European Journal of Physical Education and Sport Science
ISSN: 2501 - 1235
ISSN-L: 2501 - 1235
Available on-line at: www.oapub.org/edu

DOI: 10.46827/ejpe.v12i8.6127 Volume 12 | Issue 8 | 2025

THEORETICAL INSIGHTS INTO THE COVID-19 EFFECTS ON CHILDREN'S MOTOR SKILLS AND SCHOOL-BASED PHYSICAL EDUCATION

Sabina Maria Greceanu[i],
Monica Iulia Stănescu
National University of Physical Education and Sport,
Bucharest, Romania

Abstract:
The COVID-19 pandemic caused a profound disruption of global educational systems, with significant consequences on students' motor development and the structure of physical education lessons. The suspension of in-person classes, restricted access to sports activities, and the abrupt shift to online learning led to a dramatic decrease in physical activity levels among middle school students. This theoretical article analyzes, based on specialized literature, the pandemic's effects on motor parameters such as endurance, strength, and coordination, and emphasizes the need for curricular reorganization adapted to new educational realities. The article discusses the challenges faced by teachers and students in delivering physical education under remote or restricted conditions, as well as the necessary intervention directions for reducing motor development gaps and building a more equitable and functional educational framework.

Keywords: physical education, COVID-19, motor capacity, adapted curriculum, middle school

1. Introduction

1.1 The general context of the pandemic

The outbreak of the COVID-19 pandemic triggered a large-scale global disruption that altered the way societies function, including essential institutions like education. Schools around the world were suddenly shut down, forcing millions of students to shift to online learning almost overnight. Although this transition helped maintain access to theoretical subjects, physical education was among the most affected areas. Due to its reliance on movement, direct interaction, and practical activities, PE struggled to find its place in the

[i] Correspondence: email sabinagreceanu1997@gmail.com

digital learning environment and was often neglected or minimized in remote teaching efforts.

Middle school students, typically aged between 10 and 14, are at a pivotal stage in their physical and neurological development. During this period, they acquire essential motor patterns, refine coordination, and establish long-term movement behaviors. The pandemic interrupted this natural progression. With in-person classes suspended, access to school facilities restricted, and extracurricular sports canceled, these children were deprived of vital physical stimuli. The home environment, for most, could not substitute the diversity, intensity, or structure of physical activity offered through formal schooling and organized sports.

Furthermore, the pandemic amplified pre-existing inequalities in education. Students from socioeconomically disadvantaged backgrounds, rural areas, or vulnerable communities experienced more severe learning losses, including in physical development. These children often lacked safe outdoor spaces, digital devices, or parental support to engage in home-based physical activities. Their counterparts in better-resourced environments, although affected, had greater access to technology, guidance, and movement opportunities, deepening the physical and health gap.

The psychosocial environment during lockdown also contributed to the regression in physical behaviors. Increased screen time, social isolation, emotional stress, and irregular sleep patterns created a lifestyle dominated by sedentarism. According to Dunton *et al.* (2020), children in the U.S. showed a dramatic reduction in moderate-to-vigorous physical activity during the early months of the pandemic, while simultaneously increasing sedentary behaviors. These trends were mirrored globally.

Overall, the general context of the pandemic must be understood not only as a medical emergency but also as a multi-dimensional disruption to child development. Physical education was not immune to these effects; it was, in fact, one of the most compromised subjects, despite its critical importance for long-term health and well-being.

1.2 The need for adaptation in physical education

Faced with the unexpected and prolonged suspension of traditional schooling, educators around the world were compelled to adapt their pedagogical strategies, and physical education teachers were no exception. Yet, unlike other academic disciplines, PE could not be easily transferred to a digital format. The challenge was twofold: maintaining students' physical activity levels in a remote setting and preserving the educational value of movement, which includes skill development, emotional expression, and social bonding.

The first level of adaptation involved rethinking how physical activity could be delivered using technology. Teachers resorted to innovative solutions such as recorded video sessions, interactive online workouts, physical activity journals, and home-based movement challenges. In some cases, synchronous classes on platforms like Zoom were used to simulate group dynamics, while asynchronous tasks allowed for flexibility.

However, the effectiveness of these methods was variable and often dependent on the home environment. A child with limited space, no equipment, and a lack of adult supervision faced major obstacles in performing even basic exercises.

