LEARNING BY MOVING

INNOVATIVE AND INTERDISCIPLINARY TEACHING METHODS IN PRESCHOOL AND PRIMARY EDUCATION

edited monograph

ANDRZEJ ROKITA, KATERINA MOURATIDOU, ANGELA MAGNANINI,
EVGEN PRYSTUPA, AGNIESZKA OLECHOWSKA, AGNIESZKA ROŚCISZEWSKA,
MAŁGORZATA ŻYTKO, SARA WAWRZYNIAK

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WROCLAW UNIVERSITY OF HEALTH AND SPORT SCIENCES
2026

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INTRODUCTION

This edited monograph is the result of a collaborative European initiative (2024-1-PL01-KA220-HED-000250640) that brought together seven higher education institutions from four European countries: Wroclaw University of Health and Sport Sciences (Poland), Adam Mickiewicz University, Poznań (Poland), Maria Grzegorzewska University of Warsaw (Poland), University of Rome "Foro Italico" (Italy), Aristotle University of Thessaloniki (Greece), University of Warsaw (Poland), Ivan Boberskyi Lviv State University of Physical Culture (Ukraine). The initiative introduces and further develops evidence-based, innovative, interdisciplinary methods collectively referred to as Learning by Moving. These methods are designed for children aged 5–10, including those with special educational needs or adaptation difficulties. These approaches combine learning with physical activity to support children's holistic development in the areas of motor skills, cognition, emotions, and social skills.

At the heart of Learning by Moving is the transformative principle that children learn best when their minds and bodies are engaged together. The Learning by Moving framework integrates movement into the learning process in an inclusive, developmentally enriching way. The seven teaching methods presented in this volume demonstrate how movement can become a natural and meaningful part of classroom learning that nurtures curiosity, creativity, and joy.

Learning Through the Body: Theoretical and Pedagogical Foundations

Traditional schooling has long separated thinking from doing and intellectual activity from bodily experience. However, research in pedagogy, psychology, and neuroscience increasingly demonstrates that movement is essential to learning and development. Physical activity benefits not only health and motor coordination, but also attention, memory, problem-solving, and emotional regulation (Donnelly et al., 2016; Howard--Jones, 2014). From their earliest years, children explore and understand the world through movement–touching, running, drawing, and manipulating objects–and these embodied experiences lay the groundwork for higher cognitive functions (Adolph & Hoch, 2019).

This view aligns with the paradigm of embodied education, which posits that learning is rooted in lived sensory experiences (Clark, 2008; Francesconi & Tarozzi, 2012; Varela et al., 1991). As Ceciliani (2018) notes, the learner's conscious experience is grounded in corporeal existence – knowledge is constructed not only in the mind but also through the body. Similarly, Arnold (2002) identifies three educational values of movement: learning through movement as direct experience, learning about movement as content, and learning through movement as a means of developing other forms of knowledge.

This integrated vision of learning challenges schools to rethink how they organize teaching and space. The human body cannot be confined to physical education lessons alone — it is always present in the classroom and in every learning activity. Movement becomes a bridge between knowledge and experience, fostering academic competence, empathy, cooperation, and self-awareness.

Rethinking Teacher Training and Educational Practice

In order to make this vision a reality, teachers must be equipped with the necessary skills and confidence to design embodied, interdisciplinary learning experiences. Grossman and McDonald (2008) argue that teacher education should connect theory and practice through laboratory-based and experiential learning. In these settings, teachers facilitate autonomy and self-organization (Borgogni & Agosti, 2022) by guiding children to explore knowledge through creative, sensory, and physical engagement.

High-quality training in preschool and primary education is crucial because teachers at these levels establish the foundation for children's cognitive, emotional, and social development (Balduzzi & Lazzari, 2024). A well-trained teacher recognizes that emotions and movement are powerful mediators of learning (Spada et al., 2024). Neuroscientific research confirms that learning is most effective when children are emotionally engaged and when new information connects meaningfully with their prior experiences.

Constructivist theories also highlight the importance of active and contextual learning. Piaget (1970) emphasized the dynamic interplay between assimilation and accommodation, and Vygotsky (1978) and Bruner (1996) stressed the social and cultural nature of knowledge construction. Phenomenological perspectives, such as those of Merleau-Ponty (2012) and Ceciliani (2018), extend this view by situating learning within the child's lived, embodied experience.

In summary, effective education must address the whole learner – mind, body, and emotions – within rich, relational, and culturally diverse contexts.

Movement as a Path to Inclusion and Innovation

Teachers in today's diverse classrooms face many challenges, including cultural and linguistic diversity, varied learning needs, reduced physical activity, and social or behavioral issues. These realities necessitate innovative, interdisciplinary approaches that promote inclusion and engagement.

Movement-based learning has proven to be a powerful equalizer. It engages children who may struggle in traditional, sedentary settings, including those with attention difficulties, language barriers, or special educational needs. Allowing students to learn through play, rhythm, and coordinated action enhances participation, cooperation, and motivation (Magistro et al., 2022; Watson et al., 2017a, b).

Furthermore, physically active lessons integrate movement with academic content, improving both physical fitness and academic performance (Bartholomew & Jowers, 2011; Donnelly & Lambourne, 2011; Mavilidi & Vazou, 2021). These approaches embody what Moliterni (2013) described as "pervasive and persistent" motor experiences – a fundamental human capacity that unites all forms of intelligence and cultivates collaboration, attention, and self-awareness.

The Structure of the Book

This monograph introduces seven innovative methods that were developed within the Learning by Moving framework. Each chapter combines theoretical reflection with practical applications to offer educators insights, examples, and tools for connecting movement with learning in meaningful ways. Rather than treating movement as a distinct activity, the book illustrates how it can be incorporated into various educational settings, including classroom instruction, creative expression, and outdoor and digital learning environments.

Each chapter gradually progresses from conceptual foundations to applied practice. Initial chapter sections establish the theoretical, pedagogical, and neuroscientific principles underlying embodied learning. Later sections translate these ideas into concrete teaching approaches and adaptable classroom activities. Throughout, emphasis is placed on inclusion, creativity, and the holistic development of children.

Together, the chapters form a coherent framework that helps teachers reimagine education as an active, engaging, movement-based process that nurtures curiosity, collaboration, and joy in learning.

A Shared European Vision

The Learning by Moving project exemplifies how international collaboration can enrich educational innovation. This book demonstrates how diverse cultural perspectives can converge toward a shared goal of making education more engaging, inclusive, and human-centered by combining the expertise of researchers and practitioners from Poland, Greece, Italy, and Ukraine. Thus, this monograph represents more than a mere collection of methods. It embodies a vision of schooling that values movement as a universal language of learning — one that connects the body and mind, teacher and child, school and community. Through movement-based learning, children acquire knowledge and cultivate the joy, curiosity, and resilience that will sustain them throughout life.

References

Adolph, K.E., Hoch, J.E. (2019). Motor development: embodied, embedded, enculturated, and enabling. *Annual Review of Psychology*, *70*, 141–164, https://doi.org/10.1146/annurev-psych-010418-102836.

Arnold, P.J. (2002). *Educazione motoria, sport, curriculo*. Milano: Guerini e Associati.

Balduzzi, L., Lazzari, A. (2024). La formazione interistituzionale come elemento chiave nella costruzione del sistema integrato 0–6: il ruolo del coordinamento pedagogico. In: *L'Educazione zerosei: sistema integrato e poli per l'infanzia. Riflessioni e confronti a partire dall'esperienza formativa toscana* (pp. 80–93), Firenze: Istituto degli Innocenti.

Bartholomew, J.B., Jowers, E.M. (2011). Physically active academic lessons in elementary children. *Preventive Medicine*, *52*(Suppl 1), 51–54, https://doi.org/10.1016/j.ypmed.2011.01.017.

Borgogni, A., Agosti, V. (2022). Per una ecologia del movimento: prospettive sostenibili nella formazione degli insegnanti di Scienze Motorie e Sportive. *Pedagogia oggi*, *20*(1), 126–133, https://dx.doi.org/10.7346/PO-012022-16.

Bruner, J. (1996). *The Culture of Education*. Cambridge: Harvard University Press.

Ceciliani, A. (2018). From the embodied cognition to the embodied education in physical and sports sciences. *Encyclopaideia*, *22*(51), 11–24, https://doi.org/10.6092/issn.1825-8670/8424.

Clark, A. (2008). *Supersizing the Mind. Embodiment, Action, and Cognitive Extension*. Oxford: Oxford University Press.

Donnelly, J.E., Hillman, C.H., Castelli, D., Etnier, J.L., Lee, S., Tomporowski, P., Lambourne, K., Szabo-Reed, A.N. (2016). Physical activity, fitness, cognitive function, and academic achievement in children: a systematic review. *Medicine and Science in Sports and Exercise*, *48*(6), 1197–1222, https://doi.org/10.1249/MSS.0000000000000901.

Donnelly, J.E., Lambourne, K. (2011). Classroom-based physical activity, cognition, and academic achievement. *Preventive Medicine*, *52*(Suppl 1), 36–42, https://doi.org/10.1016/j.ypmed.2011.01.021.

Francesconi, D., Tarozzi, M. (2012). Embodied education: a convergence of phenomenological pedagogy and embodiment. *Studia Phaenomenologica*, *12*, 263–288, https://doi.org/10.7761/SP.12.263.

Grossman, P., McDonald, M. (2008). Back to the future: directions for research in teaching and teacher education. *American Educational Research Journal*, *45*(1), 184–205, https://doi.org/10.3102/0002831207312.

Howard-Jones, P. (2014). *Neuroscience and Education: A Review of Educational Interventions and Approaches Informed by Neuroscience. Full Report and Executive Summary*. London: Education Endowment Foundation.

Magistro, D., Cooper, S.B., Carlevaro, F., Marchetti, I., Magno, F., Bardaglio, G., Musella, G. (2022). Two years of physically active mathematics lessons enhance cognitive function and gross motor skills in primary school children. *Psychology of Sport and Exercise*, *63*, 102254, https://doi.org/10.1016/j.psychsport.2022.102254.

Mavilidi, M.F., Vazou, S. (2021). Classroom-based physical activity and math performance: Integrated physical activity or not? *Acta Paediatrica*, *110*(7), 2149–2156, https://doi.org/10.1111/apa.15860.

Merleau-Ponty, M. (2012). *Phenomenology of Perception*. London: Routledge.

Moliterni, P. (2013). *Didattica e scienze motorie. Tra mediatori e integrazione*. Roma: Armando.

Piaget, J. (1970). *Science of Education and the Psychology of the Child*. New York: Orion Press.

Spada, E., Mignosi, E., Accurso, F. (2024). La formazione dei docenti nella scuola primaria e dell'infanzia: l'efficacia di una rete per la promozione di esperienze innovative. *Lifelong Lifewide Learning*, *22*(45), 538–547.

Varela F.J., Thompson, E., Rosch, E. (1991). *The Embodied Mind. Cognitive Science and Human Experience*. Cambridge: MIT Press.

Vygotsky, L.S. (1978). *Mind in Society. The Development of Higher Psychological Processes*. Cambridge: Harvard University Press.

Watson, A., Timperio, A., Brown, H., Best, K., Hesketh, K.D. (2017a). Effect of classroom-based physical activity interventions on academic and physical activity outcomes: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 114, https://doi.org/10.1186/s12966-017-0569-9

Watson, A., Timperio, A., Brown, H., Hesketh, K.D. (2017b). A primary school active break programme (ACTI-BREAK): Study protocol for a pilot cluster randomised controlled trial. *Trials*, *18*, 433, https://doi.org/10.1186/s13063-017-2163-5.

EDUballs/BRAINballs:

Integrating Movement, Learning, and Development in 5–10-Year-Old Children

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Introduction

Learning through movement is increasingly recognized as a vital element of early and primary education. Children naturally engage in play and physical activity, which supports their physical health and enhances their attention, motivation, and academic performance. Contemporary educational research emphasizes the need for interdisciplinary teaching models that integrate cognitive, emotional, and motor experiences into a cohesive learning process. In this context, the EDUball/BRAINball method is an innovative approach that combines physical activity with core academic content. Developed at the Wrocław University of Health and Sport Sciences in Poland, this concept is grounded in the principles of interdisciplinary and holistic education. It merges elements of physical education, language arts, mathematics, and the natural sciences. Through play-based movement, children develop literacy, numeracy, fine motor skills, coordination, cooperation, and emotional self-regulation.

The EDUball/BRAINball method's theoretical foundation aligns with international educational frameworks, including the World Health Organization's recommendations on physical activity for children and UNESCO's Education for Sustainable Development goals. Both organizations advocate for active, engaging learning environments that foster creativity, health, and social well-being.

This chapter introduces the EDUball/BRAINball method's theoretical foundations, tracing its origins and development and summarizing key research findings on its educational and developmental outcomes. By integrating movement with learning, the method exemplifies a modern, evidence-based approach to active, inclusive, and interdisciplinary education for children aged 5–10, translating educational theory into effective, movement-based practice.

Foundations and History of EDUballs/BRAINballs

The EDUball/BRAINball method transforms interdisciplinary, movement-based learning principles into practical educational tools that blend physical activity with cognitive challenges. This approach generates a dynamic, inclusive, and engaging learning environment for children between the ages of five and ten. The method's theoretical foundation is based on the principles of interdisciplinary education, which emphasize the integration of movement and cognition (Cone et al., 2009). By combining physical education with subjects such as foreign languages, math, and science, the method encourages the simultaneous development of cognitive, motor, and social skills. This integrative model supports holistic child development by encompassing academic competence, emotional regulation, social interaction, and intrinsic motivation for learning.

The concept of educational balls was first introduced in 2002 at the Department of Team Sports and Games at the Wroclaw University of Health and Sport Sciences in Poland. Contemporary pedagogy increasingly acknowledges the importance of approaches that integrate multiple domains of learning and emphasize the interplay between cognitive and motor development. Within this framework, EDUballs/BRAINballs are an innovative, multidisciplinary teaching model promoting active participation, engagement, and a deeper understanding through play. Psychopedagogical research has demonstrated that balls are among the most naturally and spontaneously chosen objects by children during play (Lipiec, 2007; Zdebska, 2008). Their universal appeal, enhanced by diversity in size, color, and surface design, makes them particularly suitable for combining intellectual and physical tasks. Recognizing the motivational potential of play and the appeal of ball-based activities, researchers modified traditional balls for educational use. Adding letters, numbers, and symbols expanded the academic potential of the balls, allowing them to be used in diverse learning domains, including physical education and other physical activities. These innovations led to the creation of the first educational balls, "edubals" (2002), which were subsequently developed into "EDUballs" (2012), "BRAINballs" (2018), and most recently, their miniature versions, "mini-EDUballs" and "mini-BRAINballs" (2022) (Rokita et al., 2024).

The educational balls were developed by Prof. Andrzej Rokita, Dr. Tadeusz Rzepa, and Marek Nowicki, with conceptual contributions from Dr. hab. Ireneusz Cichy, Dr. Sara Wawrzyniak, and other collaborators. Protected under Industrial Design No. 1787 (September 25, 2002), the educational balls have been formally approved by the Polish Ministry of National Education and are officially recognized as didactic aids for elementary schools. They have also received a positive recommendation from the Polish Parliamentary Commission for Sport, highlighting their educational and pedagogical value. Pedagogical experiments conducted by Prof. Rokita's team led to further innovations, including the miniaturization of the balls. This process brought together an inter-university research team led by Dr. hab. Ireneusz Cichy; Prof. Andrzej Rokita; and Dr. Sara Wawrzyniak, from the Wroclaw University of Health and Sport Sciences; Prof. Michał Klichowski; and Dr. Agnieszka Rościszewska, from Adam Mickiewicz University in Poznań; as well as Prof. Michał Bronikowski, from the Poznań University School of Physical Education. Together, they created the mini-EDUball prototype (Bronikowski et al., 2022; Rokita et al., 2024). The development of the educational balls exemplifies the successful commercialization of academic research. In 2018, a licensing agreement with a U.S. company facilitated the transfer of research outcomes to the market under the BRAINball brand, marking the product's initial large-scale introduction in the United States and Canada. Then, in 2024, the Wroclaw University of Health and Sport Sciences signed a new licensing agreement with a Polish company to distribute EDUballs and mini-EDUballs in the European Union (Rokita et al., 2024).

What Are EDUballs?

Educational balls are an innovative teaching aid for preschool, primary, and physical education teachers. The EDUballs/BRAINballs set consists of 100 balls in five colors (yellow, green, blue, red, and orange) with black letters printed on them. The EDUballs have the Polish alphabet and the BRAINballs have the English alphabet, including uppercase and lowercase letters, numbers from 0 to 9, and mathematical symbols such as addition (+), subtraction (—), multiplication (*), division (:), greater than (>), less than (<), parentheses (), and the at sign (@) (Rokita et al., 2024).

This educational concept integrates physical activity with academic learning, enhancing children's cognitive, social, and motor development through movement and play. Activities using educational balls combine physical exercise with subject-specific tasks to foster active engagement in the learning process while supporting mental and physical growth. These exercises emphasize natural movements, such as running, jumping, throwing, and catching. This holistic approach makes educational balls a valuable tool for comprehensive education.

Structured activities with EDUballs/BRAINballs teach children colors, letters, numbers, basic mathematical operations (addition, subtraction, multiplication, and division), and key principles of language and mathematics (Fig. 1). At the same time, children develop physical fitness, coordination, and gross and fine motor skills, including throwing, catching, dribbling, bouncing, and rolling. These activities encourage students to practice reading syllables, words, and sentences aloud; writing letters, phrases, and sentences; counting; and solving mathematical problems. All of these activities improve spatial awareness, coordination, and graphomotor abilities (Rokita et al., 2017, 2018).

The combination of letters, numbers, and symbols, together with the balls' various colors, allows EDUballs/BRAINballs to be effectively integrated into many school subjects, including physical education and other physical activities. EDUballs/BRAINballs can support teaching native languages (e.g., Polish, English), foreign languages (e.g., English, Spanish), mathematics, and natural sciences (Rokita et al., 2017, 2016, 2018).

Figure 1. Examples of EDUballs/BRAINballs in use

Educational and Developmental Outcomes of EDUballs/BRAINballs Research

Numerous studies conducted in school environments over the past two decades have shown that combining physical activity with academic learning through EDUball/BRAINball activities significantly benefits children's overall development. These studies have examined the effects of EDUball/BRAINball activities on physical education, including their impact on physical fitness, coordination, spatial awareness, fundamental movement skills, and academic performance in areas such as literacy, numeracy, graphomotor skills, and creativity (Bronikowski et al., 2022; Rokita, 2025; Rokita et al., 2017, 2018, 2024).

These quasi-experimental studies were conducted in several schools and used parallel experimental and control groups with pre- and post-testing. Classes were randomly assigned to each group, and the studies lasted from six months to three school years. Children's academic and motor performance was assessed by trained researchers before and after the intervention. All groups followed the same core PE curriculum based on national education standards. The experimental groups supplemented the standard PE program with literacy and numeracy content by using educational balls for approximately 30 minutes twice a week, while the control groups participated in regular PE lessons without EDUballs/BRAINballs. Lesson plans for the experimental groups were prepared jointly by schoolteachers and researchers and integrated physical activities with language and mathematics tasks related to current classroom topics. Typical lessons lasted 30–45 minutes and combined movement with cognitive learning. They were regularly reviewed and adjusted to ensure consistency and effectiveness (Ribeiro et al., 2024; Rokita et al., 2017).

Studies have shown that children improved their literacy skills in their native languages, particularly in reading, writing, and graphomotor skills (Naskręt et al., 2018; Rokita, 2008; Rokita et al., 2017; Wawrzyniak et al., 2021, 2022), as well as their foreign language and numeracy skills (Cichy et al., 2020, 2022b). Children also improved in physical fitness (Pham et al., 2021, 2023; Rokita, 2008), eye-hand coordination (Cichy et al., 2015), spatial awareness (Cichy et al., 2022a; Wawrzyniak et al., 2015), and fundamental motor skills (Cichy et al., 2022a; Wawrzyniak et al., 2022). Furthermore, studies with children diagnosed with dyslexia reveal significant improvements in reading and writing skills after participating in EDUball activities, highlighting the method's therapeutic and inclusive potential (Cichy et al., 2022c).

Recent research has expanded our understanding of the EDUball/BRAINball method and its potential in education. Khorkova et al. (2025) demonstrated that using educational balls improves motor skills and significantly enhances creativity in children aged 8 to 9 years. This finding reveals an important area of development, emphasizing that these methods support academic and physical growth and encourage creative thinking, expression, and imagination in children.

EDUball/BRAINball activities provide an enjoyable platform for children to develop essential social skills by interacting with their peers in various physical settings. These experiences promote teamwork, cooperation, and effective communication, enabling children to improve their social interactions in an engaging environment. A welcoming and supportive atmosphere further enriches these activities, enabling effortless learning through play by seamlessly integrating education with movement and promoting active, inclusive, and interactive participation (Ribeiro et al., 2024).

In summary, accumulated research demonstrates that the EDUball/BRAINball method is a practical, innovative approach to integrating movement with learning. Findings consistently show that EDUball/BRAINball enhances cognitive and physical development while fostering emotional and social growth in an engaging, supportive environment. By connecting physical activity with academic content, EDUball/BRAINball activities strengthen essential skills and create meaningful, enjoyable learning experiences that contribute to children's holistic development (Fig. 2).

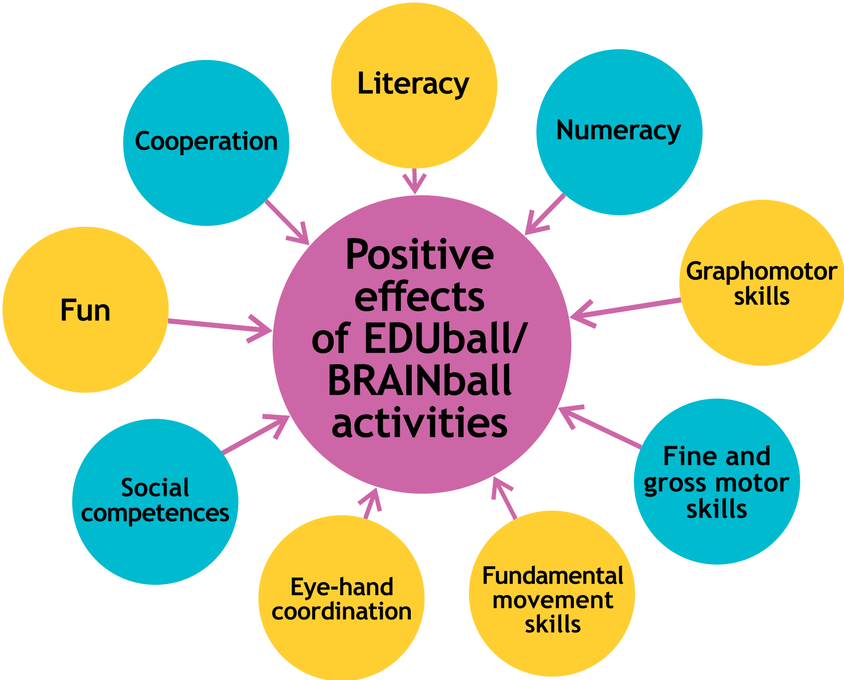


Figure 2. Areas of children's development influenced by the EDUballs/BRAINballs method

Future Directions and Ongoing Research

As research on EDUballs/BRAINballs continues to expand, new applications beyond traditional school settings are emerging. Recent studies emphasize the potential of these tools to enhance cognitive and motor development, as well as to foster inclusion, creativity, and emotional well-being. Growing interest among researchers and educators underscores the method's versatility and adaptability to various educational, social, and cultural settings.

