

Chapter

Opportunities for Enhancing Motor Behavior through Physical Education at School

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Abstract

Children's development occurs in socioecological contexts through an evolving process of reciprocal interactions between the child and multidimensional levels of the immediate environments. Inside these contexts, different opportunities for action shape motor behavior, promoting higher levels of motor competence, learning, and physical activity. Although many consider the home as one of the most critical settings for children, it is equally important to highlight the role of school, recess, physical education classes, and extracurricular activities. This chapter aims to provide a comprehensive overview of the scientific evidence concerning factors associated with school-aged children's motor behavior, pointing out the importance of affordances in acquiring new motor skills and enhancing motor competence. Therefore, this chapter provides a more comprehensive view of the relationship between the environment and behavior, which is paramount to improving practice among movement professionals and physical education teachers.

Keywords: children, education, environment, affordances, youth

1. Introduction

Children's development depends not only on their heredity but also on the influence brought about by the socioecological settings in which they are involved. Mutual interactions between developing children and their environments' physical, material, social, emotional, symbolic, and cultural aspects characterize these contexts [1]. As children develop, new environments emerge, from the proximal to the distal ones. Bronfenbrenner [2] identified these settings as "systems," with the microsystem representing the immediate context in which face-to-face interactions occur. Bronfenbrenner [2], also called "mesosystem," is the union of two or more microsystems, representing the relations between the child and their home, school, or sports context place. In addition, the exosystem influences the child through distal contexts that are not directly connected with their microsystem, such as events occurring at their parents' workplace or in their teachers' homes. Bronfenbrenner also defined the macrosystem as the cultural institutions that serve as molar archetypes of day-to-day

interactions. Finally, the chronosystem encompasses all changes that occur in children's lives over the years.

This perspective hypothesizes that the role of the central nervous system in perceiving and organizing actions is significantly reduced compared to traditional cognitive theories [3]. Instead, the developing child perceives the environment's characteristics directly. Therefore, the children can discriminate sufficient characteristics of the environment to delineate their actions without engaging in complex cognitive processes. The interaction of a person (child) and their microsystems was identified as proximal process [4], dependent on the interaction between the children and the environment possibilities. This person-setting relationship was also the focus of Gibson's theory of affordances [5]. According to this theory, all environments provide opportunities for action or an "affordance." Each environment contains objects, places, surfaces, events, and other people that offer different affordances to the developing child. According to Heft [6], the perception of relevant environmental cues guides the child's actions, facilitating the detection of new environmental properties.

The existence of an affordance inside a microsystem does not implicate that the child will always perceive and act upon it. Nevertheless, it is essential to highlight that some microsystems provide richer affordances than others [7], having more significant potential for fostering motor behavior. Furthermore, richer environments can promote physical activity (PA) and healthy behavior [8]. This statement becomes evident when comparing the differences in home environments across different regions (even in the same country) and the discrepancies in educational institutions among private and public schools.

As mentioned earlier, home is the primary microsystem for every person during the early years of life. Still, as the child matures, other contexts, especially the school, become central in their lives. Additionally, many school-aged children also spend their time after school participating in extracurricular activities, inside or outside the school. Thus, these microsystems are fundamental in promoting children's motor competence (MC). Therefore, this chapter aims to provide a big picture of the scientific evidence concerning factors associated with school-aged children's motor behavior, pointing out the importance of the affordances to acquiring new motor skills and developing MC. This chapter also provides a more comprehensive view of the relationship between the environment and behavior, paramount to improving practice among movement professionals and physical education (PE) teachers.

2. School affordances

School attendance is obligatory in most countries, and school is a place where children spend most of their weekdays. In many cultures, schools keep children for up to eight hours a day. During this time, children spend most of their day on inactive tasks and sedentary activities with few opportunities for movement. During these sedentary periods, they primarily sit and attend math, science, or language classes without engaging in PA or other motor tasks. The school has become significantly more inactive, providing fewer opportunities for children to move [9]. Therefore, excessive sedentary time at school is a concern due to its negative potential impact on children's health, well-being, and academic performance. In fact, research shows that moderate-to-vigorous physical activity (MVPA) is associated with cardiorespiratory fitness, and higher levels of fitness can also positively influence academic achievement in children [10].