The second level of adaptation involved curricular reorganization. Many PE teachers shifted their focus from competitive sports or performance assessments to general wellness, daily movement, and emotional balance. For example, stretching routines, yoga, breathing exercises, and mindfulness activities became part of the PE curriculum in several countries. This shift reflects a broader understanding of physical education as a component of holistic health, not merely athletic performance.

Varea and González-Calvo (2021) emphasized that this adaptation required a significant mindset change among educators. Teachers had to redefine success not in terms of physical output, but in terms of engagement, well-being, and resilience. Moreover, they had to work without established guidelines, often developing resources from scratch, exchanging best practices informally, and learning to use unfamiliar technologies on the go.

Despite these efforts, many teachers questioned the long-term sustainability of digital PE. Challenges related to student motivation, accountability, equity, and feedback persisted throughout the lockdown. Nonetheless, the process of adaptation opened a door to rethinking PE for the future. It demonstrated that physical education could, and should, evolve beyond its traditional models to integrate hybrid methods, individualized learning, and broader definitions of movement competence.

2. Motor development in the pandemic context

2.1 Effects on basic motor parameters

Motor development is a cumulative, progressive process that depends on the frequency, intensity, and diversity of physical stimuli. Children in the 10–14 age group are particularly sensitive to changes in movement habits, as this period marks a critical stage in the maturation of neuromuscular coordination and cardiovascular endurance.

During the pandemic, the closure of gyms, sports fields, and playgrounds interrupted regular physical activity across all demographics. But school-age children, especially those in middle school, were among the most affected, due to their dependence on school-based physical education as a primary source of structured movement.

Empirical evidence confirms a decline in motor parameters. Jurak *et al.* (2021) observed a drop in VO_2max estimates of 10–15% among adolescents who missed in-person PE classes during lockdowns. Similarly, agility and explosive strength, as measured through shuttle runs and standing long jumps, registered regressions in multiple European studies (Tomkinson & Olds, 2021). Children reported reduced motivation, muscle stiffness, slower reaction time, and lower general energy levels upon returning to physical activity.

In addition to reduced motor capacity, teachers noted postural problems and imbalances. Sedentary behaviors, including prolonged screen use, poor ergonomic

setups at home, and reduced muscular activation, contributed to forward-head posture, lumbar discomfort, and impaired coordination. These biomechanical consequences point to a deep disruption in neuromotor functioning, which cannot be reversed by simply resuming PE classes without a deliberate reconditioning phase.

2.2 Long-term consequences

While the immediate effects of inactivity were observable and measurable, the pandemic's long-term consequences on motor development are still unfolding. Movement habits formed (or neglected) during adolescence often extend into adulthood. A prolonged disruption in physical routines may result in enduring patterns of sedentary behavior, physical avoidance, and devaluation of body movement.

One of the most concerning effects is the risk of disengagement from physical activity altogether. As Howley (2021) emphasized, students who were not consistently engaged in online PE began to associate physical activity with obligation or monotony, rather than pleasure or play. This shift in perception is difficult to reverse and can diminish intrinsic motivation for sports participation later in life.

Furthermore, children who gained excessive weight during lockdowns often encountered physical and emotional barriers to returning to movement, such as peer judgment, low self-esteem, or difficulty performing basic exercises. In longitudinal research from Italy, Pietrobelli *et al.* (2020) observed an increase in caloric intake and a decline in physical activity among children with pre-existing weight issues, leading to a worsened metabolic profile within just three months.

Beyond physical implications, the learning loss in motor competence poses significant developmental risks. Children who missed critical instruction in posture, balance, spatial orientation, or object control may fall behind their peers for years without structured support. Bailey *et al.* (2022) argue that delays in physical literacy, just like in reading or math, are harder to remediate as children grow older, making early intervention crucial.

Moreover, recent research by Tambalis *et al.* (2021) suggests that the reduction in organized sports participation during COVID-19 has led to a measurable decline in children's fundamental movement skills, particularly in agility, balance, and object manipulation. These foundational skills are strongly correlated with lifelong physical activity engagement, suggesting that pandemic-induced setbacks could translate into reduced activity levels even in adulthood.