These educational balls continue to serve as highly versatile tools that promote social inclusion and anti-discrimination in educational and recreational settings. Their universal design and flexible use make them suitable for learners of different ages and abilities. By combining movement with learning, EDUballs/BRAINballs create opportunities for all participants, regardless of their physical, cognitive, or social differences, to engage actively and meaningfully.

In the future, EDUballs/BRAINballs could be incorporated into integration programs for refugee children, providing a shared platform for play, communication, and learning. These activities could help refugees overcome linguistic and cultural barriers, adapt to new educational systems, and cultivate a sense of inclusion and belonging in unfamiliar environments. Their accessibility and adaptability make EDUballs/BRAINballs a promising method for fostering intercultural understanding and social cohesion across diverse communities.

EDUballs/BRAINballs are particularly valuable in inclusive educational settings where they reduce barriers between children with and without disabilities, support equal participation, and foster cooperation, empathy, and respect for diversity. The playful, non-competitive nature of the activities encourages teamwork and strengthens group cohesion. Through shared movement and learning experiences, children acquire knowledge and skills, develop social awareness, and foster a sense of belonging.

The EDUball/BRAINball approach offers opportunities to support children with diverse needs and learning profiles. However, their effectiveness depends on skillful application in accordance with the principles of adapted physical activity. These principles aim to address psychomotor challenges throughout the lifespan, safeguard individuals' right to access an active lifestyle and physical activity-related education, and develop services that foster the integration and inclusion of children and adolescents (DePauw & Sherrill, 1994). Approaches such as Ecological Task Analysis (ETA) (Davis & Barton, 1991) could further enhance their benefits, though there is still limited empirical evidence. Children on the autism spectrum, for example, often struggle with conventional ball-based activities due to social demands (Green et al., 2002). Yet, they may show heightened attention to non-social stimuli, such as geometric shapes or objects (Congiu et al., 2024; Wang et al., 2020;). EDUballs/BRAINballs could harness these strengths and offer a motivating platform for practicing cognitive and social skills in structured activities. Carefully designed tasks could enable all students to collaborate as a team, aligning with the principles of inclusive education. However, further research is needed to confirm these effects. A sample lesson scenario for children with autism spectrum disorder illustrates this application, demonstrating how EDUballs/BRAINballs can integrate movement, cognitive learning, and social interaction while addressing individual strengths and challenges (see Lesson Scenario 3).

Planning EDUball/BRAINball Activities

Teachers or educators should consider several interrelated factors when planning EDUball/BRAINball activities to ensure the effectiveness, engagement, and inclusivity of the lesson. Thorough preparation ensures the activities will meet educational and developmental objectives while remaining enjoyable and accessible for all children (Fig. 3).

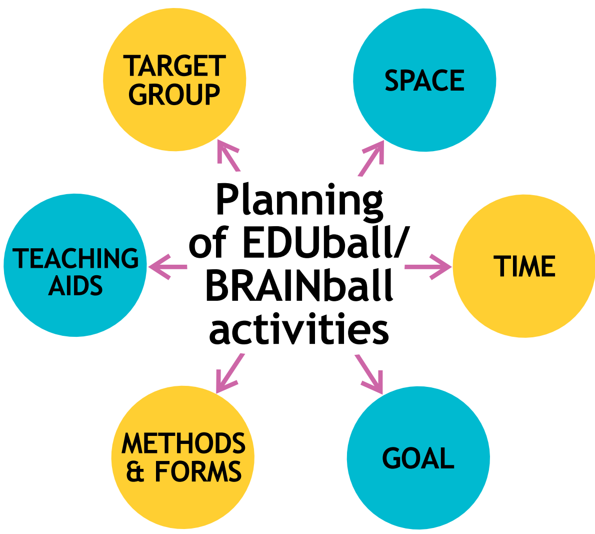


Figure 3. Key factors in planning and implementing EDUballs/BRAINballs activities

The first step is to clearly identify the target group. Teachers should consider the age of the children, the number of participants, their skill levels, and any individual needs or limitations. For younger learners, activities should be simple, dynamic, and movement-rich. For older or more advanced groups, tasks can be more complex and cognitively demanding. Educators should pay particular attention to individual differences, such as motor abilities and diverse learning needs, to ensure a supportive and inclusive environment in which every child has the opportunity to participate and succeed.

It is equally important to define clear goals for the lesson, which typically fall into three main categories:

1. Didactic goals, such as improving mathematical operations (e.g., addition or subtraction within 0–10) or strengthening language skills;
2. Motor goals, which focus on developing specific movement abilities (e.g., teaching how to catch or dribble a ball and improving spatial awareness).
3. Social goals aimed at fostering cooperation, communication, and teamwork. Activities designed around shared challenges encourage empathy, mutual respect, and a sense of social responsibility through play.

After setting goals, teachers should carefully select methods and activities. EDUballs/BRAINballs lessons can include playful exercises, problem-solving tasks, and structured games that encourage creativity and exploration. Game-based and task-oriented learning stimulate children's intrinsic motivation, making them active participants in the learning process rather than passive recipients of information.

Another important consideration is the duration of activities. Each session's length should reflect the children's abilities, attention span, and the intended learning outcomes. EDUballs/BRAINballs lessons do not have to occupy an entire class period. Short, focused activities can be equally effective in maintaining engagement and achieving the desired educational and developmental outcomes.

Next, select an appropriate location for the activities. They may take place in sports halls, outdoor fields, or playgrounds depending on the objectives of the lesson. The space should be safe, well-equipped, and spacious enough for the planned exercises. The flexibility of the method enables lessons to be easily adapted to various educational or recreational settings.

Ultimately, selecting the right teaching aids and materials can significantly enhance the effectiveness of the lesson. In addition to the balls, teachers may use items such as rings, cones, paper, puzzles, and pens to support different types of tasks. Combining these materials with physical movement promotes creativity and helps bridge the gap between physical and cognitive learning processes.

Thoughtful planning of EDUball/BRAINball-based activities allows educators to design lessons that are physically engaging, intellectually stimulating, and socially enriching. By carefully considering each factor—from participant needs to lesson goals and materials—educators can create meaningful learning experiences that foster children's holistic development.

Summary

The EDUballs/BRAINballs method shows that learning and movement are essential components of child development. By integrating academic content into physical activity, this approach promotes cognitive growth, physical fitness, and socio-emotional well-being. With over two decades of research and practice backing it up, EDUballs/BRAINballs is a model of innovative, interdisciplinary, and inclusive education. It demonstrates that children learn best when they engage in movement.

Practical Applications

The following section presents three sample lesson scenarios that demonstrate the practical use of EDUballs/BRAINballs in primary education. These examples show how educational balls can be used in different learning situations to promote physical activity and cognitive growth. One scenario is designed specifically for children with autism spectrum disorder, showcasing the method's potential for inclusive education.

For more information on the chapter's content, as well as additional materials on EDUballs/BRAINballs, visit the website accessible via the QR code.

LESSON SCENARIO 1

Topic: **'We Open the Gates of the Forest'**

Overview (as noted in the lesson log): Arranging tasks from a jumble of sentences and solving them. Introduction of the letter 'z' 'Z' – zebra. Improving the ability to add and compare numbers within the range of 5.

Objectives: Students will develop coordination skills, particularly temporal and spatial orientation and proprioception. They will consolidate knowledge of simple mathematical operations and language skills, such as improving the spelling of selected words, by engaging in physical and cognitive activities. Students will also develop the ability to cooperate in a group and build positive relationships with peers while participating in group physical activities.

Group:	Participants:	Duration:	Materials and equipment:
Grade 1 (primary school)	20 students aged 7	45 minutes	a set of EDUballs, nine sashes, 4 gymnastic hoops, 2 rings

1. Running Tag

Each student receives a yellow or green ball. One student, who holds a ball marked with the number 5, acts as the tagger. When a student is touched by the tagger's hand or ball, the tag is passed by exchanging balls.

Note: During the game, children must watch the runners to locate the ball with the number 5 and consequently the tagger.

2. Running Tag with the Letter "Z"

All students have green or yellow balls, and one student holding a ball with the letter "Z" is the tagger. When a student is touched by a hand or a ball, they can protect themselves by saying a word that begins with or contains the letter "Z," such as "zebra" or "pizza." If they fail to do so or hesitate for more than five seconds, the tag is passed to another student.

Note: Teachers may gently prompt hesitant children in a way that avoids embarrassment and keeps play engaging.

3. Number Sets

The children are divided into two teams. Each team has two hoops containing sets of balls. The task is to balance the balls using only the balls scattered around the room without moving the balls in the hoops (for example, five balls in one hoop and one ball in the other). After balancing the balls correctly, the team scores points by making shots into the basket for each ball in both sets.

Variation: Arrange two sets of balls in two gymnastic hoops. The teams must quickly count the balls in each set and place the appropriate symbol (<, =, >) between the hoops for proper comparison. Once this task is complete, the entire team runs around their sets twice and returns to the start-finish line as quickly as possible.

Note: The teacher supervises primarily for accuracy and monitors the speed of task completion. The first team to finish receives two points, and the second team receives one point. This ensures that all participants are recognized for their efforts. The teacher observes which children have difficulty comparing the sets, are less engaged, or have challenges with teamwork, paying particular attention to cooperation within the group.

4. Tossing Activities

Children toss green and yellow balls as high as possible while moving around. At a signal, they stop, and the teacher shows a ball with a plus or minus sign, assigning a task such as adding the number on the ball they are holding to two.

After completing a few examples, the children exchange balls. This activity can also be done in pairs, allowing children to check each other's results and compare them using <, >, or =.

Note: This activity helps children develop addition and subtraction skills, as well as certain motor abilities. The teacher monitors the accuracy of the tasks and how quickly the children respond. Working in pairs often increases engagement and the likelihood of completing the task.

5. Mathematical Chinese Whispers

The teacher whispers a mathematical formula to the children sitting in a circle, such as 3 + 2 = 5. The last child stands up, repeats the formula aloud, and spells it out using EDUballs. Then, all the children stand up and perform that many jumps. The teacher presents a new formula to a different child and sets a new movement task, such as dribbling or throwing a ball.

Note: During this activity, all children practice mental arithmetic, including addition and subtraction within the specified range, while improving selected motor skills. If the activity is not intense enough, it can be performed in smaller groups to increase engagement.

LESSON SCENARIO 2

Topic: **'Return From Holidays'**

Overview (as noted in the lesson log): Revision of addition and subtraction with numbers exceeding ten. Comparing numbers resulting from addition and subtraction. Names of months. Making sentences from scattered words. Music and movement game 'A train is coming from far away'.

Objectives: Students will develop temporal and spatial orientation, as well as reaction speed. They will also consolidate their knowledge of simple mathematical operations by engaging in physical and cognitive tasks. Finally, they will develop the ability to cooperate in a group while participating in group physical activities.

Group:	Participants:	Duration:	Materials and equipment:
Grade 2 (primary school)	20 students aged 8	45 minutes	a set of EDUballs/BRAINballs, gymnastic hoops and rings

1. Getting to Know EDUballs

The balls are scattered across the sports hall. Each student collects as many balls as they can carry. Together with the teacher, the children characterize the properties of the balls and organize them into sets and subsets.

Notes: The teacher encourages as many students as possible to participate in the activity and observes how they cooperate and interact while exploring and grouping the balls.

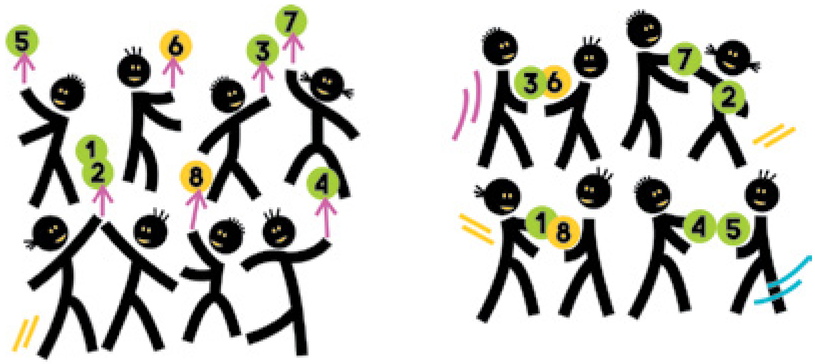
2. Running Tag

Each student has a ball, and one student holding a ball marked with the number 5 is the tagger. The tag is passed by exchanging balls between the tagger and the tagged child. The tagged child can avoid becoming the tagger by providing the correct addition or subtraction answer that equals five. If the answer is incorrect, the tag remains with the current tagger.

Notes: During the activity, children must watch the runners to locate the ball with the number 5 and identify the tagger. The teacher listens to the answers and verifies their accuracy.

3. Friendly Numbers

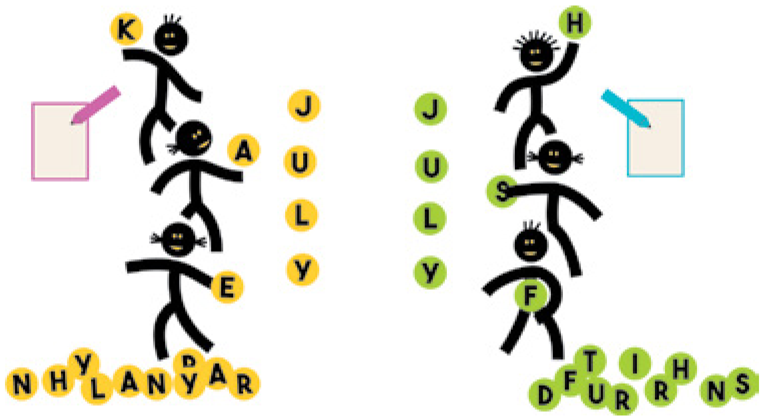
The children move around the room tossing balls. At a signal, they pair up or form groups of three so that the sum of the numbers on their balls is between 10 and 20.



Notes: The teacher serves as the judge, verifying that the groups and sums are correct. The task can be modified by introducing subtraction to increase the challenge.

4. Holiday Sentences

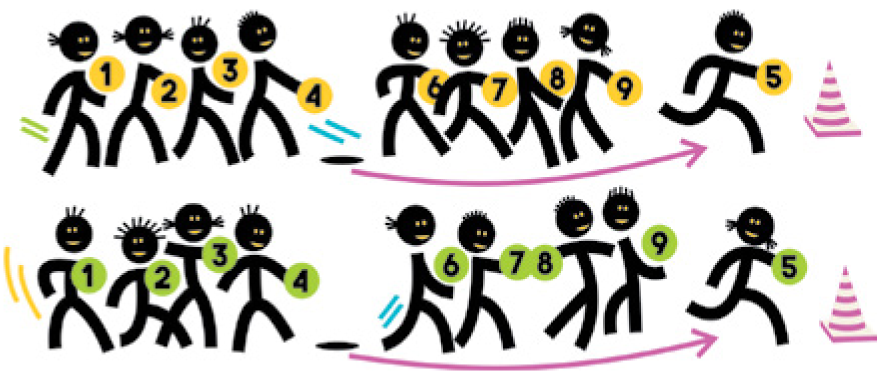
The children are divided into two teams. Each team receives a sheet of paper with words written in random order. First, the students arrange the words using EDUballs. Then, they form complete sentences from them (e.g., “July is very warm”).



Notes: The teacher supervises the accuracy of the task and monitors how quickly the teams complete it. The first team to finish receives two points, and the second team receives one point. This ensuresthat all participants are recognized for their efforts.

5. Number Races

The children are divided into two teams and line up in a row. Each team holds one ball marked from 1 to 9. The teacher announces a mathematical operation, and the child holding the corresponding numbered ball performs the task.



Notes: The teacher supervises the accuracy of each task and monitors how quickly it is completed. The first team to complete the task receives two points, while the second team receives one point. This ensures that all participants are acknowledged for their efforts. This activity can also be adapted using letters arranged in alphabetical order. For example, the child holding the letter “E” would perform the task.

6. The Train Is Coming from Far Away

The children form a train and sing the first verse of the song as they move in different directions around the sports hall. The children forming the train hold educational balls and imitate the spinning wheels of a locomotive. At the end of the second verse, the train stops to pick up passengers. New passengers join at the end of the train, ensuring that balls of the same color do not follow directly after each other.

Notes: The teacher observes the children during the game and occasionally gives commands, such as “The train is going uphill” or “ The train is turning sharply to the right.” The children respond appropriately by following the instructions.

LESSON SCENARIO 3

Topic: ‘Introduction to “cosmic” movement games, developing basic arithmetic, language, and social skills through the use of EDUballs/BRAINballs’

Overview: Lesson Scenario in Physical Education for Students with Autism Spectrum Disorder In an Inclusive Classroom Using EDUballs

Objectives: Students will develop spatial and temporal orientation through movement-based EDUball activities. They will consolidate knowledge of letters, numbers, and basic mathematical symbols by engaging in cognitive and physical tasks. Finally, they will enhance cooperation skills and build positive relationships with peers through group activities.

Group:	Participants:	Duration:	Materials and equipment:
Grade 2-3 (primary school)	15 students aged 7	45 minutes	a set of EDUballs and 1 ringo

1. Welcome to Space!

Each student holds a ball with the first letter of their name and moves around as if in zero gravity, either jogging or hopping. When the teacher says “Gravity!”, the students sit down and greet the nearest classmate according to the instructions below. The goal is to perform as many greetings as possible.

a) Students raise their balls, say their names aloud, touch their balls together, stand up, and continue moving.

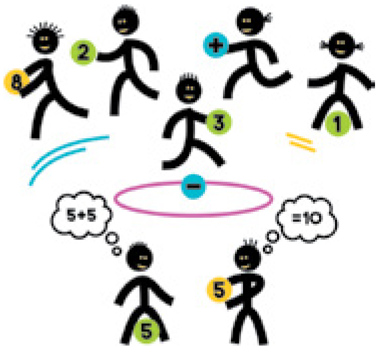
b) Exchange balls. Say, “Hello,” followed by the partner’s name. Return the balls. Touch them together. Stand up. Continue moving.

The revalidation goal is to develop awareness of eye contact and response to one’s own name.

Notes: The teacher explains the meaning of eye contact and how it is perceived differently by neurotypical individuals and individuals with autism spectrum disorder (ASD). The teacher emphasizes the importance of respecting these differences. The teacher chooses the greeting form for the students.

2. Meteorite Tag

Each student holds a ball (green or yellow) and tries to avoid being tagged by the “Meteorite Tagger,” who has a blue ball marked with the symbol “@.” The tagger attempts to touch other students on the back without dropping the ball. A tagged child immediately freezes as if in outer space, places their ball between their legs, and waits to be rescued. To “unfreeze” a classmate, an active student passes their ball to the frozen child’s hands and takes the ball from between their legs.



Modified version: Students hold randomly drawn balls (green or yellow). The "meteorite tagger" freezes children as before. A student can only rescue another if their ball has a higher number than the frozen child's (e.g., 3 can rescue 1). After some time, the teacher reverses the rule so that only children with lower numbers can rescue those with higher numbers (e.g., 1 can rescue 3).

Advanced version: The Meteorite Tagger has two blue balls, one of which is placed in the center of the ring and the other of which is held in the hands. The balls are marked "+" and "-". The tagger can switch between them at any time. During rescues, students must perform the corresponding arithmetic operation based on the sign on the tagger's ball. For the "+" ball, they perform addition (the order of the addends may vary). For "-", they perform subtraction (subtracting the smaller number from the larger one). The rescuer says the numbers aloud, and the frozen student provides the correct sum or difference. If a calculation is incorrect, the rescuer becomes frozen.

The teacher monitors the accuracy of the play.

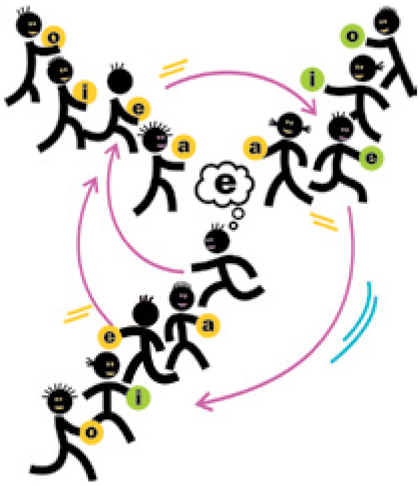
The revalidation goal is to support the development of typical peer interactions and prosocial behavior (helping others).

Notes: The teacher may explain that space temperatures can reach as low as –150°C. Select a version of the tag game that maintains an optimal level of challenge for all students.

3. Letter Sun

Students form three rows of four, resembling sun rays. The students standing in the first row hold balls with the vowel "a," the students in the second row hold balls with the vowel "e," the students in the third row hold balls with the vowel "i," and the students in the fourth row hold balls with the vowel "o." One student stands in the middle and loudly calls out a vowel. The students holding the called vowel then swap places clockwise while the middle student tries to occupy one of their positions. The student who is left without a ball takes the central position and continues the game.

Goal of the game: Support the development of communication and shared attention.



Notes: Students who do not hold the called vowel may act as judges to ensure the game runs correctly, or they may join as fifth players in the rows and hold orange balls. These students change positions each round, regardless of the vowel called, and exchange balls every three rounds.

4. Mathematical Sun

This game uses balls numbered 0–9, similar to the previous one, but with an added focus on arithmetic operations (addition, subtraction, multiplication, and division).

a) A student stands in the center and calls out an arithmetic operation, such as 4-1 or 2+1. The students holding the resulting numbers then change places clockwise while the student in the center tries to occupy one of the vacated spots. If the operation is incorrect, the student must call out a correct one.
b) The student in the center calls out multiplication or division problems. The same game rules apply. The teacher reminds students that dividing by zero is not allowed.

In the third version, the teacher calls out arithmetic problems, engaging all students in calculations. The rest of the game remains unchanged.

Revalidation goal: Supporting the development of communication and shared attention.

Notes: After the basic version has been mastered, the teacher should gradually introduce more difficult versions to avoid discouragement.

5. Return from Mars

Students sit in a circle, cross-legged, each holding their favorite ball. Together, they “build” an imaginary spaceship to return to Earth from Mars. The teacher may begin by telling a story about the challenging journey and the need to build a new ship. Then, each student describes their part of the ship, including its features and how it will function.

Each description should relate to the colors or symbols on their ball. For example, a yellow ball with the letter “T” and the number “2” might inspire the following description:

- **a yellow spaceship** (referring to the ball’s color);
- **built of titanium** (referring to “t”),
- **with two rocket engines** (referring to the number 2).

The teacher can ask additional questions to stimulate the students’ imagination. There are no fixed rules for how the features relate to the signs on the ball. For example, the letter “o” could appear within a word such as “power.” The key is that students build the spaceship together, listening to each other’s ideas. After describing their part, each student places their ball inside the circle.

Revalidation goal: Supporting the development of articulated speech.

Notes: The teacher does not evaluate the students’ descriptions, but rather encourages them to use longer utterances and their imagination when constructing the spaceship.

6. Cosmic Farewell

Students stand in a circle holding balls of various colors, with each color appearing at least twice. The teacher calls out students with specific colors. Those students place their balls on the floor, step into the circle, and say goodbye in a specified way.

- **Yellow balls:** like robots
- **Green balls:** like friendly aliens
- **Blue balls:** like astronauts
- **Red balls:** like space monsters
- **Orange balls:** like planets

At the teacher’s signal, students pass their balls clockwise until the teacher says “Stop.” Then, they repeat the activity, following the same pattern.

Revalidation goal: Supporting the ability to engage in symbolic (“pretend”) play.

Notes: The teacher may provide prompts or modeling as needed for students with ASD.

References

Bronikowski, M., Cichy, I., Klichowski, M., Kruszwicka, A., Wawrzyniak, S., Rokita, A. (2022). *Metoda mini-EduBall. Wychowanie i rozwój dziecka w świetle odkryć neuronauki*. Wroclaw, AWF.

