in the on the objectives on other health related field. "Physical literacy focus" is one among of the four main themes generated in this review. Five papers included in this study deals with the concept of physical literacy as strategy or intervention for sedentary lifestyle. Figure 6 shows the network of theme 2 identification.

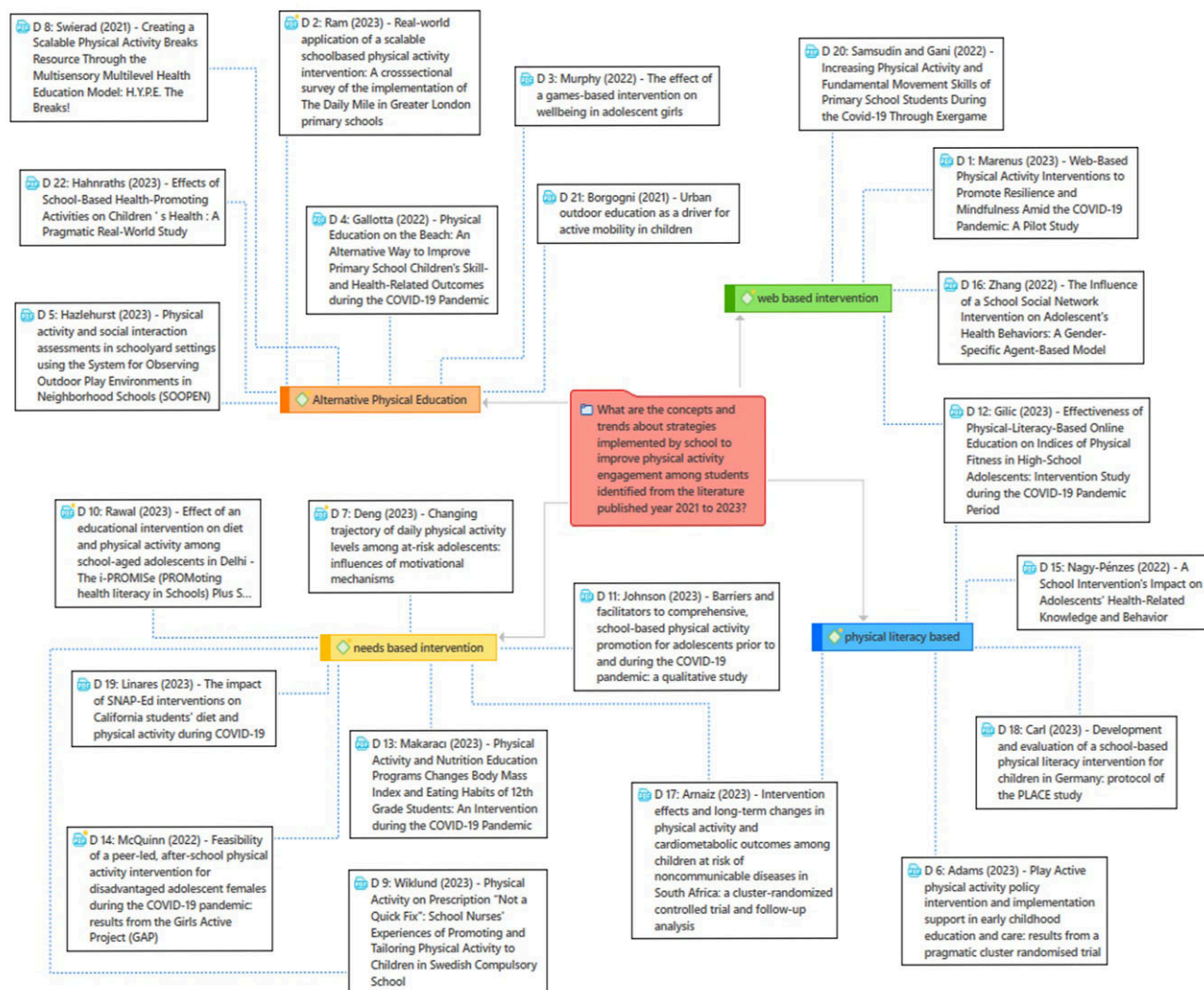


Fig. 4. General network for theme identification within selected literature

This approach is about providing awareness and knowledge about physical activity engagement which aims to provide motivation to the participants as a result. Notable result was reported through this strategy as physical fitness improved among middle school students after a series of imparting knowledge about physical literacy through video (Gilic et al., 2023). However, shows no significant impact on skills development. Similarly, Nagy-Pénzes et al. (2022) focus on the information advancement on active lifestyle and put emphasis on the factor that the intervention approach was part of the school program, resulting into a positive impact as the students made progress on familiarity about health-related perception and attitude. Yet, it was emphasized that awareness must be accompanied by another possible factor to achieve behavioral modification (Nagy-Pénzes et al., 2022).

Disseminating information about physical activity especially during this COVID-19 pandemic era is very important. Full understanding on the its positive impact will help the society to cope up with negative vibes brought by the virus spread. According to Carl et al. (2023), physical literacy is a significant concept to anchor with by intervention

approach for children. Moreso, suggested that respective authorities must design their programs within the physical literacy principle. This was backed up by the study findings that getting support by including the program within the scope of plans and policy was an advantage (Adams et al., 2023).

Theme 3: Web-based intervention

Web based intervention is a method that focus on a technological device and cyberspace as an instrument to implement modification aimed by the activities included in intervention. Four published articles focus on technology as the medium of the change they want to evaluate. Figure 7 shows the thematic analysis network of this theme together with selected quotations for presentation.

Intervention that uses virtual physical activity instruction is among the approach evaluated. According to Marenus et al. (2023) teaching physical activity through cyberspace have positive impact on students overall awareness but not in terms of mental toughness. However, improvement on physical activity engagement was not identify in the study.