Several factors may be responsible for this situation, including increased screen time and schoolteachers' extensive use of new sedentary technologies (e.g., smartphones, television, presentations, videos, computers, and streaming). As teachers rely on screens (e.g., computer-based activities), students may be more likely to remain seated and inactive, and this misuse of technology can encourage sedentary behavior among students. Straker and colleagues [11] indicate that classroom environments prioritizing digital learning can lead to prolonged sedentary patterns, reducing movement affordances during school hours. Twenge & Campbell [12] analyzed a national sample of 40,337 children and adolescents in the United States and found a consistent pattern of increased screen time among children and adolescents. This trend aligns with the observation by Ponti et al. [13] that sedentary technology use has grown by 80% during school hours. Tremblay et al. [14] also pointed out that children who engage in high screen-based activities are less likely to meet the recommended PA guidelines. Therefore, while the new educational technologies have benefits, excessive use can contribute to a sedentary lifestyle among all age students. Domingues-Montanari [15] emphasized that integrating digital tools in schools, though beneficial for learning in many aspects, often comes at the cost of reduced PA. Hence, this "new" children's routine is causing changes in their lives, decreasing the number of weekly hours of PA.

To respond to the adverse effects of increased screen time, schools can integrate active learning strategies, such as incorporating active breaks or using technology that encourages PA. Norris and colleagues [16, 17] have suggested that interventions designed to reduce sedentary time and promote active behaviors during the school day can effectively increase overall PA levels in children. In addition, a 5-minute active dance break during class positively affected children's inhibition and enjoyment [18]. Active breaks positively affected school routine, learning environment, and activation of cognitive functions in primary school children [19]. Thus, the active breaks can be adequate for well-being and cognitive functioning, representing an additional dose of PA that can help students meet their daily PA levels.

It is important to emphasize that school is a critical period for developing motor skills and enhancing MC during childhood [20–22]. Flôres et al. [23] highlight that the interaction between their environment shapes children's MC, the opportunities for action, and the feedback and instruction they receive, making the school environment particularly significant. Since the mere presence of affordances within a microsystem does not guarantee that a child will perceive or act on them, teachers and schools must seek new strategies to improve materials and create more opportunities to promote children's movement and PA.

Despite the small amount of time dedicated to free movements and play, the school still contains opportunities for children to engage in movement tasks, increasing their capabilities, especially during PE classes. Therefore, the literature shows that the school period is mainly divided into three contexts: traditional classes, recess, and PE classes.

2.1 Recess at school

Traditionally, outdoor play and other spontaneous PA are fundamental aspects of a child's daily routine, contributing to physical health, social development, cognitive functioning, and emotional well-being. Previous investigations have reported that children spend 30 to 105 minutes during recess every school day [24, 25]. Nevertheless, the shift toward digital entertainment, such as streaming services and video games, has replaced traditional outdoor play, particularly in the context of their

PA levels during school hours. Thus, the growing prevalence of sedentary technologies (e.g., smartphones, tablets, and video games) has significantly reduced these activities at school and home. The decline in PA is particularly concerning nowadays, as research has consistently shown that regular PA is essential for maintaining healthy lifestyles in school-aged children [14, 26].

The reduction in spontaneous PA may delay the development of motor skills and social interactions typically fostered during unstructured play [27]. In addition, this scenario may enhance sedentary behavior among students, which is linked to adverse health outcomes, such as obesity and lower academic performance [28, 29]. Furthermore, the decreased opportunity for social interactions and motor skill development during unstructured playtime at school could have long-term implications for children's social and physical development. Moreover, children with larger play areas at recess performed better in locomotor skills than preschools with smaller play areas [30]. Thus, it is possible to notice that the environmental settings available to play can influence the activity patterns of children in schoolyards [31].

The literature shows that recess can help children develop social skills not acquired in the more structured PE class [32, 33]. Fjørtoft et al. [34] evaluated the use of schoolyard during recess time and how this context affords PA. The authors found that asphalt areas encouraged running and playing soccer. Nevertheless, the limited landscape features constrained the range of activities, leading to a more traditional movement pattern. Conversely, schoolyards with a more diverse surrounding environment, such as those offering the opportunity to play in a forest, were more appealing to female students than to their male counterparts. The relationship between physical environmental features and schoolchildren's participation in daily PA during recess was also investigated [35]. Results showed that schools with more outdoor facilities were likelier to encourage children's movement than those with fewer facilities.