Cichy, I., Kaczmarczyk, M., Wawrzyniak, S., Kruszwicka, A., Przybyla, T., Klichowski, M., Rokita, A. (2020). Participating in physical classes using Eduball stimulates acquisition of mathematical knowledge and skills by primary school students. *Frontiers in Psychology*, *11*, 2194, https://doi.org/10.3389/fpsyg.2020.02194.

Cichy, I., Kruszwicka, A., Przybyla, T., Rochatka, W., Wawrzyniak, S., Bronikowski, M., Klichowski, M., Rokita, A. (2022a). No motor costs of physical education with Eduball. *International Journal of Environmental Research and Public Health*, *19*(23), 15430, https://doi.org/10.3390/ijerph192315430.

Cichy, I., Kruszwicka, A., Palus, P., Przybyla, T., Schliermann, R., Wawrzyniak, S., Klichowski, M., Rokita, A. (2022b). Physical education with Eduball stimulates non-native language learning in primary school students. *International Journal of Environmental Research and Public Health*, *19*(13), 8192, https://doi.org/10.3390/ijerph19138192.

Cichy, I., Kruszwicka, A., Krysman, A., Przybyła, T., Rochatka, W., Szala, E., Wawrzyniak, S., Bronikowski, M., Klichowski, M., Rokita, A. (2022c). Eduball as a method of brain training for lower performing students with dyslexia: a one-year experiment in natural settings. *International Journal of Disability and Human Development*, *21*(4), 337–353.

Cichy, I., Rokita, A., Wolny, M., Popowczak, M. (2015). Effect of physical exercise games and playing with Edubal educational balls on eye-hand coordination in first-year primary school children. *Medicina dello Sport*, *68*(3), 461–472.

Cichy, I., Rokita, A., Wawrzyniak, S. (2017). Ruch, który rozwija – wykorzystanie piłek edukacyjnych EDUball w edukacji przedszkolnej i wczesnoszkolnej: podsumowanie 15 lat badań. *Pedagogika Przedszkolna i Wczesnoszkolna*, *5*(2), 183–196.

Cone, T.P., Werner, P.H., Cone, S.L. (2009). *Interdisciplinary Elementary Physical Education*. Champaign: Human Kinetics.

Congiu, S., Doneddu, G., Fadda, R. (2024). Attention toward social and non-social stimuli in preschool children with autism spectrum disorder: a paired preference eye-tracking study. *International Journal of Environmental Research and Public Health*, *21*(4), 421, https://doi.org/10.3390/ijerph21040421.

Davis, W.E., Barton, A.W. (1991). Ecological task analysis: translating movement behavior theory into practice. *Adapted Physical Activity Quarterly*, *8*(2), 154–177.

DePauw, K.P., Sherrill, C. (1994). Adapted physical activity: present and future. *Physical Education Review*, *17*(1), 6–13.

Green, D., Baird, G., Barnett, A.L., Henderson, L., Huber, J., Henderson, S.E. (2002). The severity and nature of motor impairment in Asperger's syndrome: a comparison with specific developmental disorder of motor function. *Journal of Child Psychology and Psychiatry*, *43*(5), 655–668, https://doi.org/10.1111/1469-7610.00054.

Khorkova, M., Bojkowski, Ł., Korcz, A., Krzysztoszek, J., Łopatka, M., Adamczak, D., Bronikowski, M. (2025). Impact of the Eduball method on cognitive creativity, motor creativity, and motor fitness during physical education classes in 8- to 9-year-old children. *Frontiers in Public Health*, *13*, 1660650, https://doi.org/10.3389/fpubh.2025.1660650.

Lipiec, J. (2007). *Pożegnanie z Olimpią*. Kraków: Fall.

Naskręt, M., Borowiec, J., Grzesiak, J., Bronikowski, M. (2018). Umiejętności grafomotoryczne uczniów klas pierwszych szkół podstawowych uczestniczących w zajęciach realizowanych różnymi metodami aktywizacji fizycznej. *Rozprawy Naukowe AWF we Wroclawiu*, *60*, 46–61.

Pham, V. H., Rokita, A., Cichy, I., Wawrzyniak, S., Bronikowski, M. (2023). Effectiveness of Brainball program on physical fitness of primary school pupils in Vietnam: a longitudinal study. *Frontiers in Public Health*, *11*, 978479, https://doi.org/10.3389/fpubh.2023.978479.

Pham, V. H., Wawrzyniak, S., Cichy, I., Bronikowski, M., Rokita, A. (2021). BRAINballs program improves the gross motor skills of primary school pupils in Vietnam. *International Journal of Environmental Research and Public Health, 18*(3), 1290, https://doi.org/10.3390/ijerph18031290.

Ribeiro, T.D., Marques, A., Wawrzyniak, S. (2024). Integrating core academic subject's learnings into physical education (PE): EDUball/BRAINball approach is worth exploring. In: A. Marques, A.R. Gouveia (eds.), *Physical Education at School and in Today's Society*. IntechOpen, https://doi.org/10.5772/intechopen.1006509.

Rokita, A. (2008). *Zajęcia ruchowe z piłkami edukacyjnymi „Edubal" w kształceniu zintegrowanym a sprawność fizyczna oraz umiejętności czytania i pisania uczniów*. Studia i Monografie AWF we Wroclawiu, 93.

Rokita, A. (2025). The importance of physical activity in the holistic development of children in early school and preschool education. *Elementary Education in Theory & Practice*, *20*(3[78]), 137–155, https://doi.org/10.35765/eetp.2025.2078.09.

Rokita, A., Cichy, I., Klichowski, M., Rościszewska, A., Przybyła, T., Wawrzyniak, S., Bronikowski, M. (2024). *From EDUballs to mini-EDUballs and BRAINballs. Innovative Learning Tools Integrating Cognition with Gross and Fine Motor Skills*. Wroclaw: AWF.

Rokita, A., Cichy, I., Wawrzyniak, S. (2017). Ruch, który rozwija – wykorzystanie piłek edukacyjnych EDUball w edukacji przedszkolnej i wczesnoszkolnej: podsumowanie 15 lat badań. *Pedagogika Przedszkolna i Wczesnoszkolna*, *5*(2), 183–196.

Rokita, A., Wawrzyniak, S., Cichy, I. (2018). *Learning by Playing! 100 Games and Exercises of Brainballs*. Wroclaw: AWF.

Wang, Q., Chang, J., Chawarska, K. (2020). Atypical value-driven selective attention in young children with autism spectrum disorder. *JAMA Network Open*, *3*(5), e204928, https://doi.org/10.1001/jamanetworkopen.2020.4928.

Wawrzyniak, S., Cichy, I., Matias, A.R., Pawlik, D., Kruszwicka, A., Klichowski, M., Rokita, A. (2021). Physical activity with Eduball stimulates graphomotor skills in primary school students. *Frontiers in Psychology*, *12*, 614138, https://doi.org/10.3389/fpsyg.2021.614138.

Wawrzyniak, S., Korbecki, M., Cichy, I., Kruszwicka, A., Przybyla, T., Klichowski, M., Rokita, A. (2022). Everyone can implement Eduball in physical education to develop cognitive and motor skills in primary school students. *International Journal of Environmental Research and Public Health*, *19*(3), 1275, https://doi.org/10.3390/ijerph19031275.

Wawrzyniak, S., Rokita, A., Pawlik, D. (2015). Temporal-spatial orientation in first-grade pupils from elementary school participating in physical education classes using Edubal educational balls. *Baltic Journal of Health and Physical Activity*, *7*(2), 33–43. https://doi.org/10.29359/BJHPA.07.2.03.

Zdebska, H. (2008). *Istota i wartości zespołowych gier sportowych*. Studia i Monografie AWF w Krakowie, 49.

mini-Eduball:

A New Set of Forty Single-User Games

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Introduction

The mini-Eduball concept is a direct continuation of the EDUballs project, emerging in response to new findings in psychology and cognitive neuroscience. These disciplines increasingly emphasize the close interrelationship between linguistic, mathematical, and practical functions (Corballis, 2010; Klichowski & Króliczak, 2017). A growing body of empirical evidence demonstrates that the ability to communicate through language, perform numerical operations, and execute purposeful manual actions share a common neural substrate, at least in part (Kroliczak & Przybylski, 2024; Kroliczak et al., 2021). Consequently, these capacities are not entirely independent in their development, but instead exhibit mutual interdependencies. Furthermore, current research suggests that integrative training, which activates these domains simultaneously, yields more favorable developmental outcomes than traditional pedagogical approaches that separate motor activity from linguistic or mathematical learning.

Against this scientific backdrop, the team responsible for the original EDUballs project collaborated with cognitive neuroscientists to design a novel, hand-controlled version of EDUballs (Cichy et al., 2022; Wawrzyniak et al., 2021). The result of this collaboration is mini-Eduball, a set of educational balls that are structurally similar to EDUballs but are the size of tennis balls.

A comprehensive description of mini-Eduball construction is provided in *From EDUballs to mini-EDUballs and BRAINballs. Innovative Learning Tools Integrating Cognition with Gross and Fine Motor Skills* (Rokita et al., 2024). This publication also reconstructs the theoretical foundations underpinning this concept and details 60 basic games through which integrated mini-Eduball training can be implemented. The present chapter expands upon this collection by introducing an additional 40 single-user games. This expanded selection allows for longer and more diverse intervention programs within a school setting. Furthermore, it illustrates strategies for independently applying mini-Eduballs, e.g., to stimulate cognitive development in home environments or to structure developmentally supportive activities in informal play settings. These games can also be used beyond childhood education. They can support cognitive functions in older adults and be used as resources in therapeutic practice, including post-stroke rehabilitation for aphasia and apraxia.

Games

These games are designed to be played with a full mini-Eduball set of 60 or 100 balls. Although they are intended for individual play, they can be adapted for group play. There are no age restrictions; players just need to know the alphabet, numbers, and simple math. Each game is based on two core principles: motor skills and cognitive skills, both of which should be performed precisely. The key is to execute accurate hand movements using only the hand specified in the instructions. Most games do not have a time limit. What matters most is the player's mental and physical engagement in completing the task. The instructions provided here are suggestions – feel free to use them for inspiration when creating your own games.

Typical equipment used:

- a ball storage container
- ball stands
- a bag for drawing balls
- an additional box large enough to hold most of the balls
- task cards
- "handedness" cards indicating which hand to use

Optional: a sheet of paper and a pen.

GAME: PASSWORDS

Game Objective:

Decipher the password using the rule that each number corresponds to a letter’s position in the English alphabet.

How to play:

Place all of the yellow and green balls into the storage container. Then, draw a card with a password on it. Decipher the letters of the password in any order. After identifying each letter, find the corresponding ball and place it on a stand (Fig. 1). Before starting, draw a “handedness” card. Throughout the task of searching for balls and arranging them on stands, only use the indicated hand.

To play you will need:

- yellow and green mini-Eduball balls
- ball storage container
- ball stands (one for each letter in the password)
- password cards
- “handedness” cards

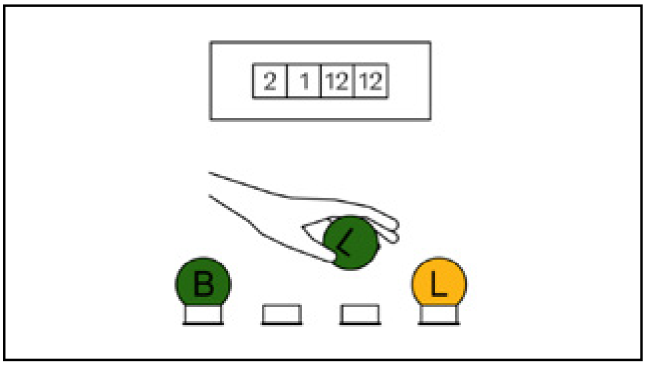

Figure 1. Equipment arrangement and an example task in Passwords

Passwords:

1.

23	8	9	20	5	2	15	1	18	4

2.

19	3	8	15	15	12

3.

3	8	5	13	9	19	20	18	25

4.

19	21	2	10	5	3	20

5.

3	15	7	14	9	20	9	22	5

6.

3	8	9	12	4

7.

5	24	1	13

8.

12	1	13	16

9.

16	12	1	25	7	18	15	21	14	4

10.

21	14	9	22	5	18	19	9	20	25

GAME: WORDS

Game Objective:

Create as many words as possible or the longest word within three minutes.

How to play:

Place all of the yellow and green balls into the container. Then, draw a card with a cognitive rule. Arrange the balls on the stands in the correct order to form words (Fig. 2). Use only the hand indicated by the “handedness” card you drew.

Tip:

1. If the task is too easy or difficult, adjust the time limit.
2. Optionally, write the words you create on a piece of paper.

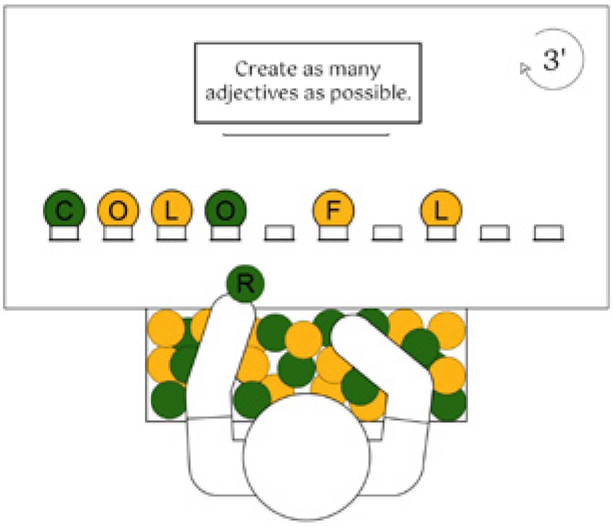

Figure 2. Equipment arrangement and an example task in Words

To play you will need:

- yellow and green mini-Eduballs
- a ball storage container
- ball stands (the number depends on word length)
- cards with cognitive rules
- “handedness” cards

Optional: a sheet of paper and a pen

Cognitive rules:

1. Create as many three-letter words as possible.
2. Create as many five-letter words as possible.
3. Create as many verbs as possible.
4. Create as many nouns as possible.
5. Create as many words as possible that start with the letter C.
6. Create as many words as possible that end with the letter R.
7. Create as many school-related words as possible.
8. Create as many words as possible related to physical activity.
9. Create the longest word possible.
10. Create as many nine-letter adjectives as possible.

GAME: THROWS

Game Objective:

Sort balls into two boxes according to a given cognitive rule by throwing them with a single bounce.

How to play:

Place the boxes on your desk about 50 cm apart or on the floor about 1.5 meters away. Put the balls into the bag. Draw the balls one by one at random. Throw each ball into the boxes with a single bounce, following the given rule. Always throw crosswise: right hand to the left box and left hand to the right box (Fig. 3).

Optionally, draw a “handedness” card to determine which hand to use for the right box. Use the other hand for the left box.

Tip:

1. You may switch hands, but always throw crosswise.
2. If the task is too easy, move the boxes farther away, or try throwing with two bounces.

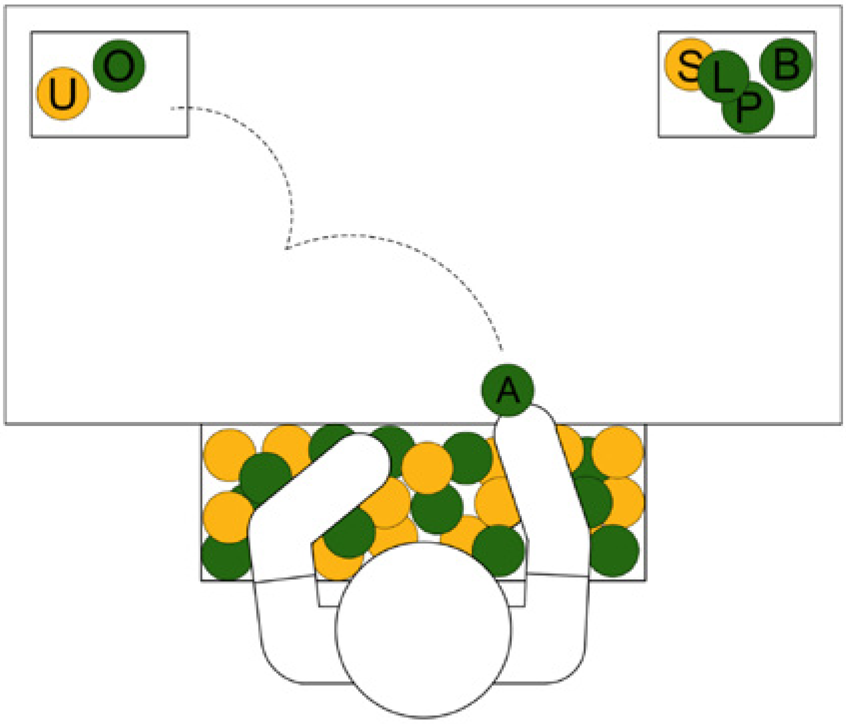

Figure 3. Equipment arrangement and an example task in Throws.

To play you will need:

- yellow and green mini-Eduball balls
- a bag for drawing the balls
- a ball storage container
- an additional box large enough to hold most of the balls
- a card with the cognitive rules

Optional: “handedness” cards.

Cognitive rules:

1. For numbers divisible by three, throw with your right hand into the left box. For numbers not divisible by three, throw with your left hand into the right box.
2. For numbers divisible by two, throw with your left hand into the right box, and throw with your right hand into the left box for numbers that are not divisible by two.
3. Vowels: throw with your right hand into the left box. Consonants: throw with your left hand into the right box.
4. If the letter on the ball appears in “umbrella,” throw it with your left hand into the right box. Otherwise, throw it with your right hand into the left box.
5. If the ball’s letter appears in “umbrella,” throw with your left hand into the right box. Otherwise, throw with your right hand into the left box.
6. If you can say a word that starts with the letter on the ball, throw with your left hand into the right box. Otherwise, throw with your right hand into the left box.
7. If you can say a word ending with the ball’s letter, throw with your right hand into the left box. Otherwise, throw with your left hand into the right box.
8. If the sum of the number on the ball and 4 is greater than 10, throw with your left hand into the right box. Otherwise, throw with your right hand into the left box.
9. Throw the first ball into the right box and remember its number. For each subsequent ball, if the previous ball’s number was odd, throw the next ball with your right hand into the left box. If the previous ball’s number was even, throw the next ball with your left hand into the right box.
10. If the number on the ball minus 3 is less than 5, throw with your left hand into the right box. Otherwise, throw with your right hand into the left box.

GAME: RIDDLES

Game Objective:

Arrange the balls in sequence and solve math riddles.

How to play:

Place all of the yellow, green, blue, and red balls into the container. Begin by arranging the balls as shown in Fig. 4. Then, read and complete the task using the hand indicated by the “handedness” card.

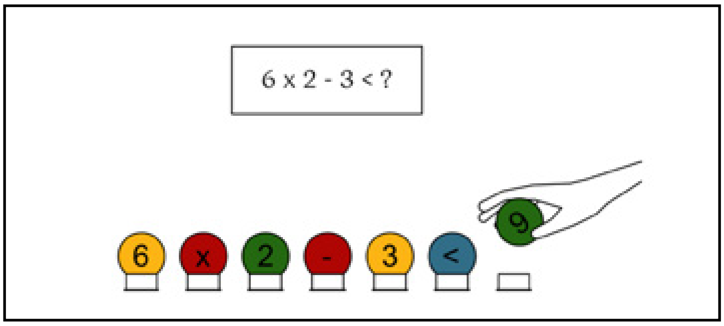

Figure 4. Equipment arrangement and an example task in Riddles

To play you will need:

- yellow, green, blue, and red mini-Eduball balls
- aball storage container
- ball stands (number depends on sequence length)
- cards with ball sequences and riddles
- “handedness” cards

Cards with riddles:

1. Complete the inequality so that it is true.

   8 : 4 + 5 > ?

2. Swap two balls on the stands so that the sum of the numbers on one side is equal to the sum on the other side. The red ball must remain in place.

   0 1 2 2 4 = 8 8 9

3. Add one ball so that the sums on both sides of the equation match.

   2 5 6 7 = 9 8 1

4. Move two balls to the other side of the equation to make it correct.

   6 + 4 × 5 = 6 + 8

5. Complete the equation with the appropriate mathematical signs.

   2 ? 8 ? 2 ? 5

6. Complete the inequality with the appropriate mathematical signs.

   3 ? 8 ? 7

7. Complete the inequality with the appropriate mathematical signs.

   8 ? 2 ? 1 ? 3

8. Complete the equation with the appropriate mathematical signs.

   2 ? 3 ? 6

9. Complete the equation with the appropriate numbers.

   ? + ? : ? = ?

10. Complete the inequality with the appropriate numbers.

    ? × ? < ? : ?

HANDEDNESS CARDS

Handedness cards (Fig. 5) are used to determine which hand should be used for a given task. The cards should be printed in the following quantities: 10 “right hand,” 10 “left hand,” 1 “both hands,” and 1 “choose your preferred hand”. Shuffle the cards thoroughly before using them.

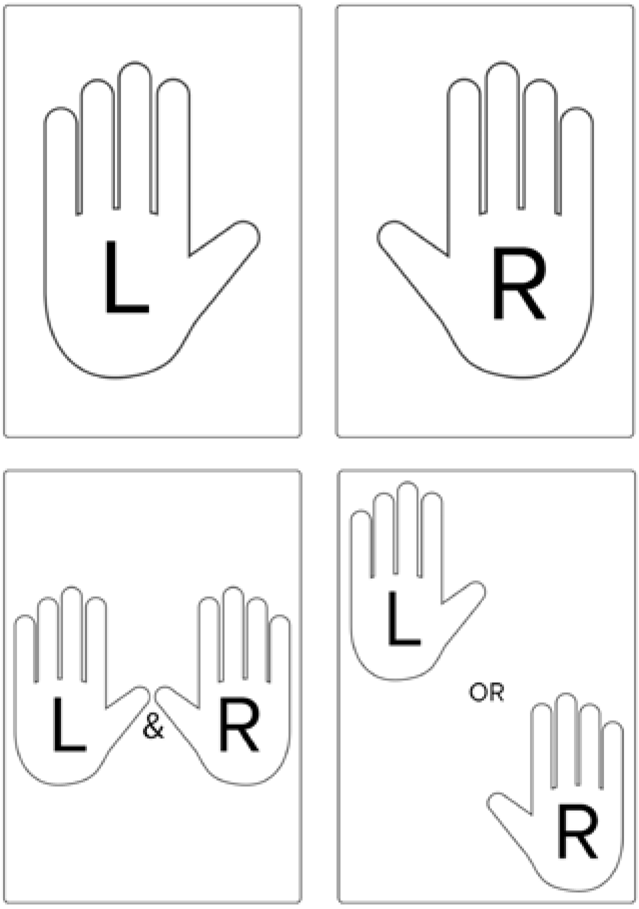

Figure 5. Handedness cards

Summary

This chapter includes 40 new mini-Eduball games which, when considered alongside the 60 previously described in *From EDUballs to mini-EDUballs and BRAINballs. Innovative Learning Tools Integrating Cognition with Gross and Fine Motor Skills* (Rokita et al., 2024), constitute a unified compendium of 100 activities recommended by the originators of the approach. These games are not intended to be implemented in a strictly prescriptive manner; instead, they provide a structured framework upon which educators and practitioners may creatively design tasks tailored to the specific needs of learners or therapeutic contexts.

However, it is essential to preserve the fundamental principle common to all 100 games: cognitive processes must be accompanied by simultaneous manual engagement, and manipulations with mini-Eduballs must invariably be coupled with the activation of neural networks responsible for language and mathematical processing. This principle of simultaneity is the foundation of the mini-Eduball method. The intended cognitive benefits, particularly the stimulation of linguistic and mathematical development, cannot be realized without it.