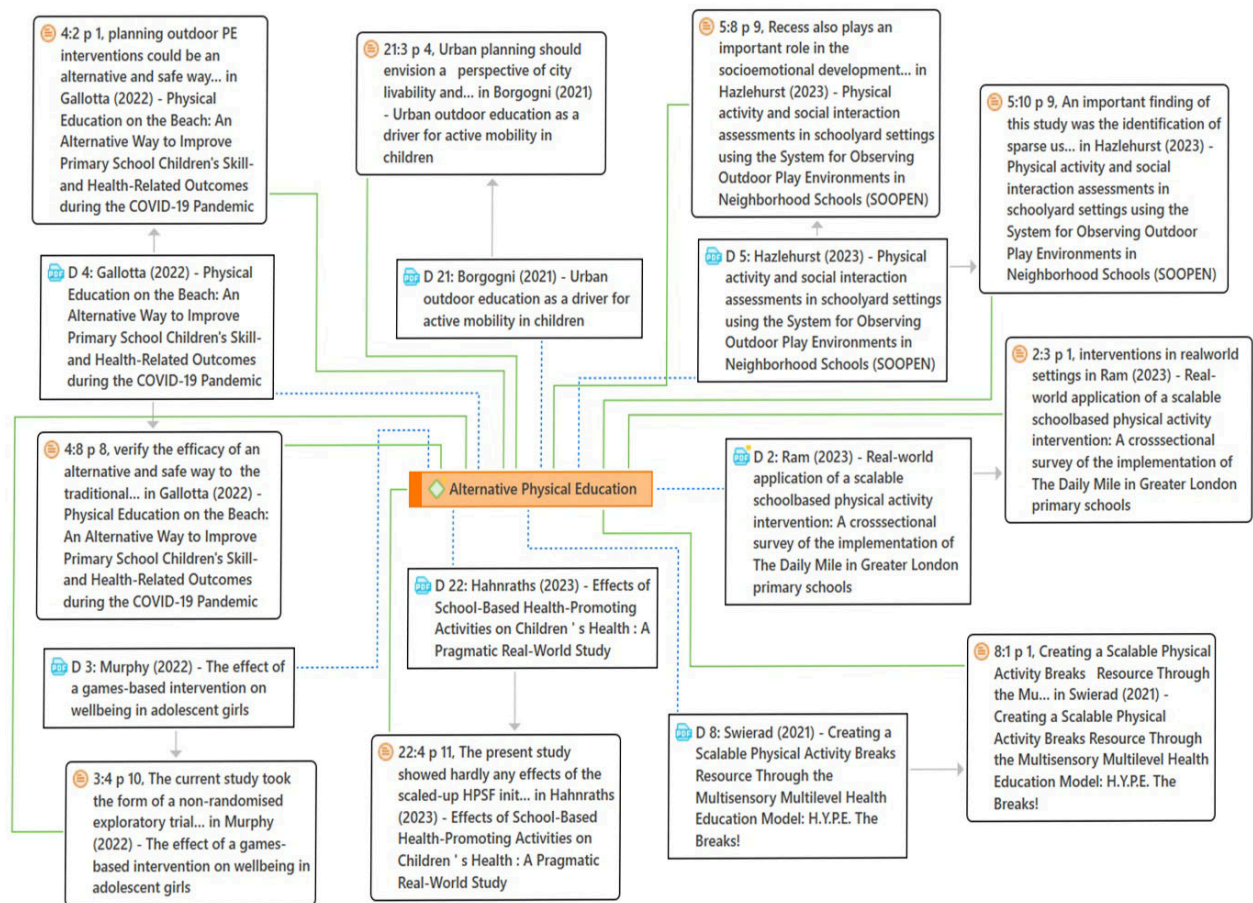


Fig 5. Network of Alternative Physical Education theme

On the study conducted by Gilic et al. (2023) intervention approach was designed video clip presentation and cited improvement on some aspects of physical fitness. Similar approach was used by Zhang et al. (2022) on their study which assess the impact of “social network intervention” on middle school students perception on well-being which concluded that results differ when group by gender. Hence, suggesting to incorporate gender sensitivity to a program when crafting or designing. Another interesting approach included in this theme is the “exergame”. According to Samsudin et al. (2022) this gains the interest of the participants because of the enjoyment associated to it. This web-based approach was concluded to have a positive effect on the fundamental movement skill among students.

COVID-19 provides a lot of change in community lifestyle. Society became cautious in every activity they need to participate. Web-based intervention program seems to be suitable to the needs provided by the current situation. Virtual activities can be done at home, therefore, decreasing the risk associated to COVID-19. Behavioral change can be attained at home through internet based activities (Samsudin et al., 2022).

Theme 4: Needs-based intervention

In depth review analysis generates “needs-based intervention” among of the four main themes (Figure 8). This theme refers to the approach that was specifically

designed to the target population. The intervention considers the characteristics of students that could possibly affect intervention results.

According to Wiklund et al. (2023) accomplishing the intended results for intervention was greater when the activity was specifically created for children perception and behavior. In their study that focus on active play engagement for children, they emphasized the significance of individualization of program. Furthermore, concluding that their approach gains kids interest and must be a long-term process. Some approach included in this theme focused on the dietary and physical activity needs of the participants. Makaracı et al. (2023) concluded in their study that awareness on the positive effect of movement as well as on dietary recommendation is beneficial to students during COVID-19 era. Similarly, Linares et al., (2023) conducted their approach aiming students nutrition and inactivity. Their approach was tailored to the students' attributes regarding nutrition and being active. According to Rawal et al. (2023) school based intervention on students behavior towards food and active play participation resulted significant impact, however, suggesting to have a program that is more inclusive. To be effective, activities included in the program must consider all factors; from strategies to implementers (Johnson et al., 2023).