Emphasis on understanding the affordances made available by play materials or equipment during recess during school days is lacking. It is also essential to perceive that some environments, or microsystems, can provide richer motor affordances than others, fostering children's motor behavior and improving PA levels [7, 8]. A literature review reveals that the most used materials were balls, indoor floor play equipment, push-and-pull toys, and balancing surfaces. In contrast, materials, such as indoor structured tracks, merry-go-rounds, tunnels, sandboxes, portable play materials, and swinging equipment, have been observed to be almost absent from these settings [36–38]. Therefore, enhancing the outdoor and recess environments should be considered a crucial strategy in promoting school PA programs. Bronfenbrenner [2] suggests that each microsystem serves as a context for face-to-face interactions—proximal processes that depend on the dynamic interplay between children and their environment. This implies that recess should be considered a crucial setting for promoting motor behavior and PA. To sum up, schoolchildren's level of PA will likely increase if the environment provides opportunities for movement and access to a wide variety of materials.

Nowadays, some schools have prohibited traditional playground games or limited the use of playground equipment due to safety concerns, leading to even more sedentary patterns during recess and lunch breaks [39]. Therefore, it is crucial to implement strategies within schools that promote active play and limit sedentary screen time, thereby ensuring that children continue to engage in activities that support their overall health and development [40]. According to Biddle et al. [27], it is important to promote new school policies and revise practices to encourage children to engage in different PAs during recess. Finally, recess should be understood as a complement

to PE classes, never as a substitution for them [41, 42]. Thus, regardless of the school area, the recess period should be an excellent opportunity to promote children's PA.

2.2 Physical education classes

Investigations have analyzed different aspects of PE classes, including motivational climates, PA levels, lifestyle and well-being, and active time during class [43–47]. Evidence supports a beneficial association between PE classes and children's PA [46, 48], generally indicating that PE classes can decrease adiposity levels in overweight children, decrease blood pressure, and enhance cardiovascular health [48, 49], promoting better levels of MC [50–52]. Nettlefold et al. [48] showed that PE classes significantly increase MVPA levels, which are important for maintaining overall health in this population. In addition, structured PE programs can lead to sustained increases in daily PA, both during and after school hours [45]. Lourenço et al. [47] explored the differences between PE structure and the influence of polythematic (those with more than one sport) and monothematic classes (only one sport during class). Results showed that polythematic PE classes promoted more MVPA compared to monothematic classes. Children during monothematic classes spent much time in sedentary to light PA intensity, which is considered insufficient for PA health benefits. These results can also be understood through Gibson's theory of affordances [53, 54], in which more action opportunities promote more interaction and proximal processes [55, 56], improving PA and motor behavior.

Despite that, different investigations have reported that children fail to engage in sufficient PA levels [57–61], making the PE classes one of the few moments of the day when children can engage in motor tasks and play. Thus, in the following pages, some of the current concerns about PE classes will be presented:

2.2.1 Low levels of PA

Although people widely recognize the potential benefits of PE classes, research indicates that many children do not achieve the recommended levels of PA during these classes. For instance, investigations in Canada have noticed that a deficient percentage of children met recommendations for PA during school PE classes [14, 48, 62]. In fact, only 9–16% of their school time is spent in MVPA. Similarly, in Portugal, only 30.2% of adolescents aged 13 to 18 years meet the PA recommendations of the World Health Organization (WHO) [59]. Despite mandatory PE curricula, many Portuguese school-aged children remain insufficiently active and physically unfit.

This issue is not unique to Portugal or Canada; the situation appears similar globally. In the United Kingdom, research has shown that 62 to 70% of school time is spent on sedentary activities [63]. In addition, 90% of girls and 77% of boys have not met the daily recommended amount of MVPA [64]. A global investigation comprising 65 countries compared children who participated in PE classes with those who did not engage in any PE classes [65]. Results showed that children who attended PE classes on three or more days had two times more chances of being sufficiently active. Furthermore, students who attended PE classes 1–2 times per week were 26% more likely to be active. The findings also demonstrated that boys had a 30% higher likelihood of meeting the recommended PA levels, whereas girls only had 15%. The Association for Physical Education suggests that students spend at least 50% of the total PE class time in MVPA. Therefore, it is possible to notice that the time for PE classes is decreasing worldwide [66, 67].

As suggested in the literature, implementing new strategies that promote higher participation of the children in PE classes and improving PA can positively influence cardiorespiratory fitness levels and student academic achievement [10, 68]. According to Lopes et al. [69], discouraging sedentary behavior among children at school can improve their levels of MC. Therefore, general literature findings have suggested that PE participation can improve PA levels. Hence, schools must provide quality PE classes to improve PA among children and adolescents.