References

Cichy, I., Kruszwicka, A., Krysman, A., Przybyla, T., Rochatka, W., Szala, E., Wawrzyniak, S., Bronikowski, M., Klichowski, M., Rokita, A. (2022). Eduball as a method of brain training for lower performing students with dyslexia: a one-year experiment in natural settings. *International Journal on Disability and Human Development*, *21*(4), 335-351.

Corballis, M.C. (2010). The gestural origins of language. *Wiley Interdisciplinary Reviews Cognitive Science*, *1*(1), 2–7, https://doi.org/10.1002/wcs.2.

Klichowski, M., Króliczak, G. (2017). Numbers and functional lateralization: a visual half-field and dichotic listening study in proficient bilinguals. *Neuropsychologia*, *100*, 93–109, https://doi.org/10.1016/j.neuropsychologia.2017.04.019.

Kroliczak, G., Przybylski, L. (2024). Handedness and the control of human technology and language. *Humanities and Social Sciences Communications*, *11*, 1457, https://doi.org/10.1057/s41599-024-03985-4.

Kroliczak, G., Buchwald, M., Kleka, P., Klichowski, M., Potok, W., Nowik, A.M., Randerath, J., Piper, B.J. (2021). Manual praxis and language-production networks, and their links to handedness. *Cortex*, *140*, 110–127, https://doi.org/10.1016/j.cortex.2021.03.022.

Rokita, A., Cichy, I., Klichowski, M., Rościszewska, A., Przybyła, T., Wawrzyniak, S., Bronikowski, M. (2024). *From EDUballs to mini-EDUballs and BRAINballs. Innovative learning tools integrating cognition with gross and fine motor skills*. Wroclaw: AWF.

Wawrzyniak, S., Cichy, I., Matias, A.R., Pawlik, D., Kruszwicka, A., Klichowski, M., Rokita, A. (2021). Physical activity with Eduball stimulates graphomotor skills in primary school students. *Frontiers in Psychology*, *12*, 614138, https://doi.org/10.3389/fpsyg.2021.614138.

Barbara Pheloung's Move to Learn Program as a Way to Support Child Development Through Physical Activity

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Introduction

Movement is a sign of fetal vitality in the womb. After birth, newborn movements, especially reflexes, are an important indicator of nervous system maturity. These movements are assessed using the Apgar scale. As children develop, these reflexes gradually disappear and are replaced by more mature posture patterns and voluntary movements within the first year of life. In children with delayed neurological maturation, however, these reflexes may persist longer than usual, signaling an increased risk of developmental or neurological disorders (Sigafoos, et al., 2021). For a pregnant woman, feeling the first movements of the fetus is one of the most anticipated and exciting moments of this important period. Many researchers emphasize the importance of perceiving fetal movements for various aspects of child development, including the assessment of fetal health. Additionally, these movements play a key role in developing the emotional bond between mother and child, particularly in forming attachment. Mikhail et al. (1991) studied 213 women with normal pregnancies and counted their fetal movements between the 28th and 32nd weeks of pregnancy. A month later, when the mothers' attachment to their fetuses was measured using the Cranley Scale, it was evident that counting fetal movements strengthened the bond between mothers and their unborn children. Similar conclusions were drawn by Malm et al.

(2016, p. 4), who studied 456 women. In their study, participants were asked to count fetal movements for 24 hours once a week. The results showed that “the intensity of fetal movements was strongly associated with prenatal bonding.” Feeling frequent fetal movements several times within 24 hours in late pregnancy was associated with higher prenatal bonding scores on all three subscales of the revised Prenatal Attachment Inventory (PAIR).

Fetal movements are unique to each fetus, and their complexity increases as the fetus develops. In some cases, these movements are triggered by reflexes in response to sudden or strong stimuli from inside or outside the mother’s body. Starting at about 25 weeks of fetal development, doctors can observe over 20 types of neonatal reflexes, sometimes up to 70, in children (Rashikij-Canevska & Mihajlovska, 2019; Wang et al., 2025). According to Rashikij-Canevska and Mihajlovska (2019, p. 513), “Many of these reflexes appear subcortically; more precisely, they originate from areas below the level of the cerebral cortex, indicating that they occur without direct involvement from higher brain centers.” These include, among others: “swallowing, breathing, visual and auditory reactions, head movements, hand grasping movements, trunk control, and lower limb movements.” During the fetal period, these reflexes play an important role in preparing the baby to survive outside the mother’s body immediately after birth and for several months thereafter. They “prepare the newborn to move against gravity, gradually leading to voluntary movements in the process of integration in the first months of life” (Rashikij-Canevska & Mihajlovska, 2019, p. 514). The Moro reflex develops around nine weeks after conception and persists until approximately twelve weeks after birth. It serves as a defensive response to potential threats. The Galant reflex develops around the 20th week of pregnancy and usually disappears by the sixth month of life. It supports the development of the child’s vestibular system. Together with the asymmetric tonic neck reflex, it plays an important role during childbirth. Additionally, it contributes to hip joint mobility development, which is essential for mastering crawling and walking (Rashikij-Canevska & Mihajlovska, 2019). The asymmetric tonic neck reflex (ATNR), in turn, significantly impacts the child’s subsequent development and shows a strong correlation with ADHD symptoms, evidenced by a significant relationship with the total CPQ score ($r = 0.59$, $p < 0.01$) (Konicarova & Bob, 2013).

Tonic neonatal reflexes are present at birth and typically persist until around 6–12 months of age. As the nervous system develops during this period, the neonatal reflexes undergo integration, enabling the formation of more complex and mature postural responses. Posture skill development involves the child achieving an increasingly upright posture while minimizing points of support (Adolph & Franchak, 2017). If these reflexes persist during the expected developmental period, they can interfere with overall development, including motor, cognitive, and socio-emotional development. Studies by Goddard-Blythe (1996), Adams and Craft (2014), and Wang et al. (2023) have shown that when primitive reflexes (PR) do not integrate at the appropriate time, they can affect the brain’s ability to process sensory information effectively (Blythe, 1996), leading to motor disorders (Adams & Craft, 2014), as well as cognitive, psychological, and neurodevelopmental problems (Wang et al., 2023).

As time passes and scientific research in the field of neonatal reflexes advances, a growing body of literature indicates a link between persistent neonatal reflexes and neurodevelopmental delays (Niklasson et al., 2017). Babinski's sign (i.e., the plantar reflex) and the grasp reflex have been associated with motor difficulties in later developmental stages (Fiorentino, 1980; Gieysztor et al., 2016), clumsiness (Fiorentino, 1980), awkwardness (Dawson et al., 2018), and learning difficulties in school (Grzywniak, 2010), including dyslexia (McPhillips & Jordan-Black, 2007), ADHD (Konicarova & Bob, 2013), and autism spectrum disorder (Chinello et al., 2018).

The asymmetric tonic neck reflex (ATNR) is one of the reflexes that often persists in children with neurodevelopmental delays. It can cause difficulties with fine motor skills, poor balance and coordination, problems with eye movements and visual tracking, developmental delays, poor hand-eye coordination, muscle weakness or tension, problems with writing or other tasks requiring fine motor skills, poor posture, and difficulties with sports or physical activity (myacare.com). It is believed that an ATNR that persists beyond six months of age interferes with the ability to position the hand for writing and consequently impedes the ability to learn to write properly. According to Futagi, Toribe, and Suzuki (2012), this reflex is of significant clinical importance for the early identification of infants with potential neurodevelopmental disorders. Therefore, normal neurological development, which allows for the maturation of newborn reflexes and the formation of postural responses, is important for children's overall development. But what if a child's psychomotor development does not follow typical patterns, is delayed, or is impaired? Research suggests that we can, especially in cases of neurodevelopmental delays not accompanied by other disabilities. There are many strategies to help children reach their full potential. Many methods for supporting the development of young children involve games and exercises based on movement. In this chapter, we will present one such method that can easily be applied to younger children. This approach can stimulate proper development as a preventive measure and provide support in cases of neurodevelopmental delays.

Move to Learn: Structure, Principles, and Effectiveness of the Program in Supporting the Development of Children with Neurodevelopmental and Educational Difficulties

One effective program is Move to Learn perceptual-motor initiative, which is outlined in the movement program *Ten Gems for the Brain. The Move to Learn Movement Sequences* (Pheloung et al., 2018). The program is designed for children facing developmental and learning challenges. It is particularly beneficial for children who have not fully integrated their early childhood reflexes, as well as those experiencing incomplete or disrupted neurodevelopment. The program can easily be incorporated as a classroom resource. Barbara Pheloung was drawn to this field while looking for ways to support her child, who was struggling more and more at school due to dyslexia. In her book

School Floors (2006), Pheloung shares her experiences and describes the efforts she made with her friend Ivonne Mary (a nun and teacher), occupational therapist Veronica Steer, and teacher Julia Dive. Together, they developed and tested the program's basic principles. The book also includes a detailed description of the first therapy centers they founded, which enabled children in need of support to participate in classes using the MtL program. The theoretical basis of the MtL program focuses on understanding the maturation of the nervous system and its importance in a child's overall perceptual and motor development. Pheloung emphasizes the importance of proper healthcare for children, including limiting antibiotic use and ensuring good nutrition. She highlights the connection between a child's overall health, recurrent infections or allergies, and consuming products with numerous preservatives and colorants (Pheloung, 2006).

However, the primary factor in Move to Learn's stimulation of child development is movement (Pheloung, 2006; Pheloung et al., 2018). The program's exercises are designed to support children's development by mirroring normal movement skills developed during infancy and early childhood. Similar to typical motor development, the program progresses from exercises performed while lying down to exercises involving turning from belly to back to crawling and finally walking upright. The program consists of short sequences of movements intended to be repeated until performed precisely. Accuracy and regularity are emphasized, and daily sessions are recommended (Pheloung et al., 2018). This approach enhances the development of movement skills and the integration of neonatal reflexes, supporting the formation of postural reactions. Repetition is important for improving automaticity and the efficiency of individual movement sequences. The sequence of movements follows the same pattern and order. Pheloung et al. (2006, 2012, 2018, 2019) maintain that this order must be retained because the developmental progress stimulated by each sequence becomes foundational to the next. Progress will be less effective if a "step" is missed or done out of order because the sequence maps how neonatal reflexes become inhibited over time. Recently, however, some have characterized this progression as dynamic rather than strictly hierarchical.

One significant benefit of the program is its ease of implementation in classes with children because it does not require significant financial investments in equipment or specialized teaching aids. Additionally, the ethical use of the program should be emphasized, as its effectiveness has been confirmed by several studies (Olechowska, 2011).

The Move to Learn program consists of a sequence of ten movement patterns repeated multiple times during exercises. This approach improves motor skill development and the integration of newborn reflexes, supporting the formation of postural responses. During the exercises, children focus on one specific movement sequence, which they practice repeatedly. Typically, it takes several sessions for a given movement sequence to become automatic before children can move on to the next stage.

In Poland, the MtL exercises are performed daily for at least five consecutive days per week in kindergarten or school. Although these exercises are typically done in a group, they can be adapted to the needs of one or two children.

The Complete Move to Learn Program Consists of Ten Movement Sequences

1. Body awareness
2. Rolling
3. Gliding on stomach/Tummy curls
4. Unilateral flip flops
5. Cross-pattern flip flops
6a. Stomach crawling
6b. Back crawling
7. Rocking
8. Unilateral crawling on hands and knees
9. Cross-pattern crawling on hands and knees
10. Cross-pattern walking (Pheloung et al., 2018).

In Polish schools, only one sequence of movements from the program is practiced each day. Each sequence is repeated for as many days as necessary for the children to make significant progress. We only move on to practicing the next sequence the following day. This means that different groups of children may practice for different lengths of time. For instance, one group may require ten days to master a sequence, while another group may be ready to advance after five days.

Rather than focusing solely on the number of days, attention should be paid to the children's progress as well as their interest and motivation to practice. Sometimes it is better to leave children slightly dissatisfied than to risk them becoming overexcited and bored with the exercises.

Each class attempts to create a pleasant and motivating atmosphere for the children. It is important that the instructor speaks in a friendly tone, smiles, and avoids comparing children to each other or emphasizing who performs the exercise best. The goal is for each child to discover their abilities, participate in the class, and find their level without feeling pressured or judged.

Pheloung emphasizes that when practicing the movement sequences from the program, all movements should be performed smoothly, rhythmically, and slowly with normal breathing. Each movement must be possible for children to execute and should never cause discomfort or pain. With repeated practice, children will find it easier to correctly perform a movement sequence (Pheloung, 2006; Pheloung et al., 2018;). According to Pheloung, children vary in their skills, so the program is inclusive and adaptable. Some children might be ready to move on to the next level of activities, while others might need adaptations. However, the cohort moves through the program as a unit, so it is the instructor's job to provide accommodations and extensions as appropriate.

A Polish study (Olechowska, 2011) of approximately 250 children aged five to nine years showed that regular exercise has the most significant and immediate effects on social-emotional development, followed by academic performance and writing skills. These results highlight the importance of social relationships and the emotional context in which the exercises are performed.

Warm-up

A short warm-up is necessary before starting a sequence of movements. This is a key element in preparing children for a series of physical exercises. The main objectives are to focus participants' attention and prepare them motorically for appropriate physical tasks (Pheloung et al., 2018). A short set of exercises has been designed to engage the whole body and focus a child's perception and motor skills on subsequent activities.

This set of activities is designed to comprehensively stimulate the child's body and senses. The class begins with calm breathing exercises combined with raising and lowering the arms to activate the chest and prepare the body for movement. This is followed by visual exercises in which the child directs their gaze in different directions and at different distances to improve eye-hand coordination. Next, there may be a gentle face massage (e.g., moving the hands over the cheeks or stretching the lips into a smile), which engages the sense of touch and the facial muscles.

For the general development portion, children perform movements with their limbs and torso that resemble "angels in the snow" while lying on their backs to support muscle strength and flexibility. Simple arm stretches can be included, such as straightening the arms at eye level for a few seconds. Another simple activity involves touching each finger with the thumb alternately — this improves the precision of movement and concentration.

An example of a lower body exercise is smoothly bringing the feet closer together and moving them apart while lying down, touching the toes. This task stimulates the hips and legs. The entire routine can conclude with a rolling exercise in the fetal position with the arms hugging the bent legs while gently rocking on the back. Then, straighten and stretch the limbs along the ground. This variety of activities minimizes monotony and allows you to adapt the warm-up to the abilities of the group and the purpose of the class.

The basic principle to follow during the warm-up and when performing the MtL program movement sequences is to maintain fluid and rhythmic movements. Each movement should be easy for children to perform and should not cause discomfort or pain. With repeated practice, children should find it easier to perform the movement sequences.

After sufficient repetition, children should be able to perform the movements with added difficulty, such as with their eyes closed, reciting the alphabet or a poem, at different speeds, spelling words (also backwards), counting by twos (also backwards), and more.

Developing Postural Control and Locomotor Sequences Through Integrated Rotational Movements in Early Childhood Development

Among the exercises specific to the MtL program, the first sequence of movements is rolling (Pheloung et al., 2018). This involves rotating while lying on your back around the central axis of your body.

In early childhood development, the ability to roll from the back to the side and then to the stomach indicates nervous system and postural muscle maturity. This skill reflects the coordination of movements of different body parts and the independence of limb movements from head movements. This skill prepares children to change body position, sit up, crawl, and walk.

Rolling over requires moving many parts of the body. The head must turn in the intended direction of movement. The arm must straighten and cross the body's midline. The pelvis must move into an oblique position. One side of the body must shorten and the other must lengthen. Both legs must lift off the ground. Interestingly, some children can perform this movement as early as two months of age, according to the Denver Developmental Screening Test, highlighting the complexity of this activity.

Conscious turning usually occurs when a child wants to look at something from a different perspective, when something intrigues them, or when they want to move. This process involves not only locomotor functions but also sight and hearing, as a child may turn in response to their mother's call or out of interest in a toy.

In the Move to Learn program, the rolling exercise involves rolling on the floor with arms stretched above the head and legs straight. This exercise stimulates the vestibular system and can sometimes cause discomfort or dizziness. We must pay attention to such reactions and respond appropriately. If a child feels dizzy, they should stop rolling, stand up, and jump up and down a few times. For the next few days, we should only perform side-to-side head rotations while the child lies on the floor. Then, we can gradually introduce half-body rolls (rolling from your back to your side and back, alternating right and left). Eventually, the child may be ready to perform a few full rolls around their body axis, which will allow them to roll across the exercise room.

Throughout these exercises, the child must maintain control of their movements. This movement typically takes place diagonally across the room, from one corner to the other. The instructor stands in one corner and the children line up in the other corner at a distance. One by one, the children roll perpendicular to the instructor. To stay on course, children should keep their eyes open and consciously align their bodies as they roll. For some children, especially those with neurodevelopmental delays, this can be difficult, requiring many repetitions to master the movement toward the instructor.

Rolling despite these difficulties is an important element in supporting the development of primitive reflex integration, especially of reflexes such as the symmetrical tonic neck reflex (STNR) and the tonic neck reflex (TNR). This activity enhances somatognosis (awareness of one's own body) and proprioception (the ability to recognize the position and movement of one's body in space). While rolling over obstacles, the tactile and vestibular systems—which are responsible for receiving tactile and equilibrium stimuli—are stimulated. Additionally, this exercise strengthens postural muscles and improves the ability to plan and perform precise movements and reposition the body relative to the midline. The combination of rotational movement and the need to control one's body, identify specific body parts, and respond to stimuli is an effective strategy to support children with neurodevelopmental difficulties. It enables them to gradually improve their motor skills and eye-hand coordination (Poli et al., 2024; Siegiel et al., 2024; Wang et al., 2025; Zhang et al., 2024). Examples of challenges include rolling through an obstacle course (e.g., pillows, rollers, mattresses), rolling with eyes closed, and stopping and changing direction on an audible signal (Pheloung et al., 2018).

Walking as an Example of Locomotor Coordination

Alternating gait is the primary movement pattern. Mastering this pattern is associated with proper maturation of bilateral integration and integration of infant reflexes in children. This rhythmic pattern of leg movement enables effective postural stabilization, which is essential for safe movement and adaptation to changing environmental conditions. This pattern supports movement planning, body schema orientation, and conscious movement control. Systematic 64 exercises such as alternating walking, walking through sensory paths, overcoming obstacles, and climbing stairs are closely related to balance development, movement planning, and body coordination. Training on unstable surfaces and changing walking direction activates the muscles that stabilize the torso and improves the adaptive responses of the nervous system. Additionally, activities such as walking to music with knee lifts or manipulating objects with the feet stimulate crossing the midline of the body and support sensory-motor integration. The regular introduction of alternating exercises increases children's overall fitness, preparing them for more complex movements and increasing their independence in everyday life (Błaszczyk, 2024; Poli et al., 2024).

Cross-pattern Walking: Motor Pattern and Functional Significance

The final exercise in the Move to Learn (MtL) program is cross-pattern walking (Pheloung et al., 2018). During this exercise, children walk around a circle while extending one leg forward and pointing to it with the index finger of their outstretched hand on the opposite side of their body. For instance, if a child extends their right leg, they point to it with the index finger of their left hand. If they extend their left leg, they switch hands, moving their left hand behind their back and extending their right hand forward to point to their extended foot with their index finger.

Walking is considered a milestone in early childhood development. Mastering the ability to balance and stabilize the body while bearing weight on straight legs is significant for children and their families. As children learn to walk, they gradually acquire the ability to move independently over long distances. This changes their perception of their surroundings and increases their ability to explore them. However, walking requires mastering several complex sub-skills. Children must develop good coordination, adequate muscle strength, balance, and control of their movements. Before walking independently, children usually first learn to stand up, maintain balance, and shift their weight from one side to the other, often with an adult's help.

In the MtL program's cross-pattern walking exercise, children move forward while pointing alternately to their left leg with their right hand and to their right leg with their left hand (Pheloung et al., 2018). Correctly performing this exercise requires a high degree of eye-hand coordination and balance while moving. Children must coordinate their vision to follow their feet as they disappear and reappear—first the right leg, then the left—while maintaining balance and moving through space. This exercise can also include challenges such as walking at different rhythms or speeds, forwards or backwards, or reciting or counting at the same time.

Summary

The Move to Learn (MtL) program includes the various movement sequences mentioned above, which are described in detail in Barbara Pheloung's methodological publications. These publications are available on the MtL website: www.movetolearn.com.au. Currently, the MtL program is expanding beyond Australia to the United States, China, France, Canada, Japan, Poland, Malaysia, Romania, South Africa, Saudi Arabia, Sweden, Switzerland, Thailand, and the United Kingdom. This international expansion is crucial because children around the world need movement to support their development.

Movement is a key factor in overall physical development and the formation of good posture during childhood. In adulthood and beyond, movement is an important indicator of physical fitness and health, encompassing both physical and mental aspects. Despite the known importance of movement, research by Pica (2008) shows that many educators and early childhood professionals are still hesitant to incorporate movement into daily activities. Perhaps they feel that there is not enough time or space for physical activity during the day. As Hannaford noted, "We have devoted years and many resources to teaching people how to learn, and yet standard achievement test scores are falling and illiteracy is rising. Could one of the key elements we are missing be simply movement?" (Hannaford, 1995, p. 16).

Therefore, we must refocus on movement in child development. Recognizing movement as an essential element of proper child development is crucial, especially in early school education. We must promote physical activity among children, compensate for deficiencies in their motor development during educational activities, and implement various proven, research-based methods and exercise programs. The Move to Learn program is one such method, offering teachers and parents of young children a wide range of opportunities. Movement is essential for children's development and health, so encourage them to be physically active!

References

Adams, Q., Craft, J. (2014). *Retained Primitive Reflexes and ADHD. Examining Atypical Symptomology in the School Aged Population*. Masters thesis. Grand Forks: University of North Dakota.

Adolph, K.E., Franchak, J.M. (2017). The development of motor behavior. *Wiley Interdisciplinary Reviews Cognitive Science*, *8*(1–2), e1430, https://doi.org/10.1002/wcs.1430.

Błaszczyk, J.W. (2024). *Biomechanika kliniczna. Podręcznik dla studentów medycyny i fizjoterapii*. 2nd ed. Warszawa: PZWL.

Chinello, A., Di Gangi, V., Valenza, E. (2018). Persistent primary reflexes affect motor acts: Potential implications for autism spectrum disorder. *Research in Developmental Disabilities*, *83*, 287–295, https://doi.org/10.1016/j.ridd.2016.07.010

Dawson, G., Campbell, K., Hashemi, J., Lippmann, S.J., Smith, V., Carpenter, K., Egger, H., Espinosa, S., Vermeer, S., Baker, J. Sapiro, G. (2018). Atypical postural control can be detected via computer vision analysis in toddlers with autism spectrum disorder. *Scientific Reports*, *8*, 17008, https://doi.org/10.1038/s41598-018-35215-8.

Fiorentino, R.M. (1980). *Normal and Abnormal Development. The Influence of Primitive Reflexes on Motor Development*. Springfield: C.C. Thomas.

Futagi, Y., Toribe, Y., Suzuki, Y. (2012). The grasp reflex and moro reflex in infants: hierarchy of primitive reflex responses. *International Journal of Pediatrics*, 2012, 191562, https://doi.org/10.1155/2012/191562.

Gieysztor, E.Z., Choińska, A.M., Paprocka-Borowicz, M.P. (2016). Persistence of primitive reflexes and associated motor problems in healthy preschool children. *Archives of Medical Science*, *14*(1), 167–173, https://doi.org/10.5114/aoms.2016.60503.

Goddard-Blythe, S. (1996). *Teacher's Window into the Child's Mind and Papers from the Institute for Neuro-physiological Psychology. A Non-invasive Approach to Solving Learning and Behavior Problems*. Oregon: Fern Ridge Press.