Needs-based intervention is very important especially when dealing to a participant that is consider as “at risk”. All security measures must be well incorporated to the activities

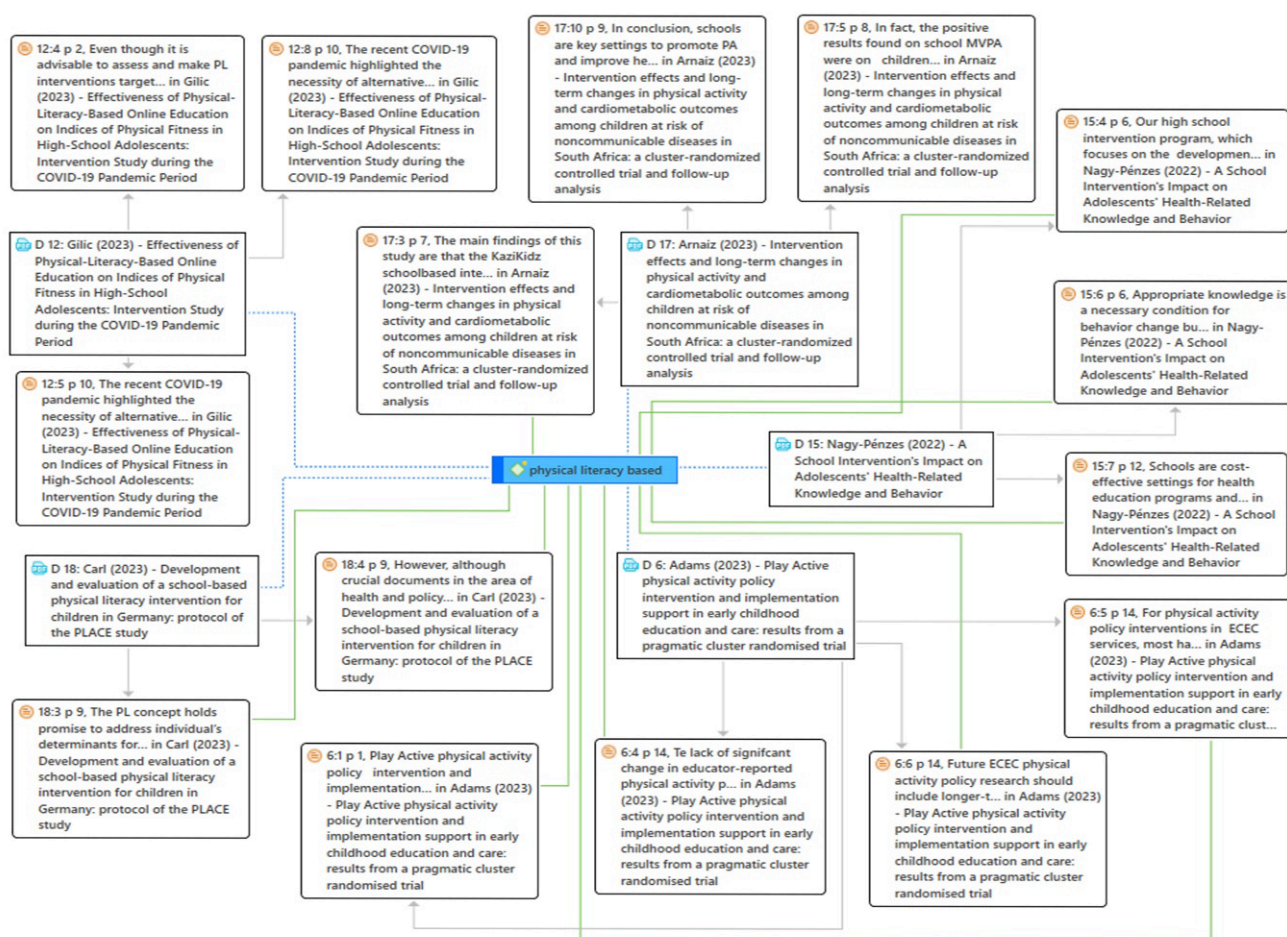


Fig. 6. Network of Physical literacy focus theme

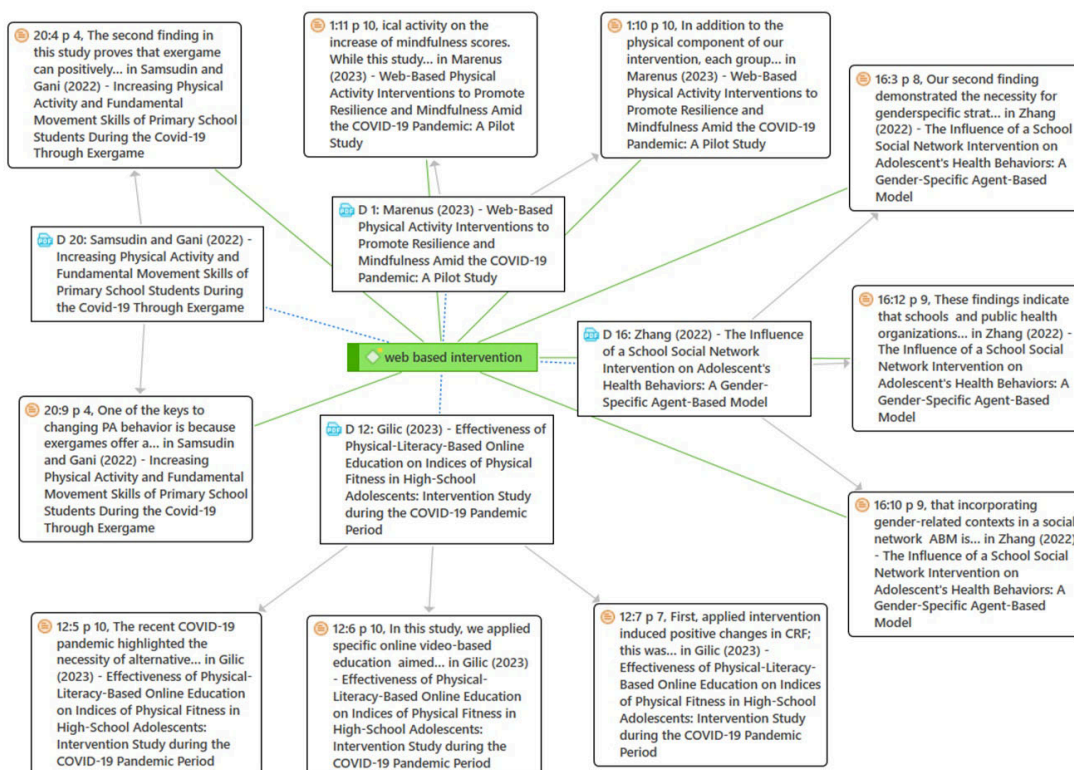


Fig. 7. Network of web-based intervention theme

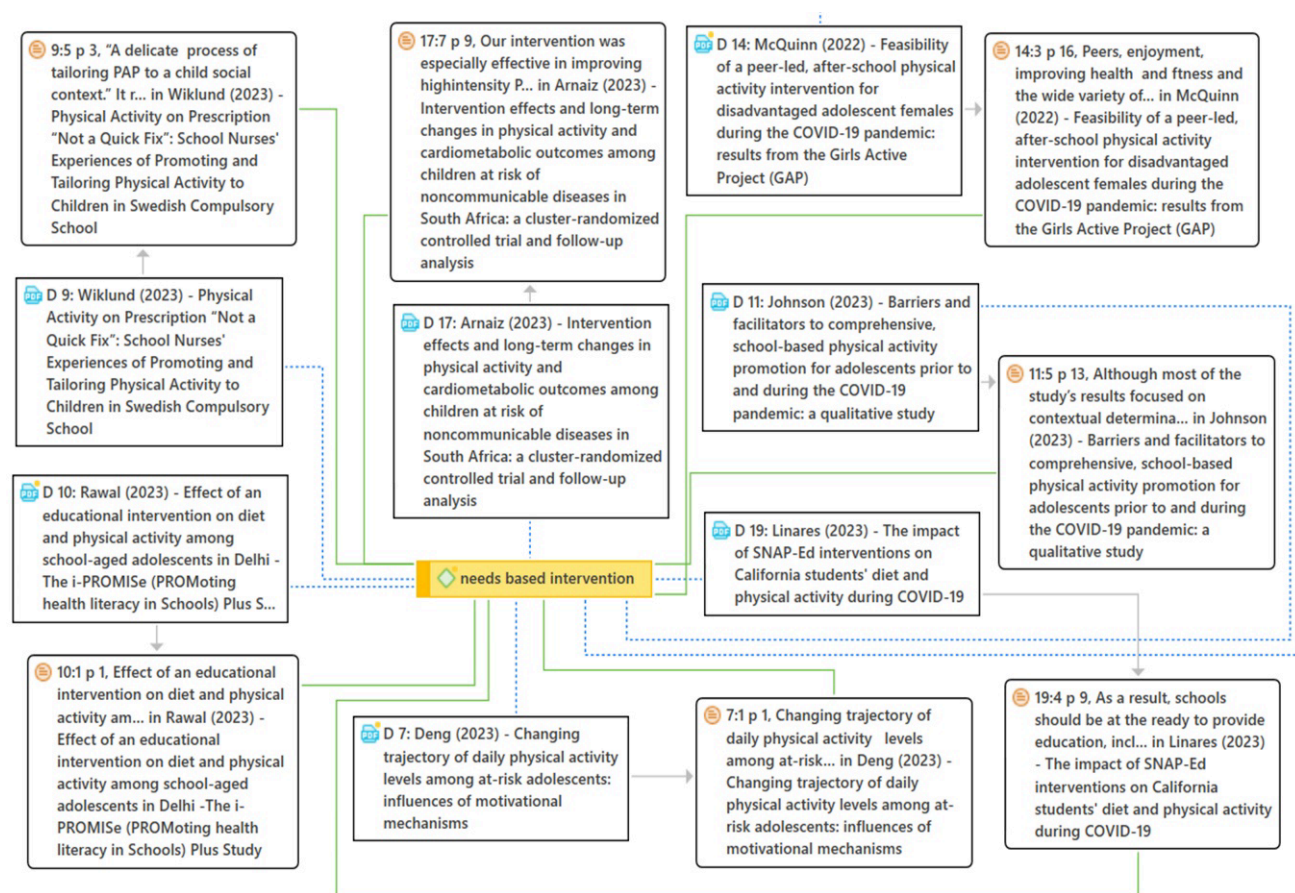


Fig. 8. Network of Needs-based intervention theme

included. Arnaiz et al. (2023) conducted intervention program to students with “cardiometabolic risk”. They concluded that the approach has positive effect on physical activity and “cardiometabolic factor”. In line with needs based intervention, it was suggested that to prevent inactivity and enhance wellbeing, modifications anchored to the target populations need must be emphasized for greater possibility of its success (Arnaiz et al., 2023).

Conclusions and future studies