Finally, the developmental disruptions induced by the pandemic cannot be viewed in isolation from emotional and cognitive health. Children who moved less also experienced increased stress, social isolation, and screen fatigue, creating a multidimensional context of vulnerability that will require an integrated pedagogical response.

3. Curricular adaptations in school physical education

3.1 Changes in teaching methods

The COVID-19 pandemic forced educators to reimagine not only *how* they taught, but *what* they taught. Physical education, traditionally delivered in group settings and grounded in direct observation and real-time feedback, had to be transferred into remote, asynchronous environments. This shift catalyzed a redefinition of the PE curriculum — one that emphasized adaptability, creativity, and holistic well-being over performance metrics.

Teachers across Europe and North America responded with varied strategies: movement logs, video-based instructions, household item workouts, and weekly fitness challenges. In countries such as Canada and Finland, educators were encouraged to prioritize "*movement minutes*" over motor skill development (Bailey *et al.*, 2022). The focus shifted from outcomes (speed, strength, flexibility) to process-oriented objectives such as body awareness, effort regulation, and enjoyment.

However, this pedagogical innovation came with trade-offs. The lack of direct supervision limited the teachers' ability to correct execution errors or adapt tasks to individual students' abilities. In schools where digital engagement was low, entire weeks of content were delivered passively or skipped altogether. Students often faced difficulties understanding instructions, maintaining discipline, or even finding the motivation to complete tasks in solitude.

In Romania, anecdotal evidence shows that many schools adopted minimal PE curricula during lockdown, with teachers either posting weekly tasks on e-learning platforms or assigning generic fitness routines. This approach, while better than inactivity, did not fully address the broader goals of physical education, such as motor learning, social interaction, or emotional resilience through movement.

3.2 The role of technology in online lessons

Technology became both a bridge and a barrier in pandemic-era physical education. On one hand, platforms such as Google Classroom, Zoom, WhatsApp, and educational YouTube channels allowed teachers to maintain a line of communication and continue some form of instruction. On the other hand, the overreliance on digital platforms, without equitable access or pedagogical training, created deep disparities in learning outcomes.

In well-resourced contexts, teachers recorded custom video sessions, hosted live online classes, and used fitness apps to track student activity. Some even gamified PE by organizing weekly leaderboards or team challenges. In contrast, under-resourced areas were plagued by insufficient internet connectivity, shared devices among siblings, and parents unable to support children's engagement in home-based movement routines.

Roth *et al.* (2021) observed that even when technological tools were available, many PE teachers lacked the training to use them effectively. Physical education, unlike other academic subjects, has traditionally resisted digitalization. The pandemic forced an

abrupt learning curve, with many educators needing to master video editing, online evaluation tools, and digital pedagogical planning in a matter of weeks.

This experience, while difficult, has created a foundation for future hybrid models of physical education that combine in-person movement with digital support, such as video libraries for at-home reinforcement, wearable fitness monitors, and peer-shared content.

4. Pedagogical challenges and opportunities in post-pandemic physical education

4.1 Obstacles encountered by teachers

When students returned to physical schools, educators were met with a host of complex challenges. Teachers were expected to rapidly assess students' physical regressions, design recovery-focused lesson plans, and simultaneously rebuild motivation, group cohesion, and class discipline.

The absence of institutional guidance further complicated matters. Many ministries of education failed to offer structured frameworks for post-pandemic physical recovery, leaving teachers to operate on instinct and personal judgment. PE sessions became either too general (in an attempt to reach all students) or too demanding (in an effort to recover progress quickly), creating inconsistencies in practice.

Another challenge was emotional exhaustion. Teachers themselves were affected by the pandemic, dealing with stress, burnout, and uncertainty. Rebuilding a motivating learning climate required emotional intelligence, patience, and continuous adaptation. According to Howley (2021), the emotional load carried by PE teachers post-lockdown was among the highest in the school workforce, due to the pressure of maintaining both physical safety and engagement.

Moreover, a new challenge emerged regarding re-socialization. After months of isolation, students returned with diminished cooperation skills, lower tolerance for frustration, and difficulty managing group dynamics. As noted by Harris and Sandford (2022), many teachers reported an increase in behavioral issues, especially in cooperative games or team-based tasks. Students needed time not just to recover motor skills, but also to relearn how to interact, share, and support each other in physical settings. This placed an additional burden on teachers, who had to become not only physical educators but also mediators of social reintegration.