2.2.2 Affordable places at school

Schools provide a fundamental environment in the lives of children and adolescents, and it is imperative to understand better how their settings shape student behavior [70, 71]. In this sense, using Bioecological models to understand motor behavior and PA can distinguish the multiple levels of influence on children's behaviors, including biological, cultural, physical environment, and policies [70].

The challenges associated with limited affordable facilities at school represent a substantial obstacle to children moving, playing, and improving PA levels. This is particularly relevant in school settings, where PA opportunities are paramount for students' health and well-being. Schools play a critical role in providing spaces for children to be active; however, many schools face challenges in maintaining and developing adequate facilities for PA, such as gyms, sports fields, and playgrounds [72].

Knuth et al. [73] aimed to analyze public and private schools in South Brazil according to the availability of PE classes, breaks, extracurricular activities, and physical spaces. Results showed that only 10.1% of the schools, particularly private ones (40%), had a gym. Additionally, private schools more consistently offered higher availability and quality of outdoor courts and green areas compared to public schools. Their findings also showed low coverage of PE classes in the first grades and insufficient availability and quality of physical structures in the public schools. Silva et al. [74] identified patterns of school environment and association with PA in different domains. Results indicated that sports courts, materials, and a track and pool improved PE participation among Brazilian students. Another report from Brazil [75] showed that in public schools, the facilities for PA were generally of moderate to poor quality, with playing environments being moderately adequate, while sports facilities, individual courts, and multisports courts often lacked functionality or were in poor condition.

On the other hand, private schools provided facilities of much higher quality, displaying excellent play areas, sports facilities, and courts. Additionally, private schools offered significantly greater PA equipment than public schools, showing better access to playgrounds and table tennis areas. Private schools demonstrated a clear advantage in PA environments' quantity and quality. When public schools lack these facilities, opportunities for PA and learning during and after school are significantly reduced. In addition, children who attend schools without adequate physical spaces are less likely to engage in PA during and after school hours. This decrease in activity is linked to higher rates of obesity and other health issues among these students, particularly in underserved communities where alternative recreational options are scarce [76].

Another problem is the introduction of new school safety policies, often in response to concerns about injuries and liability, can unconsciously limit opportunities for PA [77]. As the author pointed out, no remaining green spaces exist with trees, trunks, grass, or earth. Instead, the environment comprises cement and stone "in the name of child safety." This scenario restricts certain types of PA, such as running,

practicing sports, or free play, and can reduce overall PA levels among students. Ridgers et al. [78] have suggested that excessively structured environments may reduce children's natural inclination to engage in physical play, reducing the overall time spent in MVPA during school. While reducing risks, this structured environment also decreases the opportunities for children to be active, leading to higher rates of sedentary behavior and associated health problems.

While safety should be a legitimate concern, restrictive policies can lead to a school environment where children are less likely to engage in MVPA. Schools with severe supervision policies often see lower levels of spontaneous PA, as children may feel inhibited or less motivated to play freely, enhancing sedentary behaviors. While safer, this structured environment can reduce the number of MVPA children engage in during the school day.

2.2.3 PE structure

The lack of PE teachers, or classes taught by regular teachers from other disciplines, especially in the early years of school, instead of PE specialists, contributes to this unsuccessful scenario. Specialist PE teachers possess specific pedagogical skills that enable them to deliver high-quality PE classes. School-based PE program taught by specialist teachers was more effective at increasing the time students spent in MVPA compared to the same program taught by generalist teachers [79–81]. PE specialists create appropriate lessons that provide to the diverse needs of students, including those with lower levels of physical fitness [79]. Students taught by specialist PE teachers show more significant improvements in fundamental motor skills, such as running, jumping, and throwing [82, 83]. These skills are essential for children's overall development and their ability to participate in various PAs throughout their lifespan. The literature also showed that students' motor capabilities, such as reaction time, can be enhanced when taught by PE specialists compared to regular teachers [84].

On the contrary, regular teachers may lack the expertise to modify activities or provide effective instructions and feedback that keeps all students active and motivated. In addition, generalist teachers often lack the training and confidence to deliver practical PE classes, and many feel inadequately prepared to teach PE, resulting in less structured and lower-quality lessons. This lack of preparation can lead to lower student engagement, fewer opportunities for MVPA, and a reduced emphasis on the importance of PA. Finally, without specialized training, generalist teachers may prioritize other aspects of PE, such as health education or game strategies, over actual PA. Therefore, when generalist teachers take on PE responsibilities, there is often a reduction in the amount of time spent on physical activities during class [85, 86]. This shift in focus can lead to fewer health benefits for students, as it falls short of the primary goal of increasing PA levels.