COVID-19 pandemic draws a lot of changes in the society. Precautionary measures such as movement restriction and social distancing provides lifestyle modification. Sedentary lifestyle among children was one of the adverse effects associated to pandemic'19. School contribution on improving student's lifestyle was stopped because of its temporary closure. Therefore, health practitioners and other allied professionals conducted and evaluated school-based strategies that aim to improve students' physical activity upon its resumption.

Published literatures encompasses several school-based intervention approaches. Strategies were greatly affected by the current health situations. "Alternative Physical Education" was done in open space as part of being cautious. Also, this approach was anchor to the concept of gaining more motivation compare to traditional physical education subject. Generation of "Physical literacy focus" was a significant

concept to consider. This suggests that the approach must tackle the multi dimension foundation in physical activity engagement. Physical literacy awareness must be included in the program objective as well as in policy for its greater result. "Web based" intervention is a timely mode of activity delivery to attain the desired behavioral changes. Safety measures among students are considered because it can be done at home. Moreover, technology is considered as part of daily life for young populations. Another significant theme generation of this study was "needs-based intervention", this focus on the strategy which must be specifically tailored to the target population. Although this requires a lot of work, achieving success was greater in possibility. Future works may deal on the research gap provided and identified by previous literatures and may result for another approach. Inclusions of data base in document gathering to be use as the main source of information in this review was consider as its limitation; upcoming research to a greater extent can consider different archives and data bases.