Grzywniak, C. (2010). The effect of the form of persistent trace reflexes on school difficulties. *Szkoła Specjalna*, *2*, 98–112.

Hannaford, C. (1995). *Smart Moves. Why Learning Is Not All in Your Head*. Salt Lake City: Great River Books.

Konicarova, J., Bob, P. (2013). Asymmetric tonic neck reflex and symptoms of attention deficit and hyperactivity disorder in children. *International Journal of Neuroscience*, *123*(11), 766–769, https://doi.org/10.3109/00207454.2013.801471.

Malm, M.-C., Hildingsson, I., Rubertsson, C., Rådestad, I., Lindgren, H. (2016). Prenatal attachment and its association with fetal movement during pregnancy: a population-based survey. *Women and Birth*, *29*(6), 482–486, https://doi.org/10.1016/j.wombi.2016.04.005.

McPhillips, M., Jordan-Black, J.-A. (2007). Primary reflex persistence in children with reading difficulties (dyslexia): a cross-sectional study. *Neuropsychologia*, *45*(4), 748–754, https://doi.org/10.1016/j.neuropsychologia.2006.08.005.

Mikhail, M.S., Freda, M.C., Merkatz, R.B., Polizzotto, R., Mazloom, E., Merkatz, I.R. (1991). The effect of fetal movement counting on maternal attachment to fetus. *American Journal of Obstetrics and Gynecology*, *165*(4 Pt 1), 988–991, https://doi.org/10.1016/0002-9378(91)90455-Z.

Niklasson, M., Norlander, T., Niklasson, I., Rasmussen, P. (2017). Catching-up: children with developmental coordination disorder compared to healthy children before and after sensorimotor therapy. *PLOS ONE*, *12*(10), e0186126, https://doi.org/10.1371/journal.pone.0186126.

Olechowska, A. (2011). Move to Learn Programme in Polish educational practice: results of pilot studies in 2008–2010 as part of project Methods of Neurodevelopmental Retardation Therapy of Children in Pre-School and Early School Age financed with resources assigned to own studies of The Maria Grzegorzewska Academy of Special Education. In: E.M. Kulesza (ed.), *Movement, Vision, Hearing. The Basis of Learning* (pp. 165–186). Warszawa: The Maria Grzegorzewska University.

Pheloung, B. (2006). *School Floors. Effective Perceptual Movement Programs for Your Classroom*. Iceform Pty.

Pheloung, B. (2019). *Help Your Class to Learn. Effective Perceptual Movement Programs for Your Classroom*. Griffin Press.

Pheloung, B., King, J. (2012). *Overcoming Learning Difficulties*. Doubleday.

Pheloung, B., Steer, V., Dive, J. (2018). *Ten Gems for the Brain. The Move to Learn Movement Sequences*. Murwillumbah: Move to Learn.

Pica, R. (2008). *Physical Education for Young Children. Movement ABCs for the Little Ones*. Champaign: Human Kinetics.

Poli, F., Meyer, M., Mars, R.B., Hunnius S. (2025). Exploration in 4-year-old children is guided by learning and curiosity-driven movement. *Child Development*, *96*(1), 191–202, https://doi.org/10.1111/cdev.14158.

Rashikij-Canevska, O., Mihajlovska, M. (2019). Persistence of primitive reflexes and associated problems in children. *The Annual of the Faculty of Philosophy in Skopje*. *72*(22), 513-522.

Siegel, D.N., Siddicky, S.F., Davis, W.D., Mannen, E.M. (2024). Mechanical environment influences muscle activity during infant rolling. *Human, Movement, Science*, *95,* https://doi.org/10.1016/j.humov.2024.103208.

Sigafoos, J., Roche, L., O'Reilly, M.F., Lancioni, G.E. (2021). Persistence of primitive reflexes in developmental disorders. *Current Developmental Disorders Reports*, *8*(2), 98–105, https://doi.org/10.1007/s40474-021-00232-2.

Wang, M., Yu, J., Kim, H.D., Cruz, A.B. (2023). Attention deficit hyperactivity disorder is associated with asymmetric tonic neck primitive reflexes: a systematic review and meta-analysis. *Frontiers in Psychiatry*, *14*, 1175974, https://doi.org/10.3389/fpsyt.2023.1175974.

Wang, M., Yu, J., Li, H., Zhao, C., Li, Y., Yang, X. (2025). Development of the children's primitive reflex integration assessment scale. *Frontiers in Psychology*, *16*, 1495990, https://doi.org/10.3389/fpsyg.2025.1495990.

Zhang, D., Soh, K.G., Chan, Y.M., Feng, X., Bashir, M., Xiao, W. (2024). Effect of functional training on fundamental motor skills among children: a systematic review. *Heliyon*, 10(23), e39531, https://doi.org/10.1016/j.heliyon.2024.e39531.

LESSON PLAN 1

Lesson Element	Description
Lesson Topic	Rolling: In the World of Moving Balls
Age Group	Children aged 5-9 (in groups with varied developmental levels, tasks should be adjusted to children's psychomotor abilities)
Duration	20–25 minutes
General Objectives	• Supporting the integration of primitive reflexes, particularly the Symmetrical Tonic Neck Reflex (STNR) and the Tonic Neck Reflex (TNR). • Promoting the development of somatognosia, i.e. awareness of one's own body, and proprioception, understood as the perception of one's body. • Stimulating the tactile and vestibular systems, responsible for processing touch and balance stimuli. • Strengthening postural muscles. • Improving motor planning skills, movement precision, and spatial orientation. • Crossing the body's midline.
Specific Objectives (Learner)	• Can perform a rotational body movement in a lying position. • Can maintain the correct body position while performing the exercise. • Identifies selected body parts during rotational movement. • Can differentiate and respond appropriately to tactile and vestibular stimuli during changes of body position. • Can carry out and modify a movement sequence based on the teacher's instructions. • Coordinates vision and motor activity depending on the task. • Can perform a task crossing the body's midline.
Teaching Methods	Play method, task-based method, modelling and movement imitation method
Organizational Forms	Group work with individual adjustment of difficulty

Teaching Aids	Large hall, gym mat, ball/balls
Lesson Procedure	1. **Greeting and introduction (2-3 min)** • The teacher briefly presents the topic and aim of the lesson: “Today we will move like real balls, rolling in different directions.” Demonstration of the movement on a ball. 1. **Warm-up (6-8 min) — according to Move to Learn program guidelines:** • Inhale and exhale with hands placed on the stomach. • Eye movements (up-down, side-side, circles, near-far). • Cheek rubbing (up-down-circular movements). 1. **Main part — rolling (10-12 min)** • Children line up. The teacher demonstrates the exercise: the child lies on their back on the gym mat, with arms stretched overhead, then rolls from one side to the other. • The next stage is to lie on the stomach and repeat the rolling movement in this position. • Additionally, in later repetitions, the child alternates the starting point — initiating movement with one chosen arm or leg, and next time switching sides and starting with the opposite limb. 1. **Ending and calming down (2-3 min)** • Children lie on the gym mats and perform breathing exercises (calm inhale and exhale).
Methodological Notes	As this exercise strongly stimulates the vestibular system, it may cause dizziness or nausea. If such symptoms appear, the exercise should be stopped immediately and the child should perform a few jumps. In the following days, it is recommended that the child makes gentle head movements to the right and left. If a child refuses to take part, their decision should be respected. The exercise should be performed with eyes open.
Evaluation	Observation: direction, smoothness and control of movement, response to instruction, crossing the body’s midline, somatognosia, and visual-motor coordination.

LESSON PLAN 2

Lesson Element	Description
Lesson Topic	Track Challenges
Age Group	Children aged 5-9 (in groups with varied developmental levels, tasks should be adjusted to children's psychomotor abilities)
Duration	20-25 minutes
General Objectives	• Supporting the integration of primitive reflexes, particularly the Symmetrical Tonic Neck Reflex (STNR) and the Tonic Neck Reflex (TNR). • Promoting the development of somatognosia, i.e. awareness of one's own body, and proprioception, understood as the perception of one's body. • Stimulating the tactile and vestibular systems, responsible for processing touch and balance stimuli. • Strengthening postural muscles. • Improving motor planning skills, movement precision, and spatial orientation. • Crossing the body's midline.
Specific Objectives (Learner)	• Can perform a rotational body movement in a lying position. • Can maintain the correct body position while performing the exercise. • Identifies selected body parts during rotational movement. • Can differentiate and respond appropriately to tactile and vestibular stimuli during changes of body position. • Can carry out and modify a movement sequence based on the teacher's instructions. • Coordinates vision and motor activity depending on the task. • Can perform a task crossing the body's midline.
Teaching Methods	Play method, task-based method, modelling and movement imitation method
Organizational Forms	Group work with individual adjustment of difficulty
Teaching Aids	large room / gym hall; gym mat; ball(s); colored discs or beanbags; cones; bubble wrap

Lesson Procedure	1. **Greeting and introduction (2–3 min)** • The teacher briefly explains the topic and goal of the lesson: • "Today, just like last time, we will move like real little balls, rolling in different directions. But this time, we'll have to overcome some obstacles!" 1. Warm-up (6–8 min) — according to the Move to Learn program guidelines: • Inhale and exhale with hands placed on the stomach. • Eye movements (up-down, side-side, circles, near-far). • Cheek rubbing (up-down-circular movements). 1. **Main part — rolling (10–12 min)** • Children line up. One by one they lie on their back or stomach on the gym mat, arms stretched above the head. Each child is asked to complete two of the prepared exercises: • **Magic Ball** — the child holds a small ball in their hands and rolls without letting it drop. • **Magic Treasures** — the child picks up a beanbag from one hoop and, by rolling, carries it to the next hoop. They begin either on their back or stomach. • **Twin Balls** — two children lie side by side on separate mats and roll at the same time, trying to keep the same rhythm. • **Ball Slalom** — the child rolls while avoiding cones placed along the track. • **The Path** — different textures (bubble wrap, rubber mat, rehabilitation roller) are placed on the floor. The child rolls so that each turn ends on a new surface. 1. Ending and calming down (2–3 min) • Children lie on the gym mats and perform breathing exercises (calm inhale and exhale).
Methodological Notes	As this exercise strongly stimulates the vestibular system, it may cause dizziness or nausea. If such symptoms appear, the exercise should be stopped immediately and the child should perform a few jumps. In the following days, it is recommended that the child makes gentle head movements to the right and left. If a child refuses to take part, their decision should be respected. The exercise should be performed with eyes open. Children should be encouraged to roll on both sides and to start movements with different limbs.
Evaluation	Observation: direction, smoothness and control of movement, response to instruction, crossing the body's midline, somatognosia, and visual-motor coordination.

LESSON PLAN 3

Lesson Element	Description
Lesson Topic	Cross-Pattern Walking: Harmony of Body and Mind
Age Group	Children aged 5-9 (mixed developmental levels – modifications possible for younger or older children depending on psychomotor development)
Duration	20-25 minutes
General Objectives	Support the integration of primitive reflexes, particularly the Asymmetrical Tonic Neck Reflex (ATNR). Improve bilateral coordination, balance, and body schema awareness. Develop attention span, movement control, and motor memory in dynamic conditions.
Specific Objectives (Learner)	Completes a full warm-up preparing the musculoskeletal and nervous systems for exercise. Maintains correct posture during the activity. Uses an alternating movement pattern (hand-opposite leg). Maintains balance while moving. Responds to the teacher's cues to change pace, direction, or add extra tasks. Can focus on the task and maintain smooth movement flow.
Teaching Methods	Play-based method with elements of friendly competition; task-based method; demonstration and guided imitation; developmental movement approach
Organizational Forms	Group work with individual adaptation of difficulty level
Teaching Aids	Open space (indoor hall or safe outdoor area), marked lines/path (tape or rope), optional rhythmic music, floor markers

Lesson Procedure	**1. Greeting and introduction (2-3 min)** Briefly explain the aim of the lesson - "Today we will practice a special walk that helps improve balance, memory, and coordination of the whole body." Remind children about safety rules (no running, keep safe distance). **2. Warm-up (6-8 min)** according to Move to Learn program guidelines: Breathing in and out while raising and lowering straight arms. Eye movements (up-down, side-side, circles, near-far focus). **1. Main Activity — Cross-Pattern Walking (10-12 min)** Arrange participants in a circle or along a path. Demonstrate: step forward with the right foot, touch it with the left hand; alternate. Practice at a slow pace, then gradually increase speed. More challenging variations: walk backwards, close eyes, count aloud or recite a rhyme, change pace on a signal. Monitor posture and movement smoothness. **4. Cool-down and relaxation (2-3 min)** March in place slowly, take deep breaths, relax arms and legs.
Methodological Notes	This activity supports integration of primitive reflexes, particularly ATNR, which enhances visual-motor coordination, balance, and readiness for school tasks. Always start with a complete warm-up. Adjust the exercise pace to individual abilities. Avoid direct comparisons - each child works at their own pace. Ensure the space is free from obstacles.
Evaluation	Observation: movement smoothness, correct alternating pattern, ability to maintain balance, reaction to changes in pace/direction, level of concentration.

The Crispiani Method

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Introduction

Even though schools have traditionally focused on cognitive aspects while underestimating the importance of experiential learning, learning through movement has been a constant theme in educational research (Kolb, 2014). However, the body and movement represent primary sources for the construction of thought and metacognitive processes in a continuous, circular relationship. The Embodied Cognition paradigm (Shapiro, 2019), inspired by phenomenology, redefines humans as psycho-physical entities in which body and mind are fundamentally and inseparably intertwined.

In neuroscience, Rizzolatti and colleagues' discovery of mirror neurons profoundly reshaped the conception of the motor system in relation to cognition and learning (Rizzolatti, 2015). These neurons are activated when an action is performed or observed. Therefore, action and perception can no longer be considered separate modules, but rather parts of the same integrated system. This discovery confirmed the connection between motor, cognitive, and emotional processes, shifting the understanding of the motor system from merely executing movements to being a central component of learning.

Thus, body and movement are essential to the development of emotional and relational skills, as well as learning processes. They facilitate the development of first-order conceptual representations, or experiential representations, which precede and support the formation of second-order cognitive representations, or abstract representations (Damiani & Ascione, 2018). Dewey and Montessori anticipated these ideas in pedagogy, both emphasizing movement as the primary driver of learning across domains.

Movement involves change, transformation, experimentation, ability, confrontation, and encounter, not just action. Moving means participating, smiling, playing, and sweating. According to Moliterni, individuals develop knowledge and competence related to the representation of time and space, lateralization processes, and cognitive functions through action and manual activity (Moliterni, 2013). Therefore, cognition emerges from the constant interplay of the body, environment, motor activity, emotion, and perception. Cognition concerns the coordinated organization of human actions according to parameters such as sequence, spatial-temporal order, simultaneity, coordination, and control.

Dewey also argued that conscious states tend to manifest in action. Neglecting this principle causes inefficiency and wasted energy in schoolwork. Reason, he said, is essentially the law of ordered and effective action (Dewey, 1950). From both an epistemological and a pedagogical perspective, Arnold (2002) has also highlighted the relevance of movement, defining it as "intentionally educational action." Arnold attributed a threefold value to movement: as specific knowledge (in), as an object of study and analysis (about), and as a means of constructing and developing other forms of knowledge (through).

Therefore, movement in school is not confined to physical education classes or their traditional settings. Instead, it becomes a guiding principle for preventive, habilitative, formative, and transformative actions, contributing to the development of knowledge, relationality, and the humanity of each individual.

Within this framework, the Crispiani Method positions itself as a preventive, habilitative, and formative approach. In a classroom setting, it can be a valuable resource for each child's psycho-physical, emotional, and relational development.

Polysemy of the Crispiani Method

A necessary premise for understanding the cultural and logical configuration of the *Crispiani Method* is a clarification of the very concept of method.

Since the earliest expressions of human thought, reflection has addressed critical issues concerning the ways and forms of organizing thinking. This inquiry gave rise to a speculative field later termed *epistemology*. Epistemology is a complex construct often equated, particularly in the Anglophone world, with *gnoseology* (James Frederick Ferrier[1], 1856) but, in its broader cultural sense, it refers to critical thought and non-absolute forms of knowledge: a *logos* about *episteme*. It may thus be associated with metathought or metaphilosophy.

Already in classical Greek philosophy, epistemology denoted the critical study of the criteria, foundations, and origins of scientific knowledge, as well as its modes of manifestation across time and cultures. It represents a *regulatory evolution* of thought, broadly inscribed within the philosophy of science. In the 19th century,

1 Scottish philosopher (1808-1864).

however, epistemology underwent a semantic expansion, intersecting with other conceptual frameworks, particularly in analytic philosophy and the works of the Vienna Circle (Carnap, 1966).

Within this context, the paradigm of *method* already present in classical scientific and epistemological traditions reemerged and developed along a trajectory that progressively diversified its meanings. From Greco-Latin sources, the term denotes "the path to follow" (*metà-hodòs, methodikè tékne*), later appearing in Vitruvius as *methodus* or *methodica ars*, and in Quintilian, primarily in relation to scientific thought, research, and any purposeful activity.

Despite theoretical elaborations that underscored the uncertainty of knowledge—as highlighted by Descartes in his *Discourse on the Method,* which proposed "methodical doubt" as a strategy of inquiry—the concept of method was for a long time associated with prescriptive and regulatory meanings, as in Comenius's *The Great Didactic*.

In scientific and professional domains, especially in relation to the analysis of mental processes, the notion of method—variously expressed as methodology, methodical approach, school of method, etc.—has shaped strategic options or styles of thought: scientific, analytical, synthetic, inductive, deductive, dialogical, intuitive, comparative, maieutic, experimental, geometric, and so forth. In all cases, method referred to a logically sequenced, predetermined procedure made up of planning, rules, prescriptions, and technical rigor, to be respected and executed according to a model.

Great educational and scholastic experiences and theories have suffered the same fate as professional conduct, which is systematically organized according to planned methods and timelines, pursued in a linear fashion and divorced from the profound meaning of its proposed training practices. This has led to the improper attribution of methods to J.M. Itard and E. Seguin, F. Froebel, O. Decroly, R. and C. Agazzi, M. Montessori, A.S. Makarenko, G. Mialaret, R. Dottrens, R. Steiner, R. Feuerstein, and others.

Of extraordinary importance is Maria Montessori's reflection on *method*, which aimed to define its meaning and authenticity beyond generalized procedures. Montessori argued that every science requires its *own method*. For experimental pedagogy, this meant striving to "render the mind virgin so that it may proceed without obscuring obstacles [...] we must therefore not start, for example, from preconceived ideas about child psychology, but with a methodical that [...] establishes the method proper to experimental pedagogy. [...] My present study deals precisely with this [...] and result from my own experiences [...]." (Montessori, 1970, p. 21)[2].

A similar inclination toward an autonomous and authentic configuration of method in education, different from pre-established models, was later articulated in the 1970

2 Original quote: "rendere vergine la mente perché possa procedere senza ostacoli oscuranti [...] non dobbiamo quindi partire, per es., da idee prestabilite sulla psicologia infantile, ma da una metodica che [...] stabilire il metodo proprio della pedagogia sperimentale [...]. Il mio presente studio tratta appunto [...] risulta da mie esperienze [...]".

Richmond Report (Richmond, 1974), which stressed the importance of experiential foundations derived from direct observation of students' responses.

Alongside broader cultural and epistemological developments of the 20th century, which moved science and thought away from claims of absolute knowledge and scientistic rationalism toward critical, relativist, fallibilist, and postmodern perspectives, method came to be reconceived in relation to "practices," "good practices," contextualized procedures, and subjective or intersubjective conduct.

The same tendency is also evident in the field of pedagogy, which reveals educational and didactic awareness shaped by procedures that are increasingly contextualized and shared, and sensitive to the situations and subjectivities inevitably present in educational relationships. In this regard, several broad theoretical reflections have been particularly significant. The French epistemologist and pedagogue G. Mialaret, for instance, points out that a *method* makes use of techniques but cannot be reduced to them; on the contrary, it requires a clear distinction: an educational method is a more or less structured and coherent set of intentions and implementations directed toward explicitly or implicitly stated goals. Conversely, he suggests that a *technique* consists of a more or less coherent set of tools, materials, and procedures and may therefore have an end in itself or be applicable to different pedagogical methods. At the same time, Mialaret acknowledges that method, technique and didactic procedure are sometimes difficult to distinguish from one another (Mialaret, 1970).

The most comprehensive reconfiguration of the paradigm of *Method* can be identified within the *culture of complexity* and in the foundational works of Edgar Morin, beginning with his pursuit of a renewal of the *Method* of thought and of the sciences, articulated in the six volumes of *The Method* (Morin, 2002) and further elaborated throughout his prolific subsequent production (In *The Method*, the French epistemologist conceives of mental functioning as approaching complexity by seeking to grasp its infinite variations and the mystery of the natural world, thus exploring the dense interrelations between order, disorder, and organization, where subjectivity and intersubjectivity converge alongside transdisciplinary thinking and the contextualization of phenomena. Every human act is in fact related to the knowing subject and to the culture to which that subject belongs, thus simultaneously reflecting specificity and diversity. Central to this perspective is a conception of knowledge itself as a complex human function, called to know itself and the very nature of knowing, since the complexity of every phenomenon and every cognitive act always includes contradictions and the subjectivity of the actors involved a reintegration of the observer.

The Morinian method is therefore a journey, valuable when it encourages us to leave the path, to sense the air to the right and to the left, to move in circles, and to open ourselves to the elaboration of ideas. Unlike a set of recipes aimed at a fixed goal, as in a predetermined program, Morin presents the method as a way of confronting disorder and complexity in the presence of chance and uncertainty, of ignorance and confusion, thus "the method as a journey," as the thinking activity of living thought, not an abstract one. Furthermore, complex thought integrates, within its understanding of method, the experience of wisdom (Morin, 2003).

Along a different trajectory, the Italian scholar Franco Bertoldi captures the profound significance of an educational action that is lived and contextualized, open to uncertainty, and *designed* rather than rigidly preplanned (Bertoldi, 1971). Likewise, a broad movement of rethinking the constitutive logics of *Method* emerges in the transition away from taxonomic and linearly programmed didactic practices toward more contextualized and reflective approaches, often described as *clinical* (Crispiani & Serio, 1996).

The question of *Method* is thus fraught with critical issues and centrally concerns the scientific status of the processes enacted by human beings. It is therefore not neutral but necessarily engages the planes of thought and deliberate human action in advance (Goria, 2021).

In the case of the **Crispiani Method**, the adoption of the category of *Method* is grounded on a platform of principles and forms of awareness shaped by complexity and a clinical orientation, presenting itself as a body of indicators which, while expressing a coherent theoretical framework, suggest and guide practical and organizational solutions. Paying evident tribute to Montessori culture and its bio-psycho-pedagogical consistency, the following key tenets stand out:

- An organic, personological, and ecological conception of human nature;
- A dynamic and interactive conception of development and education;
- A primarily praxical-motor perspective on behavior;
- A view of education as a *Helping Relationship* (Relazione di Aiuto, RdA);
- Constant attention to overall developmental processes (*assessment*);
- Careful, reasoned design of environments and working materials;
- The valorization of the three subjectivities involved in every process: the educator, the learner, and the context;
- Prior knowledge of the competences/functions of subjects in education ("to know in order to educate");
- Attention to the case-specific and the unpredictable;
- The decision-making autonomy of the conductor of the educational process;
- The plurality and flexibility of proposed practices;
- The systematic use of neuroactivation and the cognitive-motor condition (CMT).

Owing to its realistic and consistently reasoned nature and vocation, the Crispiani Method is characterized as an Empirical-Semiotic Method (Crispiani, 2011).