Social distancing measures remained in place in some schools even after reopening, prohibiting direct contact, equipment sharing, or indoor activity. This severely limited the variety of games and sports that could be taught. Teachers had to redesign their annual plans, eliminate partner-based exercises, and invent alternative activities that conformed to health regulations.

4.2 Student adaptability and emerging solutions

Despite these limitations, many students exhibited resilience and adaptability. Those who had engaged in independent movement during lockdown- be it through dance,

online workouts, or family walks- returned with a surprising capacity for self-regulation. Teachers observed improved initiative and creativity among students when given open-ended tasks or autonomy.

In addition, student-led movement challenges, such as step-count contests or freestyle routines, fostered renewed interest and peer bonding. The rediscovery of outdoor environments- parks, schoolyards, forest trails- as legitimate PE spaces was another positive outcome. These environments not only respected health guidelines but also allowed for a more relaxed, less performance-driven experience.

In countries like Slovenia, movement became a national priority. Jurak *et al.* (2021) describe how educators were trained in "*motor rehabilitation pedagogy*," integrating kinesiology principles into lesson design to safely rebuild endurance, mobility, and flexibility in students.

The pandemic also encouraged teachers to adopt a more holistic, student-centered pedagogy. Many began integrating short mindfulness sessions, breathing techniques, or stress-relief stretches into their classes, creating a more integrated form of physical education that addressed body, mind, and social-emotional learning simultaneously.

5. Directions for intervention and good practices in post-pandemic physical education

5.1 Motor recovery programs

The recovery of motor performance post-pandemic cannot rely solely on increased activity volume. Instead, it must be guided by structured, evidence-based intervention programs tailored to each age group's developmental stage. These programs should start with diagnostic assessments to determine individual regressions, followed by progressive conditioning phases.

Key components of effective motor recovery include:

- Dynamic mobility routines to reestablish joint range and muscle activation.
- Low-impact aerobic activities to gradually improve endurance without overloading the cardiovascular system.
- Play-based strength activities that use bodyweight and light resistance.
- Coordination drills focused on spatial awareness, bilateral integration, and reaction time.

Programs must also consider the psychological readiness of students to reengage in group activities. Inclusivity, emotional support, and positive reinforcement must be prioritized to counteract the fear of failure or social judgment.

Collaboration with physiotherapists, school psychologists, and family members can enhance the impact of such programs. Integrated support teams ensure that students who present with compounded issues (motor, emotional, cognitive) receive comprehensive care.

5.2 Successful examples from practice

Several national and local initiatives offer successful models for post-pandemic PE recovery. In Germany, mobile PE vans provided open-air instruction in underserved neighborhoods, often accompanied by music and games to foster engagement (Roth *et al.*, 2021). In Japan, schools implemented 15-minute morning exercise sessions for all students, which proved to increase attention span and classroom performance.

In Romania, some schools began collaborating with local sports clubs to offer after-school programs focused on motor reeducation. Although still in a pilot phase, these initiatives show promise in blending formal and informal learning environments.

Internationally, the concept of "movement-friendly schools" has gained traction. These institutions redesign their schedules and spaces to integrate physical activity throughout the day, not only during PE classes. Recess, hallway transitions, and even classroom lessons incorporate elements of movement, thereby normalizing activity and reducing sedentary time.

These practices point toward a new paradigm in physical education- one where movement is not confined to the gym, but integrated across all aspects of school life. This transformation, catalyzed by the disruptions of COVID-19, holds the potential to elevate PE to a foundational pillar of modern education.

6. Conclusions

The COVID-19 pandemic served as both a stress test and a catalyst for transformation in the domain of school-based physical education. The prolonged closure of educational institutions, coupled with restrictions on sports and recreational activities, led to a significant regression in students' physical fitness, motor skills, and movement habits. For middle school children, a population undergoing crucial neuromotor and psychological development, the sudden removal of structured physical activity from daily routines resulted in measurable declines in aerobic endurance, strength, coordination, and postural integrity.

Educators responded with commendable effort, creativity, and dedication. They transitioned to online platforms, invented new methods of instruction, and made movement possible even within the limitations of students' home environments. However, the quality of physical education during the pandemic was heavily dependent on access to technology, parental support, and students' home conditions. This contributed to significant disparities in motor development outcomes, disproportionately affecting students from rural, low-income, or otherwise disadvantaged backgrounds.