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Conflict of interest

Authors state no conflict of interest.

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Стратегії шкільної освіти щодо поліпшення залучення учнів до фізичної активності під час пандемії COVID-19: тематичний огляд

Віктор Фелло Піорес^{1ABCDE}, Роксана Дев Омар Дев^{1ACDE}, Мохд Мохар Мухамад^{1ACDE}, Даратун Нісса Бінті Пуад Мохд Карі^{1ACDE}

¹Малайзійський університет Путра

Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 10 с., 3 табл., 8 рис., 24 джерела.

Мета дослідження. Впродовж останнього десятиліття проблема відсутності фізичної активності серед школярів становила значну небезпеку для здоров'я. Ситуація загострилася, коли світ вразила пандемія COVID-19. Обмеження пересування, що призводить до тимчасового закриття шкіл, суттєво впливає на залучення учнів до фізичної активності. Тому стратегії та практики, спрямовані на поліпшення залучення до активної ігрової діяльності, а також на протидію її негативному впливу на здоров'я учнів, були широко впроваджені вчителями та адміністрацією шкіл після їх повторного відкриття. Було опубліковано численні статті про ефективність впровадження інтервенцій на базі шкіл під час пандемії COVID-19, але досі бракує оглядового дослідження, спрямованого на виявлення закономірностей і тенденцій щодо впровадження шкільних практик у цій сфері. Таким чином, цей матеріал має на меті сформувати уявлення та визначити концепції в рамках опублікованих статей протягом 2021-2023 років.

Матеріали та методи. Статті для цього дослідження були відібрані з наступних наукометричних баз даних: SCOPUS, Sage, ProQuest, Academic Search complete, Science Direct. Для забезпечення комплексності цього огляду було застосовано аналіз якісних даних за допомогою комп'ютерних програм (ATLAS ti. 23). Результати дослідження були сформовані та представлені за допомогою кількісної та якісної оцінок.

Результати. У дослідженні було визначено чотири головні теми: 1) Альтернативна фізична культура – модифікація традиційного предмета фізичної культури; 2) Фокус на фізичну грамотність – підхід, заснований на багатовимірній основі залучення до фізичної активності; 3) Веб-орієнтована інтервенція – підхід, заснований на віртуальному та кіберпросторі; 4) Інтервенція, орієнтована на потреби – фокусується на інтеграції характеристик учасників та спеціально розробленій програмі.

Висновки. На структуру стратегій, що реалізуються школами, значною мірою впливає поточний стан здоров'я громади. Результати цього дослідження слугуватимуть орієнтиром для розробки майбутніх інтервенційних підходів до вирішення проблеми малорухливого способу життя молоді, пов'язаного з певними проблемами здоров'я громади та іншими суміжними питаннями.

Ключові слова: школа, інтервенція, фізична активність, ATLAS ti. 23, COVID-19.

Information about the authors:

Piores, Victor Fello: runnersHigh13@yahoo.com; <https://orcid.org/0000-0003-4712-0002>; Department of Sports Studies, Universiti Putra Malaysia, Jalan Universiti 1, 43400 Serdang, Selangor, Malaysia.

Dev, Roxana Dev Omar: rdod@upm.edu.my; <https://orcid.org/0000-0001-8456-5268>; Department of Sports Studies, Universiti Putra Malaysia, Jalan Universiti 1, 43400 Serdang, Selangor, Malaysia.

Muhamad, Mohd Mokhtar: mk_mokhtar@upm.edu.my; <https://orcid.org/0000-0001-5376-6016>; Department of Foundations Education, Universiti Putra Malaysia, Jalan Universiti 1, 43400 Serdang, Selangor, Malaysia.

Puad Mohd Kari, Dharatun Nissa Binti: nissa@upm.edu.my; <https://orcid.org/0000-0002-7187-3146>; Department of Counsellor Education and Counselling Psychology, Universiti Putra Malaysia, Jalan Universiti 1, 43400 Serdang, Selangor, Malaysia.

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