In line with the pedagogical indicators outlined above, the construction and validation of a method require at least three foundational assertions:

1. The Method constitutes a coherent theoretical framework;
2. The practice of the Method generates selected experiences in constant critical interaction with the theoretical framework, serving as a source of conceptual and practical dialectics;

3. The professional of the Method (teacher, therapist, trainer, tutor, educator, mediator, coach) assumes design and decision-making autonomy and is configured as a Conceptual Therapist or Conceptual Trainer.

Conceptual Framework

Anthropology

Due to its theoretical nature, as an expression of conceptions and cultures, the Crispiani Method is grounded in a complex and organically oriented system of views concerning the main actors of educational processes. This foundation originates from an active and neurobiological vision of the human being, which constitutes its anthropological framework of reference.

Human beings, together with the overall developmental process that accompanies and sustains them, attributes a particular centrality to the wholeness of the person and to their expressive modalities. This is defined as ecology, or an "ecological approach," which reflects both a Theory of Personality and an Anthropology referring to the conceptual vector of the Bio-Psycho-Social Structure of personality (APA, 1992), or, in its operationalist variant, the Bio-Psycho-Operant Structure (Crispiani, 2001). This framework constitutes an organic and corporeal platform upon which the person and their behavior are based. At the same time, while acknowledging the equal ethical and civic value of the social and cultural dimensions of the individual, and therefore a shared ontology of the person, it is assumed as a Praxico-Motor Theory (PMT).

Human beings and their behavior are thus deeply rooted in the *corporeal dimension* which, together with *movement*, represents the biological foundation upon which all systems of the human organism converge according to a fundamental principle of evolutionary co-occurrence. As a result, the development of the body-movement dimension and the overall development of personality are characterized by an *optimal correlation index* (*factor K*), particularly during childhood.

Cognitivism and Cognition

From its origins in classical idealism, and subsequently in 18th-century rationalism, Hegelian idealism, and the major theorization of mental processes developed between the late 19th and early 20th centuries first in Europe (Gestalt-theorie, Decroly, Claparède, Piaget, Vygotskij, Szeminska, Inhelder, Sinclair, Feuerstein, etc.) and later in the United States (Bruner, Neisser, Chomsky, Ausubel, Dennett, etc.) there emerged a conception of human action and of the functional development of the person. This conception reaffirms the centrality of thought as the primary factor responsible for individual conduct, beyond the presumed primacy of genetic or perceptual-experiential components advanced in other theoretical frameworks.

In line with the earlier tradition of *educational activism*, the idea takes hold of "an active and plastic conception of the mind (thought, intelligence, cognitive processes) and of its expressions (culture, languages, behaviors) [that] constitutes the background of awareness upon which, by reconnecting the most grounded scientific connections with philosophical rationalism on the one hand and with psychological cognitivism on the other, a relatively new vision of both mental work and of educational and therapeutic procedures took shape in the second half of the twentieth century" (Crispiani, 2004, p.11)[3].

Appropriately described as a *paradigm*, this framework is a multifaceted cultural background supported by a broad architecture of notions which, over time, were linked to thought and the mind, and only later articulated as *cognitivity*, *cognition*, *cognitive sciences*, and *cognitivism*. It is therefore a complex and multifaceted phenomenon, marked by multiple criticalities but also by partial associations with other theoretical models. Emerging in the 1920s–1930s, it reached a more widely accepted formalization only in 1956 with Neisser's proposal, which marked in a striking and unequivocal manner the dismantling of the behaviorist paradigm (Filograsso, 1998).

Human action is always mediated by the individual mind and by cultural affiliations, and thus by forms of communication as well as by processes of constructing and deconstructing concepts and knowledge. In this sense, *cognition* expresses the coordinating and organizing activity exercised by the mind in regulating human existential functions—motor, perceptual, of thought, of communication, relational, and so forth. The *cognitive function*, distinct from the intellectual function, acts as the mediating agent (interactive, constructivist, equilibrating) of the relationship with environments and of adaptation processes.

In the same period, though unevenly, both brain and mind began to be inscribed within the human organic platform, on par with other organs and functions, all imbued with corporeality. This development led to overcoming the remnants of the classical idealist separation between body and spirit, as well as the subsequent Cartesian dualism between body and mind, in favor of the unity of individual existence between organic and psychic, structures and functions, brain and mind, captured in the powerful image of the *embodied mind* (Gomez Paloma, 2013; Siegel, 2013).

The *cognitivist paradigm* thus encompasses a wide range of indicators of professional practice oriented in a cognitivist sense:

1. Reference to the mind as the primary source of behavior;
2. Mind-brain relationship;
3. Corporeal nature of the mind (*embodied*);
4. Human capacity to produce mental representations;

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3 Original quote: "una concezione attiva e plastica della mente (pensiero, intelligenza, processi cognitivi) e delle sue espressioni (cultura, linguaggi, comportamenti) [che] costituisce lo sfondo di consapevolezze sulle quali, ricucendo le più fondate connessioni scientifiche con il razionalismo filosofico per un verso ed il cognitivismo psicologico per l'altro, nella seconda metà del 900 prende forma una visione tendenzialmente nuova sia del lavoro mentale che delle procedure educative e terapiche.

5. Qualitative development of the mind;
6. Distinction between learning and knowledge;
7. Distinction between intellectual and cognitive functions;
8. Knowledge as construction;
9. The mind's metacognitive capacity;
10. The mind's self-regulatory capacity;
11. Autopoietic functions of mind and brain;
12. Social/cultural nature of knowledge;
13. Human thought as "strategy";
14. The "subjective" and "social" nature of knowledge.

The body of these indicators thus remains central to the conception of the processes of personal development and to the practices of prevention, functional diagnosis, habilitation planning, teaching, and education in general, as emphasized in the *Crispiani Method*. This conceptual framework is also substantiated by a qualified set of studies and publications within scientific networks in collaboration with universities in Poland (Crispiani, 2012, 2014, 2015, 2016, 2023, 2024).

Cognitive-Motor Training

Long intuited through reflection on human behavior, and within the renewed perspectives on the unity of body and mind (nature and culture), this construct indicates the radical interaction between cognitive processes and motor activity. The *Cognitive-Motor paradigm* was first defined and developed within the French schools of neuropsychology and psychomotricity. However, it was only in the early 2000s that the two vectors began to converge and give shape to a new construct defined as *Cognitive-Motor Training*, which also finds some earlier precedents in American works of the 1950s.

Motricity in all its manifestations (physical, mental, verbal, perceptual, emotional) and *cognitivity* (organized and coordinated action) constitute a bio-psychic unity that regulates the entire intentional behavior of the individual, with particular relevance of the pluri-motor, senso-motor, verbo-motor, ideo-motor synergies and synesthesias, as well as of spatio-temporal organization, upon which correct human action is based. This functional association between motor and cognitive dimensions is not new to multilateral international research (Crispiani, Palmieri, 2019) and has been further traced to cerebral loci and related neurophysiological processes: basal ganglia, frontal lobes, cerebellum, inter-hemispheric connections, axonal drive, connective tissues, hypo-/hyper-connectivism, etc.

Connected within the neuromotor network, movement and *cognitivity* regulate each other from the earliest sequential coordinations related to feeding (sucking, swallowing, breathing), which in fact require the function of *timing* as the coordinated and successive unfolding of actions. From this derives the indicator of the *sequential* or *procedural*, today associated with many behavioral disorders.

Anomalies in cognitive and motor behavior can generate delays, disorders, or disorganizations affecting:

- Environmental exploration;
- Learning and knowledge;
- Neuroactivation (self-control, self-inhibition, *self-regulation*);
- Impulse control;
- Active and passive verbal function;
- Ordered mental functions.

From personal research and from the analytical comparison of neuroscientific observations, a conceptual framework and set of professional practices have taken shape, progressively and insistently linking the cognitive and the motor dimensions in a regime of automatic reciprocity and functional synergy. Out of this emerges, following the model of *synergetics* (Haken, 1985), a third functional product, a new configuration and progressive development, which we define as *cognitive-motor*. In educational practices, this reveals intense functional enhancements of an automatic, dynamic, and overlapping nature, also referred to as *dual-task* and *multi-task*.

The training conducted in this sense consists of a coherent set of intensive educational practices with a praxic-motor foundation, involving mental activity with a primary focus on:

- Ideo-motor effectiveness (ideation);
- Readiness of initiation;
- Executive fluency;
- Prompt *self-regulation, self-evaluation*, inhibition;
- Verbal readiness;
- Constant comprehension of the meaning of action;
- Global thinking and whole-part relation;
- Emotional *self-control*

Research and Experience

Framework

Scientific inquiry always originates from prior experiences, hypotheses, and intuitions — personally experienced and critically reflected upon — before being influenced or distracted by external documentation or existing literature. Such sources should be consulted and evaluated only after the necessary comparison of contexts, theoretical assumptions, and, no less importantly, the appropriate translation of terms[4].

In our case, the groundwork lies in extensive teaching practice within preschools and primary schools; in-depth didactic experience; analysis of developmental processes

4 Words or expressions of Anglophone origin that have been introduced into Italian literature in an inaccurate way: phonological, disorder vs. deficit, fluency vs. speed, learning vs. knowledge, cognitive, etc.

and developmental diversity; and, in a closely related area, experience with developmental disorders and disabilities in their various forms, alongside the author's own scientific training.

Issues related to acquiring reading, writing, and mathematical thinking skills form a clear central focus in research on early childhood, drawing on a plurality of sources and contextual frameworks and following a process recognizable as Action Research (AR). The contextual frameworks include:

- Scientific and professional studies on the physiology of mental processes (e.g., how we walk, read, calculate);
- Scientific and professional studies on the diversity or pathology of mental processes (e.g., why one walks poorly, reads poorly, calculates poorly, etc.);
- Methods, procedures, and didactic styles;
- Contemporary conditions of childhood;
- Didactic, habilitation, rehabilitation, and training practices, both individual and group-based;
- Intensive preventive or habilitation practices (intensive treatments, day or residential camps, etc.).

Clinical experience and the significant functional improvements achieved in professional and school settings are also supported by at least three more formalized and already published studies:

1. The School in Motion Project
2. The Three-D Correlations Study
3. The Neuromotor Correlates and Reading Speed Study.

The School in Motion Project

Originating from an initial experience in Swiss schools committed to enhancing motor activities, the *Lo Scoiattolo*[5] Project was later developed in Italy, engaging primary schools in the Marche Region. Its focus was on the correlations between motor activation and school-based learning and cognitive processes, based on the idea that the orderly and systematic activation of motor actions engages the individual neuromotor system and strengthens its performance. This, in turn, generates functional gains that benefit a set of abilities commonly referred to as *executive functions* and further realized in the enhancement of the essential — and at times critical — function known as *neuroactivation*.

This approach builds upon a conceptual and terminological framework now widely recognized, highlighting the strong correlation between general neurophysiology and movement. It emphasizes the enhancement of overall electrophysiological activity within the human body, particularly at the cerebral level, aligning itself with the best traditions

5 Organized by the Italian Sports Center (CSI), CSI Marche Region, CONI Marche. Scientific Director: Piero Crispiani. In collaboration with Eleonora Palmieri, Roberta Mininno, and Ilaria Vella.

of psychomotricity, neuropsychomotricity, cognitivism, and constructivism and, consequently, with a holistic and integrated view of the person's developmental process.

Central to the *School in Motion* format is a broad set of motor practices, including:

1. Motor activity;
2. Motor play;
3. Game-sport activities;
4. School-based sports practices;
5. Motor-led didactic activities;
6. Observation of neuromotor skills and aptitudes;
7. Individual praxical-motor assessment (individual motor profile).

The primary objectives of the Project, pursued through the strengthening of neuromotor functions, include:

1. General coordination enhancement;
2. Enhancement of cognitive functions (organizational, coordinative);
3. Acceleration of operational initiation across functional domains;
4. Acceleration of executive functions;
5. Acceleration of actions;
6. Acceleration of verbal communication.

Within the constraints of the school setting and the broad diversity of pupils and their individual developmental trajectories, the research progressed through targeted phases of work:

a) Presentation and sharing of the project;
b) Introduction of motor practices and teacher training;
c) Presentation of assessment tools and observation methods;
d) Implementation of the first data collection;
e) Implementation of the second data collection;
f) Data processing and evaluation;
g) Feedback and reporting back to the participants of the School in Motion Project.

The Three-D Correlations Study

Published in 2011, the study focuses on one of the central paradigms of the theory of dyslexia and of the entire *Crispiani Method*, namely the fundamental interplay between dislaterality and the manifestations of dyslexia, and, alongside it, dysgraphia and dyscalculia.

The study involved 614 children and adolescents, divided into four age groups ranging from three years to over eighteen years, individually analyzed starting with motor and lateral dominance assessments — thanks to the collaboration of a network of assistants and researchers — and identified co-occurrences between dyslaterality and dyslexia.

By associating the dyslexic condition with nine types of *lateral dominance*[6] and considering five dysfunctional forms (*dyslaterality*[7]), while excluding cases of *physiological delay in the stabilization of dominance*, 94.30% of the sample were found to be affected.

We can confidently state that, in light of today's more accurate detection of dyslaterality, for example, regarding *abstract/mental cross-patterns* or spontaneous gestures, the percentage of individuals with combined dyslexia and dyslaterality approaches universality, justifying the notion of *Three-D Correlation* (Dyslaterality – Dyspraxia – Dyslexia).

The Neuromotor Correlates and Reading Speed Study

"Neuromotor Correlates and Reading Speed" is the title of a clinical research project conducted from September 2014 to January 2015 at the "Victor" Clinical Center of Psychology and Pedagogy in Macerata, designed as an Action Research study by Prof. Piero Crispiani[8] and Dr. Eleonora Palmieri[9], specialists of the Itard Institute[10], and carried out in consultation with Prof. Angela Fawcett (Swansea University, UK).

A fundamental premise of the research was the identification of a qualitative reference value integrating *reading speed* (quantitative vector) with the broader qualitative indicator of fluency (qualitative vector):

SPEED + FLUENCY

The aim of the study was therefore to evaluate optimal reading performance — expressed in terms of speed and fluency — following participation in a habilitation treatment based on the practices of the *Crispiani Method* and *Cognitive Motor Training (CMT)*.

The research design included:

- Pre-intervention assessment of reading speed and fluency;
- A habilitation treatment lasting three months, with three one-hour sessions per week;
- Post-intervention assessment of reading speed and fluency;
- Statistical analysis of performance differences.

The evaluation tests and subsequent habilitation treatment involved 33 Italian children with diagnosed dyslexia, aged seven to thirteen years, including 19 girls and 16 boys.

Reading Tests

The reading test was administered individually using a text identical for the entire study group, designed according to the following criteria:

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6 Right - Left - Mixed - Crossed - Ambidextrous - Non-dominant Left - Right with interference and leftward orientation - Opposed - Physiological delay.

7 Constituting dyslaterality: Mixed - Crossed - Non-dominant Left - Right with interference and leftward orientation - Opposed.

8 Honorary Professor at the University of Macerata; Scientific Director of the Research Center on Dyspraxia and Dyslexia; President of COMIS (Cognitive Motor International Society).

9 Clinical Psychologist, Neuropsychomotrician, Specialist at the Itard Institute.

10 Institute of Research, Training, Certification, and Services.

a) Same length and number of characters and spaces.
b) Same text difficulty index.
c) Text unknown to the reader.

As stated in the guidelines of the Crispiani Method, the text difficulty index, with respect to a predetermined length, is determined by:

a) the ratio between long words (four syllables or more) and the total number of words;
b) low word repetition;
c) absence of the graphemes k, x, y;
d) absence of non-Italian words.

The Treatment

Between the pre-test and the post-test, the students individually attended the individualized treatment *(Trattamento Abilitativo Individuale)* consisting of cognitive-motor practices and activities based on the *Crispiani Method*, with a particular focus on the coordinative and organizational functions identified by the Method as important factors in reading performance:

- spatial organization;
- temporal organization;
- readiness of the reading start (incipit);
- graphomotor skills;
- sequencing;
- lateral dominance;
- left-to-right tracking;
- verbal-motor synesthesia;
- ideomotor synesthesia;
- perceptual-motor synesthesia;
- independent reading practice;
- handwriting practice;
- numerical and calculation practice;
- text comprehension practice.

Assessments and Results

This section presents data regarding improvement after three months of treatment in terms of the overall quality of reading, integrating speed and fluency, assessed through qualitative pre- and post-test procedures.

The performance value goes beyond the indication of reading speed to provide a more inclusive evaluation of *fluency* by incorporating additional and meaningful quality indicators:

- readiness of the incipit;
- consistency;
- appropriate speed;
- few interruptions;
- sustained self-regulation;
- sustained attention.

Table 1 shows the mean differences between pre- and post-test reading speed according to the *Individual Fluency Index*. In this table, from left to right, we report each participant's initial score, the score after three months of treatment, and the percentage of improvement (with an average improvement of 30%).

Participants	Start	Alter 3m	-%
1	3 m 21 s	2 m 49 s	15,9
2	4 m 36 s	3 m 58 s	13,77
3	2 m 48 s	2 m	28,57
4	2 m 43 s	2 m 8 s	21,47
5	2 m 32 s	1 m 24 s	44,74
6	1 m 33 s	44 s	52,69
7	1 m 25 s	1 m 4 s	24,71
8	1 m 2 s	38 s	38,71
9	2 m 20 s	1 m 20 s	42,86
10	1 m 50 s	50 s	54,55
11	2 m	1 m 23 s	30,88
12	1 m 20 s	45 s	43,75
13	1 m 25 s	1 m 2 s	27,06
14	2 m 40 s	1 m 58 s	26,25
15	3 m 10 s	2 m 34 s	18,95
16	5 m 32 s	4 m 36 s	16,87
17	2 m 34 s	2 m 7 s	17,53
18	2 m 57 s	2 m	32,20
19	1 m 45 s	1 m 2 s	40,95
20	3 m 5 s	2 m 15 s	27,03
21	1 m 26 s	46 s	46,51
22	3 m 17 s	2 m 45 s	16,24
23	2 m 22 s	1 m 40 s	29,58
24	2 m 54 s	1 m 49 s	37,36
25	2 m 49 s	1 m 43 s	39,05
26	3 m 39 s	2 m 35 s	29,22
27	2 m 29 s	1 m 39 s	33,56
28	1 m 34 s	44 s	53,19
29	1 m 44 s	56 s	46,15
30	2 m 21 s	1 m 34 s	33,33
31	3 m 23 s	2 m 47 s	17,73
32	2 m 14 s	1 m 10 s	47,76
33	3 m 33 s	1 m 16 s	50 33
Mean	152 s	105 s	-30,92%

Table 1. Differences between reading speed before and after treatment.

The Crispiani Method

Cognitivist and constructivist activity, an empirical-semiotic attitude, and conceptual commitment lie at the origin of the progressive development of an organic theory and the related professional practice expressed in both school-based and out-of-school educational settings, including:

- Infant and early childhood services;
- Schools of all levels;
- Habilitation and rehabilitation centers;
- Sports centers;
- Training camps[11];
- Centers for adults and the elderly.

Over time, experience and pragmatic reflection have led to the configuration of a Method, understood in the previously discussed projective sense and expressed through the following *method indicators*:

1. Preventive functional knowledge of the person in education (*Knowing in order to Educate*).
2. Appreciation of the individual's current performance levels ("threshold strategy");
3. Clinical approach to the learner in education (individual — empirical — ecological);
4. Design of the habilitative intervention (*Clinical Educational Project – CEP*);
5. Intentionality in every training action;
6. Appropriate executive intensity;
7. Appropriate execution speed (consistency, fluency);
8. Primacy of neuroactivation and daily *Activity Gym* practices;
9. Orientation toward functional enhancement and exercise of bio-psychic functions;
10. Exclusion of compensatory measures (procedures, tools) replacing personal action;
11. Constant praxic-motor and cognitive-motor activation (*Cognitive Motor Training*);
12. Constant activation of verbal communication (*Verbal Motor Training*);
13. Globalist and cognitive approach to performance (*Global Method*);
14. Careful investigation of developmental conditions of *diversity* (developmental, functional, cultural, linguistic, etc.);
15. Careful functional assessment of conditions of *disability*;
16. Practices of motor play and play-sport activities;
17. Culture of sport (narration, self-narration, reflection, social practices, self--regulation, self-assessment);
18. Individual Praxic-Motor Profile;
19. Practices of motor didactics;
20. Strengthening of basic instrumental abilities (motor skills, language, reading, writing, mathematics).

11 Itard Day Campuses and Itard Residential Campus in Nocera Umbra, Province of Perugia, Italy.

Three Guidelines

Global educational action, focused on the uniqueness of the learner (*ecology*), unfolds along three intentional and intensive lines:

- Readiness to initiate (*incipit*);
- Executive consistency;
- Prompt self-regulation and self-correction;
- Constant understanding.

According to the timing and methods guided by the trainer (teacher, educator, therapist, tutor), the three main action lines are:

1st line — general neuroactivation;
2nd line — strengthening of basic instrumental abilities;
3rd line — cultural and disciplinary enhancement.

Aids and Actions

Following the indications of the Project Manager and the trainer, the *Habilitation Treatment* is supported by selected educational and therapeutic materials, including:

- the 13 Actions;
- *Victor Notebooks* (1. reading-writing; 2. verbal expansions);
- other work materials.

Motor-Didactics

In schools or other instructional contexts, the Crispiani Method implements and develops *Motor-Didactics* practices, learning and cognitive activities supported by basic or synergistic praxical-motor processes. These are reciprocal, rhythmic teaching and learning actions between educator and learner, a kind of "splendid isolation" among the three subjectivities of teaching (learner — educator — context), always accompanied by movement.

It is therefore a form of didactics with movement, for example:

- Reasoning + movement;
- Oral expression + movement;
- Narration + movement;
- Calculation + movement

The aim of this style of teaching, grounded in the biological nature of behavior (electrical, connective, dynamic), is rapid and effective neurobiological activation, strengthening:

- Incipit;
- Executive consistency;
- Sustained attention;
- Prompt self-regulation;
- Prompt spatial and temporal orientation;

- Prompt memory access;
- Prompt lexical access;
- Enhancement of phrasal and expansive structures;
- Enhancement of sequential/procedural actions (succession);
- Maintenance of effort (resilience).

The **MotoDidattica Project (PMD)** involves teachers and *Itard Therapists* and is articulated in two main frameworks:

1. Didactic practices based on basic motor skills;
2. Didactic practices with motor guidance.

Motor-Didactics is, moreover, included and encouraged within other actions of the Method and in related materials/supports:

- The 13 Actions;
- The *Victor* Workbooks;
- The Individual Habilitative Treatment (TAI);
- Motor play and play-sport activities.

The Crispiani Method in Play Ball

The conceptual principles, the lines of action, and the practical experiences form the basis of an extensive repertoire of *motor play* and *play-sport* activities, designed and implemented with reference to the enhancement of coordinative, synesthetic, spatio-temporal, and neuroactivation functions, among others, which constitute an important component of the Method. Within this theoretical and experiential framework, a practice intentionally centered on *motor play with the ball* has been developed, defined as the *Crispiani Method in Play Ball*.

The *Play Ball* activities are designed and carried out in accordance with the principles and *expertise* of *Cognitive Motor Training,* which integrates neurophysiological developmental vectors in the cognitive and neuromotor domains, thereby generating an educational training approach that fosters synergistic interaction between cognitive and praxic-motor functions, producing gains in functional developmental processes.

These play-based practices aim at two main areas of neuro-psycho-motor competence development:

- *Neuroactivation*: prompt initiation, reactivity, rapid self-regulation, etc.;
- *Functional enhancement*: execution speed, coordination, synesthesia, spatio-temporal orientation, endurance, self-regulation, etc.