In the post-pandemic phase, the challenges faced by teachers were no less complex. Reintegrating students into physically demanding routines revealed new layers of difficulty: loss of motivation, psychological resistance, uneven progress, and institutional ambiguity. Nevertheless, this period also opened a space for rethinking PE-

not as a static, gym-based subject focused on performance metrics, but as a dynamic, integrative domain that contributes to the holistic development of children.

The most valuable lesson of the pandemic is the recognition that physical education cannot return to its pre-pandemic status quo. The forced digitalization of PE, while limited in effectiveness, exposed the untapped potential of hybrid instruction, flexible learning, and student autonomy. Outdoor education, gamified challenges, community collaborations, and intersectoral partnerships emerged as viable pathways toward more resilient and inclusive physical education systems.

Looking ahead, educational stakeholders must capitalize on this momentum to reform PE curricula with three priorities in mind: recovery, innovation, and equity. Recovery programs must be science-based, adaptable, and inclusive, ensuring that all students, regardless of background, regain their physical competence and confidence. Innovation must involve blending traditional instruction with technology and informal movement, expanding the reach and relevance of PE. Equity must remain a guiding principle - not only in access to movement opportunities but also in representation, cultural relevance, and emotional safety.

The consequences of the pandemic, while disruptive, have created an unprecedented opportunity to reframe physical education as a key contributor to public health, academic success, and personal development. A reimagined PE, rooted in inclusivity, joy, and lifelong movement, may yet become one of the most lasting positive legacies of an otherwise difficult historical moment.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Author(s)

Greceanu Sabina Maria, PhD Student, National University of Physical Education and Sport, Bucharest, Romania.
Stănescu Monica Iulia, University Professor, National University of Physical Education and Sport, Bucharest, Romania.

References

Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R., & Penney, D. (2022). Reframing Physical Education in the Post-COVID Era. *European Physical Education Review, 28*(1), 3–18.

Dunton, G. F., Do, B., & Wang, S. D. (2020). Early Effects of the COVID-19 Pandemic on Physical Activity and Sedentary Behavior in Children Living in the U.S. *BMC Public Health, 20*(1), 1351. https://doi.org/10.1186/s12889-020-09429-3

Harris, J., & Sandford, R. (2022). The COVID-19 pandemic and physical education: The impact on teachers and implications for future practice. *European Journal of Physical Education and Sport Science, 8*(1), 14–29. https://doi.org/10.46827/ejpe.v8i1.4127

Howley, D. (2021). Challenges for Physical Education Teachers Teaching Online During COVID-19. *Journal of Teaching in Physical Education, 41*(1), 42–50. https://doi.org/10.1123/jtpe.2020-0172

Jurak, G., Morrison, S. A., Leskošek, B., Kovac, M., Hadžić, V., Vuković, R., & Starc, G. (2021). Physical Activity During the COVID-19 Pandemic in Adolescents from Central and Eastern Europe. *International Journal of Environmental Research and Public Health, 18*(4), 2146.

Pietrobelli, A., Pecoraro, L., Ferruzzi, A., Heo, M., Faith, M., Zoller, T., Antoniazzi, F., Piacentini, G., Fearnbach, N., & Heymsfield, S. (2020). *Effects of COVID-19 Lockdown on Lifestyle Behaviors in Children with Obesity Living in Verona, Italy: A Longitudinal Study*. Obesity, 28(8), 1382–1385. https://doi.org/10.1002/oby.22861

Roth, A., Köhler, M., & Gieß-Stüber, P. (2021). Physical Education Outdoors: A Response Model from Germany in the Face of the COVID-19 Pandemic. *Sustainability, 13*(13), http://dx.doi.org/10.5960/dzsm.2022.537.

Tambalis, K. D., Panagiotakos, D. B., Psarra, G., & Sidossis, L. S. (2021). Physical fitness and its associations with academic performance and school behavior among primary school children in Greece during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health, 18*(9), 4930. https://doi.org/10.3390/ijerph18094930

Tomkinson, G. R., & Olds, T. S. (2021). Secular Changes in the Physical Fitness of Children and Adolescents: A Global Perspective. *Sports Medicine, 51*(6), 1117–1128. https://doi.org/10.1159/000101075