Another critical factor is the class size during PE classes. Compared to educational establishments with a high student-to-teacher ratio, those with a lower ratio can optimize the time each student participates in PE classes while maintaining class sizes that ensure the safety, learning, and PA levels [87]. Also, in smaller PE classes, students can spend a more significant proportion of class time engaged in MVPA. Smaller classes allow for more individualized attention, fewer distractions, and less time spent on classroom management, all of which contribute to more efficient use of class time [88]. In smaller PE classes, teachers have more opportunities to perceive each student closely and provide feedback, which is crucial for skill development [89].

Smaller class sizes allow teachers to give more individualized feedback, which can significantly improve students' motor skills and overall physical performance [90].

The literature has still not agreed on the ideal number of students during PE classes. However, evidence suggests that a smaller number of students in PE classes can improve PA, more on-task levels, and fewer management issues [88, 91]. Therefore, a small number of students in PE classes permitted personalizing the teacher-student relationship, allowing the teachers' efforts to be less mitigated among students, thereby improving the teaching-learning process.

3. Challenges and future directions in school environments: A bioecological perspective

In this chapter, we adopted Bronfenbrenner and Gibson's theories to understand some of the most critical microsystems and the affordances within them that influence children. This approach highlights schools' fundamental role in shaping children's motor behavior and PA levels.

Schools are environments where children spend a significant portion of their day, making them a central setting for interventions to improve MC, PA, health, and motor skills. However, the chapter identifies several challenges that underscore the need for schools to actively promote PA and create environments rich in affordances that encourage movement and play. One of the key points discussed is the impact of the school's physical environment and the materials used in PE classes. General results support Bronfenbrenner and Gibson's theories, which indicate that better physical settings and quality of the materials are associated with PE participation, especially in private schools [73–75]. The differences between institutions, especially in those with poor availability of affordable care, can have long-term consequences on children's physical and social development, as children in environments with fewer affordances are less likely to engage in activities to promote MC and PA.

This chapter also raises concerns about PE classes. Research has shown that the quality and effectiveness of these classes are paramount to improving MC, motor skills, and PA levels [79, 84]. PE classes taught by specialist teachers are more effective at increasing MVPA than the ones taught by generalist teachers. In addition, specialists can design lessons with more affordances, diversified, and more suitable to students' needs [79]. Moreover, the literature also showed that PE specialists help students improve a comprehensive set of motor skills [82, 83]. Therefore, the evidence suggests that PE specialists can create engaging and practical lessons that provide for the diverse needs of students, leading to higher levels of engagement and skill acquisition. Thus, this finding emphasizes the importance of giving adequate schoolteacher training and ensuring that PE classes should be prioritized in school curricula.

The increasing prevalence of sedentary technologies and restrictive school policies has significantly reduced opportunities for movement inside the schools. This scenario decreases children's opportunities to engage in social interactions, play, and have fun, especially during recess. The unstructured playtime at school, which provides free movement, discovery, and exploration of the context, could have long-term implications for children's social and physical development [7, 55, 77]. Literature also showed that larger playing areas to explore during recess help children and promote locomotor skills [30], influencing their play patterns [31]. Therefore, safety needs to be carefully addressed without compromising children's access to active play,

especially during recess at school. Hence, schools should rethink safety policies to prevent inadvertently discouraging movement and play.

Finally, the chapter emphasized the need for schools to adopt a Bioecological approach to promoting PA and MC among students. This approach should include improving the physical environment and the quality of PE classes and implementing policies that reduce sedentary behavior and encourage active lifestyles. Schools should be viewed as one of the most significant microsystems in children's lives, so efforts to combat childhood obesity and inactivity must be one of their main goals. Schools can play a critical role in fostering healthy habits that children will carry into adulthood by creating environments that support movement and PA.

4. Conclusion

This chapter has highlighted the critical role of schools in shaping children's motor behavior, PA, and overall development. Grounded in Bronfenbrenner and Gibson's theories, it underscores the importance of school environments as primary microsystems that offer affordances for movement and motor skill development.

However, the findings reveal several challenges that schools face in effectively fulfilling this role, including the quality of PE classes, the availability of suitable materials, and the structure of the school day, particularly recess. Today, addressing the urgent need for movement among children has become increasingly important.

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