Conducted either individually (*individual training*) or in groups, such activities promote key functional prerequisites of neuromotor behavior: *initiation, fluency, cross patterns, rotational patterns, reverse patterns.*

The ball and the cognitive-motor relationships it generates serve as central elements of educational activities involving *motor play* and *play sport*. In group settings — especially in primary and early childhood education — ball games foster cooperation and the development of transversal skills, such as trust in others and mutual knowledge, as well as problem-solving abilities.

In this regard, the integration of the *Crispiani Method* with the five-phase pedagogical model developed by the *Laboratory of Didactics and Special Pedagogy* (Magnanini, 2018) becomes particularly relevant. The five proposed phases include:

1. *Knowledge;*
2. *Trust;*
3. *Collaboration;*
4. *Motor play and play-sport;*
5. *Reflection.*

The cyclical implementation of these phases through ball activities or free body movement highlights how movement fosters motor and cognitive development, as well as a range of emotional, social, and relational competencies. This is in line with the embodied perspective mentioned at the beginning of this paper. Through movement, children refine the competencies necessary for active and responsible citizenship. This process culminates in the final phase, during which the teacher encourages children to express their emotions and reflections through discussion or drawing activities. This enables the teacher to adjust instructional strategies and helps children reflect on and share their actions with their peers.

References

Arnold, P.J. (2002). *Educazione motoria, sport e curricolo*. Milano: Guerini e Associati.

Bertoldi, F. (1971). *Critica della certezza pedagogica*. Roma: Armando.

Carnap, R. (1966). *I fondamenti filosofici della fisica: Introduzione alla filosofia della scienza*. Milano: Il Saggiatore.

Crispiani P. (2001). *Pedagogia clinica* (reprint ed.). Ancona: Edizioni: Itard.

Crispiani, P. (2004). *Didattica cognitivista*. Roma: Armando.

Crispiani, P. (2011). *Dislessia come disprassia sequenziale. La sindrome dislessica. Dalla diagnosi al trattamento. Le pratiche ecologico-dinamiche*. Ancona: Edizioni Itard.

Crispiani, P. (2012). Styles of thinking and teaching strategies. In: B. Siemieniecki (ed.), *Edukacja medialna. W świecie ponowoczesnym* (pp. 351–364). Toruń: UMK.

Crispiani, P. (2014). Lekcja metakognitywistyczna. *Kognitywistyka i Media w Edukacji, 1*, 203–213.

Crispiani, P. (2015). Kreatywność. Procesy poznawcze i strategie edukacyjne. In: J. Skibska, J. Wojciechowska (eds.), *Nauczyciel i uczeń w przestrzeni kreatywnych działań* (pp. 65–68). Warszawa: Żak.

Crispiani, P. (2023). Nauki kognitywistyczne a pedagogika. In: D. Siemieniecka, G. Karwasz (eds.), *Dydaktyka i pedagogika kognitywistyczna. Zasady ogólne i implementacje w fizyce* (pp. 13–19). Toruń: UMK.

Crispiani, P. (2024). Paradygmat kognitywizmu. In: P. Crispiani, B. Siemieniecki, G. Karwasz (eds.), *Dydaktyka kognitywistyka* (pp. 7–61). Toruń: UMK.

Crispiani, P., Palmieri, E. (2019). *Champion pressing*. Ancona: Edizioni: Itard.

Crispiani, P., Serio, N. (eds.) (1996). *Manifesto sulla progettazione. Testo e commento al Manifesto di Chiaravalle*. Roma: Armando.

Damiani, P., Ascione, A. (2017). Corpo e movimento per un modello dell'apprendimento "embodied cognition based": la scuola e i disturbi del neurosviluppo. *Italian Journal of Health Education, Sport and Inclusive Didactics, 1*(1 Suppl.), 41–50 https://dx.doi.org/10.32043/gsd.v0i1_Sup.51.

Dewey, J. (1950). *Il mio credo pedagogico*. Firenze: La Nuova Italia.

Ferrier, J.F. (1856). *Institutes of Metaphysic. The Theory of Knowing and Being*. Edinburgh–London: Blackwood and Sons.

Filograsso, N. (1998). Prefazione all'edizione italiana. In: J. Bruner, H. Haste (eds.), *Making sense. La construzione del mondo nel bambino* (p. 8). Anicia.

Gomez Paloma F. (2013). *Embodied Cognitive Science. Atti incarnati della didattica*. Ciampino: Nuova Cultura.

Goria, G. (2021). *La filosofia e l'immagine del metodo*. Roma: Inschibboleth.

Haken, H. (1985). L'approccio della sinergetica ai sistemi complessi. In: G. Bocchi, M. Ceruti (eds.), *La sfida della complessità* (pp. 293–308). Milano: Feltrinelli.

Kolb, D.A. (2014). *Experiential Learning. Experience as the Source of Learning and Development*. New Jersey: FT Press.

Magnanini, A. (2018). *Pedagogia speciale e sport. Modelli, attività e contesti inclusivi tra scuola ed extrascuola*. Padova: InContropiede.

Mialaret, G. (1970). *Introduction à la pédagogie* (Italian trans.). Roma: Armando.

Moliterni, P. (2013). *Didattica e scienze motorie. Tra mediazione e integrazione*. Roma: Armando.

Montessori, M. (1970). *La scoperta del bambino*. Milano: Garzanti.

Morin, E. (2002). *Il metodo. 5. L'identità umana*. Milano: R. Cortina.

Morin, E. (2003). *Educare per l'era planetaria*. Roma: Armando.

Richmond, K.W. (ed.) (1974). *Educazione permanente nella società aperta*. Roma: Armando.

Rizzolatti, G. (2015). The mirror mechanism and its clinical relevance. *Journal of the Neurological Sciences, 357(Suppl 1)*, e487–e488.

Shapiro, L. (2019). *Embodied Cognition*. London: Routledge.

Siegel, D.J. (2013). *La mente relazionale. Neurobiologia dell'esperienza interpersonale*. Milano: R. Cortina.

Kinetic Theatre:
From Playful Motion to Holistic Learning

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Introduction

Theatre is a complex form of creation and performance by nature,as well as a collective art. For this reason, it has been incorporated into educational programs to promote children's socialization. Specifically, theatre teaches children the value of teamwork and harmonious cooperation in achieving a shared goal. During acting classes, students learn to accept the limits and restrictions set by the group. They learn to respect rules, acknowledge others' preferences, and make space for their peers (Anklam et al., 2020; Lohfeld & Westphal, 2020). Therefore, educators play a vital role in fostering a cooperative spirit in each activity by adopting games that promote familiarity, trust, contact, and collaboration.

On the other hand, *theatrical play* incorporates theatrical elements and techniques in a creative, unconfined way. It represents the intersection between theatre and play. This combination provides children with opportunities to express their emotions, develop self-awareness through physical and cognitive engagement, and achieve self-actualization. It allows them to organize and externalize their experiences, knowledge, ideas, emotions, and concerns by utilizing verbal and nonverbal expressive means (Avdi & Chatzigeorgiou, 2007; Kourentzis, 2018; Wood, 2013). Therefore, it is not surprising that theatrical play promotes children's motor, cognitive, emotional, and linguistic development and supports their holistic growth and personality development. Finally, it should be noted that theatrical play encompasses various forms of pretend play, including role-playing, improvisational drama, storytelling, fantasy play, and kinetic theatrical play, also known as physical theatre.

Historical Development of Kinetic Theatre

Anneliese Schmolke pioneered the concept of kinetic theatre in mid-20th-century Germany. She developed it as a response to the rigid, text-centered conventions of traditional children's theatre. By 1949, Schmolke and Hans Bergese were teaching movement in conjunction with music. Beginning in 1953, Schmolke collaborated with Herbert Langhans to explore new forms of creative play. They systematically observed and recorded children's movements in school settings through music and dance. This integration of play, music, and dance, which emerged in the 1960s, laid the groundwork for Kinetic Theatre, which was formalized in 1975. Parallel work by Jean Château in France also contributed to this evolving field (Schmolke, 1976). Schmolke's research addressed concerns in German children's theatre, where performance practices emphasized memorization over spontaneity and imagination. The absence of alternatives between spoken text and movement-based play prompted the development of a new form: Kinetic Theatre (KT). Schmolke founded a tradition in Cologne that was sustained and expanded in 1969 by Wolfgang Tiedt and in 1974 by Anne Tiedt. Together, they advanced KT as an evolving theatrical form. Since the 1980s, KT has continued to evolve, incorporating new modes of physical expression and interdisciplinary collaboration.

What Is Physical Theatre?

Kinetic Theatre is a relatively new theatrical form that relies primarily on movement and physical expression. In KT, dialogue is largely replaced by gestures, postures, and bodily movement—expressions through the body become the main communicative medium. However, actors may still use brief verbal elements—such as words, verses, or short sentences—to clarify the narrative for the audience.

According to Schmolke (1976), KT emphasizes direct physical actions rather than spoken language. It disrupts conventional expectations by creating characters and social patterns through movement. This form of theatre invites the audience into a sensory and interpretive experience, fostering a closer connection between performer and viewer. As she notes, KT is self-sufficient, relying neither on props nor costumes, and develops its own structure and direction (Schmolke, 1976). On the other hand, Tiedt (1995) defines KT as a specialized practice in which human movement becomes the primary vehicle of expression, composition, and performance. Depending on its context, it may manifest as physical theatre, dance theatre, athletic theatre, or mime. Tiedt (1999) further describes KT as an umbrella term for a variety of expressive forms centered on movement. Rather than telling stories through action, it conveys emotional states, relationships, and behaviors through imagery and motion (Tiedt, 1991, 1995).

From the above it is obvious that KT centers on action—whether overt or subtle—eschewing the predictable structures of conventional theatre. Whereas traditional theatre often shapes characters through dialogue, KT develops characters through movement alone. This approach demands a more engaged audience, eliciting either cognitive engagement or, especially for children, a direct sensory experience. The result is often a deeper, more intimate connection between performer and audience, surpassing even that of interactive theatre.

Core Elements of Kinetic Theatre

Kinetic Theatre is defined by its reliance on the performer as the central agent of expression, shaping the entire performance without the need for scripted dialogue, stage set, or elaborate costumes. Unlike interactive theatre, where movement often supports inner emotion or narrative, in KT, movement itself becomes the primary language of expression. Integrated into this form are sound, language, materials, objects, and musical or rhythmic elements, all of which are treated as essential aspects of the performance. In addition, KT can be understood through four foundational components: *movement*, *music*, *dance*, and *improvisation/play* (Fig. 1). These elements closely align with the ways young children naturally engage with the world. As Tiedt (1991) notes, movement, play, music, rhythm, and language are intertwined in early childhood, shaping communication, learning, and creativity.

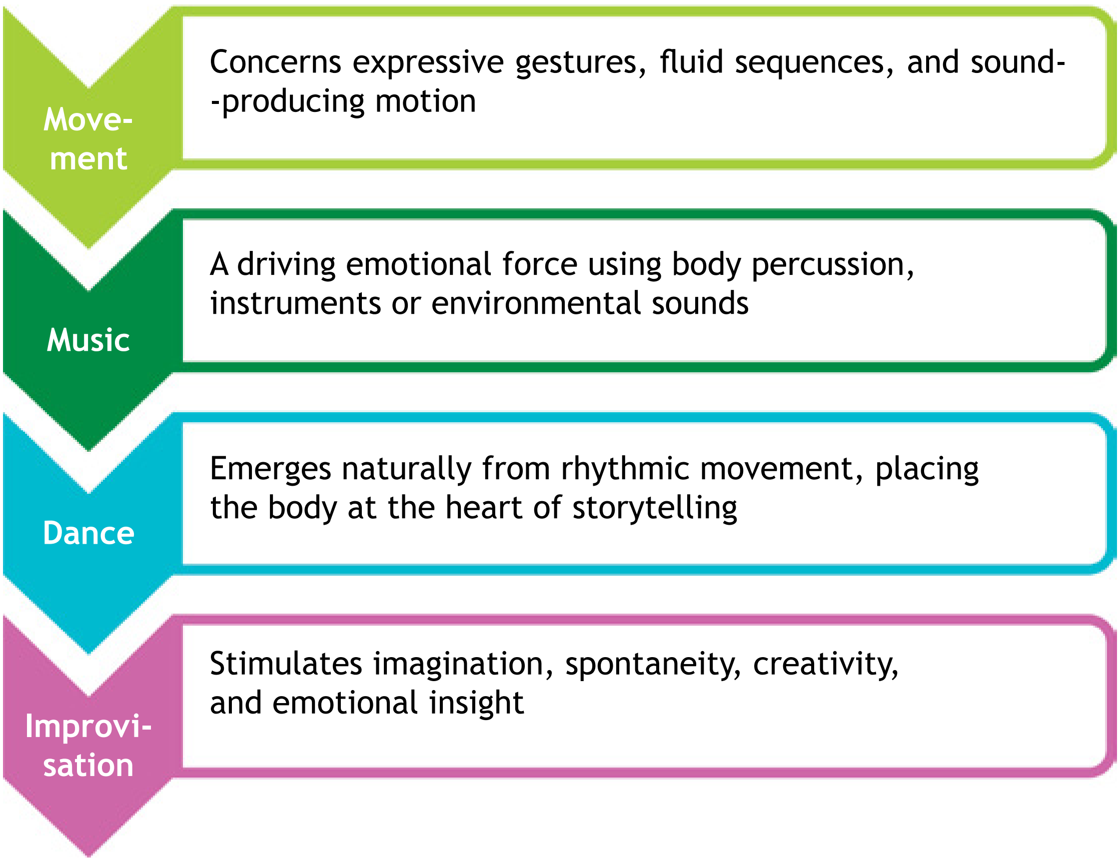

Figure 1. The four structured elements of Kinetic Theatre

The following sections explore each of these four elements in detail, offering educators a framework for organizing activities and understanding why KT is particularly suited to early childhood education.

Movement is the most fundamental element of KT. In this form, the body replaces speech as the central means of storytelling and communication. Through gesture, posture, facial expression, and spatial dynamics, performers convey meaning in a direct and embodied way. In addition, every movement occurs in space — in dimensions (size, height, width), planes (sagittal, horizontal, frontal), directions (forward, backward, upward, downward, sideways, right, left, diagonal), spatial orientation (to the front, back, side), pathways (curved, straight), and levels (high to low) (Tiedt, 2001). Three primary forms of movement typically appear in KT:

- *Gestures and body language:* Emotions and ideas are expressed through nonverbal cues such as posture, facial expressions, and physical orientation in space.
- *Dynamic motion sequences:* Movement patterns are often fluid and unscripted, responding organically to rhythm, sound, and interactions with other performers.
- *Movement-sound interactions:* Performers use physical objects (e.g., fabrics, wooden instruments, metal structures) to produce sound through motion, thereby enriching the sensory and emotional impact of a scene.

These movement types reinforce the idea that KT is not limited to physical activity—it is a multi-layered experience where the body, sound, and materials merge into expressive storytelling.

This is especially important in early childhood, when language development is ongoing. Physical movement becomes a natural outlet for expression, allowing children to externalize thoughts and feelings that they may not yet be able to articulate in words. In this way, KT offers a developmentally appropriate mode of communication and learning. More specifically, in KT, the body becomes a vehicle for creativity and imagination, allowing the child to safely explore both themselves and the world around them, while also supporting their holistic development. Spatial awareness, rhythm, balance, and collaboration with other children are all elements that enhance the child's sense of self and of others. Furthermore, through participation in KT, children experiment with different modes of movement, embody characters, and experience situations through their bodies, thereby cultivating both empathy and imagination (Neuber, 2009). Therefore, it is not surprising that, as empirical findings from a recent study indicate (Konowalczyk, et al., 2018), a KT intervention program positively affects the productivity of children from socially disadvantaged areas and improves the problem-solving skills of children who are not socially disadvantaged.

In addition, **music** is not a backdrop in KT—it is an active force that shapes and enhances the performance. Schmolke (1976) emphasized that music in theatrical contexts ranges from basic rhythmic patterns to fully developed compositions, always remaining intertwined with performance. In KT, this synergy with movement occurs naturally: rhythm emerges from body percussion, object manipulation, vocalizations, and ambient soundscapes (Fig. 2).

Children engage with music in various ways within KT:

- *Body percussion:* Clapping, stomping, and vocal sounds create rhythm and structure.
- *Instrumental and environmental sounds:* Everyday objects, recorded soundscapes, and vocal elements contribute organically to the sonic environment.
- *Musical improvisation:* Spontaneous sound-making allows performers to interact in real-time, making music and movement mutually responsive.

The integration of sound and action engages children intuitively, often before conscious understanding occurs. Music shapes how they move and feel, influencing the tone and emotional depth of their performance (Schmolke, 1976). Rather than merely accompanying the action, music is a key expressive tool in KT.

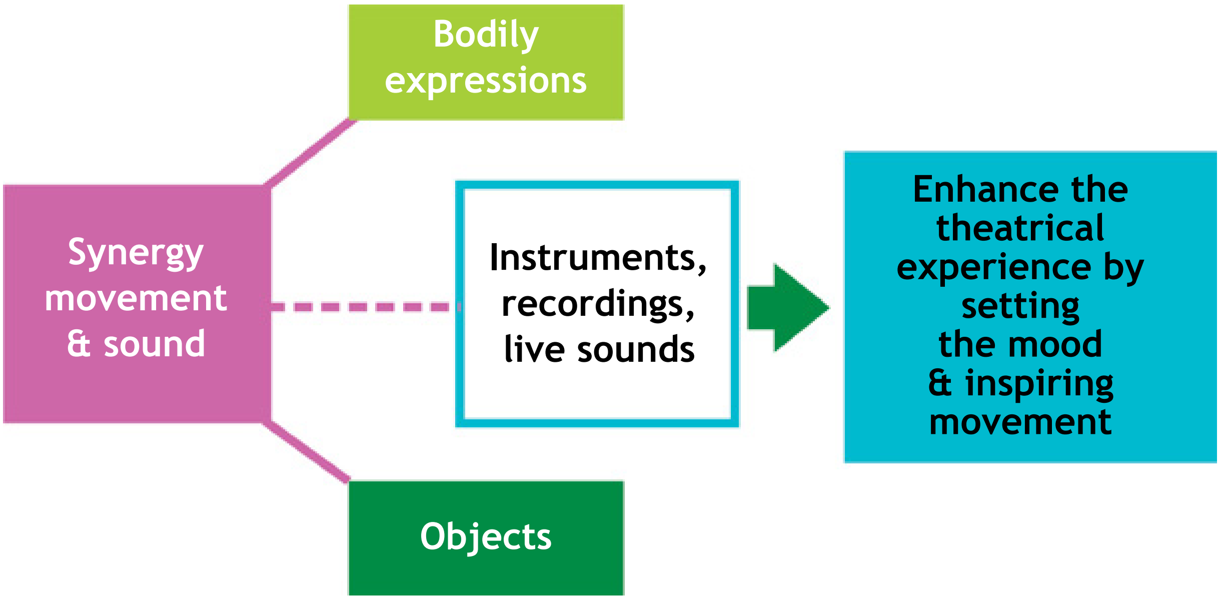

Figure 2. Synergy of movement and sound in Kinetic Theatre

With regard to the third structured element of KT—dance—it emerges naturally from rhythmic movement and bodily expression. Whether structured or improvised, these movements emerge in response to music, space, and emotional intention. Dance allows the performer to communicate not only action but internal states—joy, tension, curiosity—through bodily form.

This connection between movement and rhythm is fundamental. Repetition, a principle common in both theatre and dance, enables movement to evolve into expressive sequences (Schmolke, 1976). As Rosenberg (1990) observed, any situation involving movement contains the potential of becoming either choreography or improvisation, since movement can serve as a direct expression of internal emotion.

In contrast to traditional theatre, where movement often plays a secondary role to text, KT centers movement as a complete communicative act (Guschker & Kießling-Braß, 2024; Konowalczyk et al. 2018; Neuber, 2010). Through this lens, dance becomes both art and language, offering performers—especially children—a medium to embody and express stories, emotions, and relationships.

Finally, **improvisation** in KT involves spontaneous action that arises in response to a given situation or stimulus. It invites imagination, transformation, and creative problem-solving. Often sparked by an external cue—a sound, a gesture, or a story prompt—improvisation unfolds with a natural structure: beginning, middle, and end (Spolin, 1999; Vera & Crossan, 2005).

In educational settings, improvisation is tailored to the developmental stage of children. Younger children benefit from guided group activities centered around stories or familiar routines. Older children may engage in structured role-playing (e.g., pretending to ride a bus or visit a zoo), while more experienced students might work in small groups to develop complex themes such as family conflicts or classroom scenarios.

These activities help learners develop key skills for theatrical improvisation:

- Constructing believable scenarios
- Creating coherent narrative structures
- Introducing and resolving dramatic conflicts.

Most importantly, improvisation nurtures spontaneity, collaboration, and emotional expression. Through imaginative play, children develop confidence in their creative abilities and a deeper understanding of themselves and others.

To summarize, KT is built upon four closely interwoven elements: movement, music, dance, and improvisation, whilst at its core lies the expressive potential of the body. For young learners, this form of theatre offers a rich, intuitive platform for emotional expression, creativity, and communication. By engaging the senses and the imagination, KT supports holistic learning and becomes a powerful tool in early childhood and primary education.

Kinetic Theatre in Practice: Structure, and Exercises

Kinetic Theatre is a flexible and inclusive approach suitable for learners of all ages. A typical session begins with simple, unstructured movements—often in response to stimuli such as music—and gradually transitions into more structured improvisations and collaborative compositions. The aim is to foster creativity, bodily awareness, and emotional expression through movement.

Rather than following instructor-directed drills, KT encourages movement that emerges naturally from each participant's internal impulses. Exercises are designed to a) engage the whole body, b) explore various spatial levels (high, medium, low), and c) progressively increase in complexity. What sets these activities apart from traditional physical education is their focus on expression and creating meaning, and not on athletic performance or repetition.

Moreover, a KT Session is Typically Organized Into Four Interrelated Phases

Warm-Up & Preparation

This phase activates both body and mind, while also builds group cohesion. Activities may include breathing exercises, stretching, rhythm-based games, or free movement improvisations. For younger children, playful routines that focus on familiar body parts or everyday actions serve as accessible entry points to movement exploration. The warm-up sets the tone for the session, fosters attention, and helps establish a safe, supportive group atmosphere.

Exploration & Technique

Students expand their movement vocabulary and expressive skills. They might experiment with tempo, spatial orientation, body dynamics, or partner work. Props, music, and imaginative prompts often support this phase. Educators may guide structured improvisations or demonstrate techniques, encouraging exploration of specific physical or emotional themes such as balance, transformation, or contrast.

Creative Composition

This core phase focuses on building performances, individually or in groups. Learners are invited to shape improvised or loosely structured movement sequences using the tools introduced earlier. Compositions may follow a thematic cue (e.g., "conflict and resolution") or a narrative structure with a beginning, middle, and end. The educator facilitates the creative process, offering guidance and feedback while allowing space for independent interpretation and expression.

Reflection & Feedback

The session concludes with a reflection phase that supports critical thinking and emotional insight. Students share observations, articulate their experiences, and offer feedback to peers. Depending on the age group, this can take the form of group discussion, reflective journaling, or structured questioning. This phase helps learners connect their physical expression with broader social, emotional, or cognitive themes.

In addition, KT activities should be carefully tailored to the developmental stage of participants. With young children—particularly in kindergarten or early primary school—movement tasks should be simple, focused on basic body awareness, and supported by short demonstrations. These foundational activities help children internalize abstract concepts like space, direction, and rhythm. Older learners can handle more sophisticated movements and abstract ideas (e.g., freedom, cooperation, or transformation). They can also work more independently, engaging in group-based compositions that allow deeper emotional exploration and greater creative ownership.

The Educator's Role in Kinetic Theatre

The teacher plays a central and multifaceted role in KT. Far from being a director in the traditional theatrical sense, the educator may act as a facilitator, a co-creator, a guide, and/or a reflective partner in the learning process. The educator's primary task is to establish a psychologically safe, inclusive space where all students feel free to explore, take creative risks, and express themselves physically without fear of judgment. This involves nurturing trust within the group, recognizing interpersonal dynamics, and adapting the structure of the session to fit the needs of the learners. Another key responsibility is offering imaginative prompts that stimulate creative engagement. These may include a) narrative suggestions (e.g., "Move as if you're caught in a strong wind"), b) emotional cues (e.g., "Show how your body reacts when it's excited"), and c) thematic prompts tied to broader educational goals (e.g., empathy, collaboration, or sustainability).

Through such provocations, teachers support students in accessing and articulating inner experiences through movement. Additionally, throughout the session, the educator also serves as a guide—observing, offering modeling techniques and feedback, and helping shape the group's creative trajectory. However, it is important to note that the teacher does not impose fixed interpretations, but encourages multiple perspectives, validates individual choices, and supports the collective evolution of the performance.

Kinetic Theatre and Children's Holistic Development (especially in ages 5-10)

Kinetic Theatre provides a powerful medium for exploring and supporting emotional development in children. By emphasizing movement as a form of communication, it creates opportunities for students to externalize and process emotions that may be difficult to articulate verbally. One of the central educational aims of KT is to help children translate their emotional experiences into embodied forms of expression. This is achieved through activities that focus on: a) expressing emotions physically, b) enhancing bodily and facial expressiveness, and c) developing the capacity to recognize, interpret, and understand both personal emotions and those of others (Goldstein & Lerner, 2018). Through these goals, KT nurtures not only expressive abilities but also emotional literacy—helping children to name, make sense of, and empathize with feelings.

The selection and design of KT exercises are guided by the developmental stage of the learners. For younger children, themes are often grounded in familiar and emotionally safe contexts such as home routines, classroom experiences, or simple social interactions. These relatable scenarios enable children to connect meaningfully with the activity and explore their emotions within a secure framework. In this way, movement becomes a bridge between lived experience and self-expression.

As children grow older and gain more refined emotional awareness, they can engage with increasingly complex emotional content. Their ability to use facial expression and physical gesture deepens, allowing them to convey subtle emotional shifts or nuanced internal states. Older students are also better equipped to explore more emotionally charged or abstract scenarios—such as anxiety about school performance, feelings of exclusion, or experiences of loss and separation.

By embodying these situations through movement, students are given a constructive outlet to process difficult emotions. Rather than suppress or intellectualize their feelings, they are encouraged to explore them physically, creatively, and communally. This embodied practice fosters emotional resilience and helps children develop a healthier relationship with both their own emotions and the emotions of others. In essence, KT becomes a safe space where children can practice empathy, deepen their self-awareness, and gain confidence in expressing their inner world—all through the natural and intuitive language.

For children between 5 and 10 years old, KT offers a meaningful and age-appropriate way to support their overall development through movement, play, and creative expression. More specifically:

- **Physical development** is supported through active participation, helping children improve balance, coordination, motor control, and spatial awareness. Movement games and playful exercises also build body confidence and awareness.
- **Cognitive skills** grow as children engage in improvisation, follow movement sequences, and respond to changing situations. These activities develop memory, attention, problem-solving, and flexible thinking in a playful, non-pressured setting.
- **Social and emotional development** is strengthened through group performances and imaginative play. Children learn to work together, build trust, express feelings through the body, and understand others' emotions by stepping into different roles and situations.
- **Language and communication** benefit as well. Verbal and non-verbal expressions are both explored—through voice, gesture, facial expression, and storytelling. Children learn to communicate ideas clearly and to listen actively during group activities.
- **Creativity and imagination** flourish in KT. Through movement and play, children explore new ways to express themselves, invent characters, and tell stories without needing complex language. This creative freedom helps them build confidence and emotional resilience.

Overall, KT is a rich educational approach for this age group, since it combines movement, emotion, and imagination in ways that promote not just skill development, but also joy, curiosity, and connection (Tiedt & Tiedt, 1999).

The following section presents three distinct KT lesson plans, each centered on a specific theme. These scenarios can be implemented not only within the context of Physical Education but also in broader educational, recreational, or leisure-time settings. All three are designed to support the holistic development of students across all levels of education.

Theme: Getting to Know Each Other

1. *Free Movement with Name Sharing:* The children move freely and spontaneously around the space to the accompaniment of music. Each time the music stops, every child says their name to the children closest to them.
2. *Name Sharing in Pairs:* Similar to the first activity, but in pairs. Every time the music stops, each child introduces their partner or presents their pair to the nearest pairs.
3. *Theatrical Introductions in a Circle:* The group gathers in a circle. The teacher, or a willing child, begins by theatrically introducing the child to their left (e.g., saying, "Ladies and Gentlemen, let me introduce...," followed by the name). Then that child introduces the next, and so on. Once all children have been introduced, the activity can be repeated in the opposite direction, with the starting child introducing the one to their right, etc.
4. *Musical Direction and Group Coordination:* The group stands in a circle, and all children move spontaneously in the same direction, one behind the other, accompanied by music. When they hear a signal from the teacher (e.g., one clap), they make a half turn and start walking in the opposite direction. When they hear a second, different signal (e.g., two claps), they turn toward the center of the circle, hold hands, walk together toward the center raising their hands and shout "Opa!" Then they return to the edge of the circle and continue moving in the previous direction. The teacher can give up to 10 direction changes during the activity.
5. *Imaginary Volleyball:* Children are divided into groups of four and form a circle. They imagine they are playing volleyball, making imaginary passes to each other and receiving the imaginary ball.
6. *"I Am Your Mirror":* The children are divided into pairs. Standing face-to-face, one child makes movements, gestures, and facial expressions like a model, while the other imitates them as their mirror image. After 2-3 minutes, they switch roles.
7. *"I Am Your Guide":* The children remain in pairs. One stands behind the other and gently covers the front child's eyes with their hands (without resting their elbows or arms on the other's shoulders). Both begin to walk, and the guiding child carefully steers the blindfolded partner by softly turning their head in the direction where there is free space.
8. *"We Are the Two Poles of the Same Magnet":* Children remain in pairs but scatter separately around the room. The teacher tells them that a fairy has turned each pair into a magnet with two poles (one on each child). Then the teacher

plays rhythmic music and asks the children to move freely around the space. Each time the music stops, they must find their partner and "connect" as the poles of a magnet. However, the magnetic connection point changes each time (e.g., elbows, one palm, knees, one heel, etc.), and the specific body part is announced by the teacher each time the music stops.

9. *Improvised Contact Movement in Pairs:* The children remain in pairs and improvise movement patterns, ensuring they always maintain at least one point of physical contact with each other.
10. *Group Improvisation: First Encounter.* In groups of 4–5, children improvise and present a story around the theme: "First Meeting Between Strangers."

Theme: Senses

1. *Movement in the City:* The children move freely and spontaneously around the space to the sound of music, as if they are on a busy city street, trying to avoid bumping into each other.
2. *Race to the Least Crowded Corner:* Similar to the previous activity, but this time children freely choose one of the four corners of the room. They aim to move quickly to the corner with the fewest people—without clearly revealing their chosen destination to the others.
3. *Model and Shadow:* The children are in pairs. One child leads, moving through the space while varying their steps, levels, and types of movement. The second child acts as their shadow, imitating exactly what the leading child does. Each time the "shadow" accidentally bumps into the "model," it counts as a "burn." After 5 burns, they switch roles.
4. *Describing through Touch:* The children remain in pairs, sitting face-to-face, holding hands, and closing their eyes. One child gently explores the other's hands through touching and begins to describe what they feel. After 2-3 minutes, they switch roles.
5. *Drawing on the Back:* Children stay in pairs. One child sits in front while the other, sitting behind, draws a simple shape on their partner's back using their index finger (e.g., a circle, a sun, a wave). The front child must guess what shape was "drawn." After 3-5 shapes, they switch roles.
6. *Writing with the Foot:* Still in pairs and now facing each other, each child takes turns "drawing" an imaginary shape or letter of the alphabet with their foot. Their partner must try to guess what was drawn. Each child creates 3–5 shapes.
7. *Echoing Rhythms:* In pairs, one child creates a rhythmic pattern using hand claps, foot stomps, or mouth sounds. The other child becomes their echo, repeating the pattern they heard.

8. *Guess What I Feel:* Children stay in pairs. One child closes their eyes while the other makes a sound that expresses an emotion (e.g., laughing to show joy). The child with closed eyes tries to guess the emotion. After 3–5 rounds, they switch roles.
9. *Walking Barefoot through Imaginary Textures:* The children gather in a corner of the room and, one by one, walk diagonally across the space barefoot. Each time, they pretend to walk on different surfaces as described by the teacher (e.g., gravel, hot sand, sharp rocks, deep water).
10. *Imaginary Smelling:* Children stand side by side and pretend to smell various items as named by the teacher (e.g., sour lemon, chocolate cake, a rose, dirty socks), expressing their reactions physically and facially.
11. *Group Improvisation:* *Lost in the Forest*. In groups of 4–5, children improvise and present a story with the theme: "A group of friends gets lost in the forest."

Theme: Hands

1. *Hands and Sounds Freeze:* The children move freely and spontaneously in the space with music. Every time the music stops, each child freezes and moves only their hands, accompanying the movement with an improvised sound.
2. *"Tango":* Children form pairs and prepare to dance an improvised tango to music. One child places their left hand on their partner's waist and extends their right hand to the side and slightly forward to receive the other's left hand. This child leads the dance by gently pulling with the right hand and lightly pushing the back with the left. After 2–3 minutes, they switch roles.
3. *Fish Hands:* Children spread out in the space and stretch both arms forward. To the sound of music, they pretend their hands are two fish (or one, if they keep both hands together) swimming freely, encountering other fish, playing with them, and then swimming away again.
4. *Pushing Imaginary Objects:* Each child finds a space and, from a standing position, pretends to push heavy imaginary objects in the direction the teacher indicates (e.g., forward, backward, sideways), accompanying their effort with vocal sounds.
5. *Relaxing the Arms:* In pairs, one child lies down and lifts their arms upward. The partner gently holds, shakes, and softly stretches their hands and arms in slow, calming movements to help them relax. After 2-3 minutes, they switch roles.
6. *Imaginary Objects:* Children sit in one or two parallel rows facing the teacher. The teacher names various imaginary objects (e.g., a pencil, a cup, a book, a rose with thorns), which the children mime picking up, using, and then setting down behind them.

7. *Morning Routine Pantomime:* Standing in parallel lines facing the teacher, the children mime their morning routine in front of a bathroom sink based on the teacher's instructions (e.g., turning on the tap, washing and drying their face, brushing teeth, combing hair, etc.).
8. *Choreographed Morning Routine:* Similar to the previous activity, but this time the whole group, guided by the teacher, builds a shared, step-by-step pantomimed morning routine, naming each movement in order.
9. *Pantomime Wall:* Children are spread out in the space, facing the teacher, and follow instructions to mime being behind an invisible wall while trying to find a door or corner to exit the room. Emphasis is placed on how they position their hands on the wall and coordinate their body and feet accordingly.
10. *Pantomime Rope:* Similar to the previous activity, but this time the children pretending to be pulling a large, imaginary ship's rope.
11. *Group Improvisation: Escape*. In groups of 4–5, children improvise and present a story with the theme: *"Escape."*

References

Anklam, S., Meyer, V., Reyer, T. (2018). *Didaktik und Methodik in der Theaterpädagogik. Szenisch-Sytemisch: Eine Frage der Haltung!?* Seelze: Klett/Kallmeyer.

Avdi, A., Chatzigeorgiou, M. (2007). *The art of drama in education. 48 suggestions for drama workshops* [in Greek]. Athens: Metaxmio.

Guschker, B., Kießling-Braß, J. (2024). Weil es Geist und Körper angeht. Dem Thema „Hate Speech" in einem fächerübergreifenden Unterrichtsmodul der Sekundarstufe II durch wissenschaftliches Schreiben und Bewegungstheater begegnen. *WE_OS-Jb -Jahrbuch der Wissenschaftlichen Einrichtung Oberstufen-Kolleg*, *7*(1), 57–73, https://doi.org/10.11576/we_os-7678.

Konowalczyk, S., Steinberg, C., Pürgstaller, E., Hardt, Y., Neuber, N., Stern, M. (2018). Kulturelle Bildung in bildungsbenachteiligten Milieus. Eine empirische Untersuchung zur Wirkung von Tanz- und Bewegungstheaterangeboten in der Ganztagsgrundschule. *Journal of Childhood and Adolescence Research*, *2*, 179–190, https://doi.org/10.3224/diskurs.v13i2.04.

Kourentzis, L. (2018). *From Theatrical Play to Organised Performance and From Theatrical Play to Theatrical Performance for Children*. Athens: Traveler.

Lohfeld, W., Westphal, K. (2020). Perspektiven der Ästhetischen und Kulturellen Bildung. In: M. Zimmermann, K. Westphal, H. Arend, W. Lohfeld (eds.), *Theater als Raum bildender Prozesse* (pp. 25–30). Bielefeld: Athena/wbv.

Neuber, N. (2009). *Kreative Bewegungserziehung – Bewegungstheater*. 3rd ed.). Aachen: Meyer and Meyer.

Neuber, N. (2010). Darstellen, Vorführen, Aufführen – Vom Bewegungsspiel zum Bewegungstheater. In: H. Lange, S. Sinning (eds.), *Handbuch Methoden im Sport – Lehren und Lernen in der Schule, im Verein und im Gesundheitssport* (pp. 458–476). Balingen: Spitta.

Rosenberg, C. (1990). *Praxis für das Bewegungstheater*. Aachen: Meyer and Meyer.

Schmolke, A. (1976). *Das Bewegungstheater. Hilfen und Anregungen für das Spielen mit Kindern und Erwachsenen*. Wolfenbüttel-Zürich: Möseler.

Spolin, V. (1999). *Improvisation for the Theater. A Handbook of Teaching and Directing Techniques*. 3rd ed. Evanston: Northwestern University Press.

Vera, D., Crossan, M. (2005). Improvisation and innovative performance in teams. *Organization Science*, *16*(3), 203–224, https://doi.org/10.1287/orsc.1050.0126.

Goldstein, T.R., Lerner, M.D. (2018). Dramatic pretend play games uniquely improve emotional control in young children. *Developmental Science*, *21*(4), e12603, https://doi.org/10.1111/desc.12603.

Tiedt, A. (2001). Bewegende Verse. Wie aus einem Gedicht Bewegung wurde. *Sportpädagogik*, *25*(5), 28-31.

Tiedt, W. (1991). Bewegungstheater. In: N.R.W. Kultusministerium (ed). *Sporttheater im Verein. Materialien zum Sport in Nordrhein-Westfalen*. *32* (pp. 64–74). Frechen: Ritterbach.

Tiedt, W. (1995). Bewegungstheater, Bewegung als Theater, Theater mit Bewegung. *Sportpädagogik*, *19*(2), 15-24.

Tiedt, W. (1999). Bewegungstheater. In: W. Günzel, R. Laging (eds.), *Neues Taschenbuch des Sportunterrichts (Band 2). Didaktische Konzepte und Unterrichtspraxis* (pp. 309–336). Hohengehren: Schneider.

Tiedt, A., Tiedt. W. (1999). Kreativität. Idee und Gestaltung künstlicher Bewegung. In: B. Ränsch-Thrill (ed), Kreativität. Phänomen-Begriff-sportwissenschaftliche Aktualität. Brennpunkt der Sportwissenschaft, *21* (pp. 128–151). Sankt Augustin: Academia.

Wood, E. (2013). *Play, Learning and the Early Childhood Curriculum*. 3rd ed. London: Sage Publications.

Learning and Moving Method

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Introduction

Maths is boring – too much time in classroom is spent giving answers and too little on learning (a 6-year-old) (Boaler, 2016, p. 50).

According to contemporary psychological and educational theory, particularly the constructivist approach, children activelyexplore the world by constructing knowledge and skills through interaction with their environment and by applying their prior knowledge. Constructivism allows us to view education as a creative cognitive process in which students develop competencies by engaging in activities that promote independence and utilize their individual potential. This involves solving problems inspired by curiosity about the world and questions that arise from educational situations created by teachers, interactions with peers, and experiences within the family and local environment (Filipiak, 2012; Klus-Stańska, 2024; Michalak, 2020; Żytko, 2021).

The quote at the beginning of this chapter reveals the child's need for active exploration, which the school failed to satisfy by imposing a classroom-based structure that limited development. This early educational experience is characterized by subordination to a teacher whose communication model assumes a hierarchical relationship and learning "by imitation" (Klus-Stańska, 2002). The teacher is the most important figure:

they plan and organize lessons, give instructions, and expect specific responses and activities within strictly defined boundaries. In this child's reflection, there is a clear desire to actively engage in learning and gain space to do so rather than merely respond to the teacher's questions. But what is—or could be—this genuine learning?

Supporting the learning process in mathematics and science education requires respecting certain developmental conditions and fostering the process of building children's conceptual understanding. When it comes to mathematical and scientific concepts, it is particularly important to progress gradually from the concrete to the abstract. The Concrete-Representational-Abstract (CRA) model is based on J.S. Bruner's (1966) psychological concept of three types of cognitive representations of the world. Throughout life, humans have access to these representations, which can be used flexibly at different stages.

Enactive (action-based) – thinking is linked to actions, motor activities, and manipulations of concrete objects; enactive representations function throughout a person's life and are manifested in activities such as throwing a ball or riding a bicycle, derived from practical experiences; they help build spatial awareness.

Iconic (image-based) – representations of the environment using mental images, expressed through drawings, various graphic forms, models of situations, and by comparing and distinguishing differences; visualization of thought.

Symbolic (language-based) – enables the use of abstract forms of thinking and representing the world through symbolic systems: language, numbers, musical notation.

Bruner's concept significantly impacted educational psychology and teaching practice. His contributions to cognitive learning theory are extremely important.

He introduced the notion of creating categorical knowledge in learning theory. Bruner argued that the primary mechanism in understanding the world is identifying differences and similarities between objects and events, and processing information in a way that allows it to be categorized. For example, objects that are perceived as similar are grouped into a single category. In school settings, Bruner recommended learning through discovery because it enables students to identify connections between categories, thereby stimulating thinking. These categories are encoded into systems that enable the transfer of acquired knowledge and skills to new, unfamiliar situations.

Bruner emphasized the importance of children's intuition, everyday concepts, and personal knowledge in his concept. He cautioned against early formalization of children's knowledge by introducing scientific terms or definitions too soon. He encouraged leaving space for children to experience, experiment, and explore the world.

In the early stages of development, children primarily learn enactively, exploring the world through their own actions and experiences (both positive and negative) in direct interaction with reality. Later, iconic representation begins to dominate as children learn to use images and diagrams and perform calculations without concrete objects. During adolescence, symbolic learning predominates, requiring an understanding of and ability to apply abstract concepts. Developmental progress involves increasingly smooth transitions between modes of representation and the ability to adapt an approach to interpreting the world according to the situation, problem, or task at hand.

All representations are available throughout life, but Bruner identified developmental stages indicating when each is dominant. According to Bruner, the educational process should encourage students to discover, learn independently, and organize knowledge based on its meaning and significance to them. Independent exploration of concepts ensures a better understanding and more effective practical application. Teachers should engage students in active dialogue and support the learning process, constructing a form of scaffolding. Scaffolding creates a social situation in which the teacher supports the learner by providing guidance, hints, or structure to help the student reach a higher level of understanding than they could independently. It involves adjusting the level of support according to the learner's abilities and gradually withdrawing assistance as competence grows so that the learner can take responsibility for their own learning.

This approach emphasizes active participation, collaboration, and dialogue. Teachers should facilitate meaningful exploration, encourage questioning, and allow students to test hypotheses and construct their own understanding. Learning becomes a dynamic process where knowledge is actively built and internalized through experience, reflection, and application.

By fostering discovery and independent inquiry, Bruner's educational philosophy cultivates critical thinking, problem-solving, and transferable knowledge. The ultimate goal is to support learners in becoming autonomous, motivated, reflective thinkers who can apply their knowledge creatively and effectively in real-world situations. Once the goal has been achieved, the scaffolding is dismantled.

The teacher's actions are characterized by:

- stimulating the student's interest;
- supporting goal-oriented behavior;
- pointing out critical moments in the task-solving process;
- providing emotional support and alleviating tension
- encouraging the search for different ways of acting.

Bruner also emphasized the importance of working in small student groups as an excellent opportunity to build such scaffolding. In this context, a peer becomes a particularly valuable source of support and a pillar in the developmental process, and this kind of social relationship provokes developmental change.

Description of the Learning and Moving Method

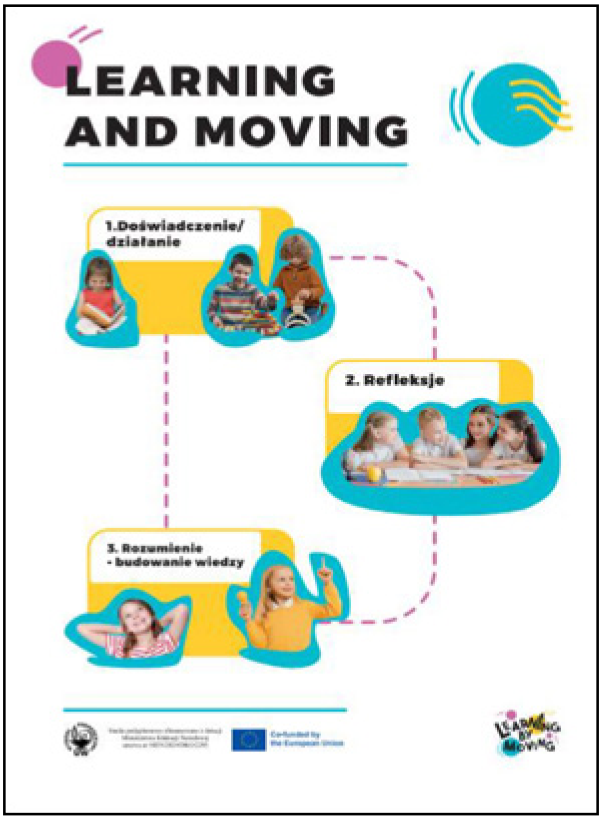
We present a method that is a model of teacher support for the learning process of early primary school children. This method is based on J. Bruner's concept of various forms of representation in the cognitive process. We focus particularly on developing mathematical and scientific competencies.

In these educational areas, organizing the learning process appropriately is crucial. This organization should be rich in educational situations and experiences tailored to the developmental needs of children aged 6–10. Acquiring these competencies requires developing an understanding of concepts involving symbolic language to describe the world. Learning mathematical and scientific principles involves discovering relationships, identifying patterns, applying different problem-solving strategies, and engaging in critical and creative thinking. Children's intellectual activity is crucial to achieving success. However, it cannot be limited to operations with mathematical symbols and abstract reasoning alone. Understanding mathematical and scientific concepts requires constructing models of mathematical situations and physical and natural phenomena, as well as visualizing and manipulating elements in a practical context (Dąbrowski & Kondratek, 2017).

Active learning of mathematics and science according to the Learning and Moving method assumes:

- discovering mathematical principles, recognizing patterns, and applying one's own problem-solving strategies,
- building models of phenomena, processes, dependencies, and relationships using representations based on manipulation of concrete materials, visualization, and activities involving symbols,
- incorporating movement in reference to the concept of embodied learning – an important form of activity that supports the learning process and the modelling of observed phenomena,
- explaining strategies, providing arguments, persuading others to accept one's own solutions, engaging in discussion and reflection.

The model of active learning in the Learning and Moving Method is represented by the following picture:



The main elements of this model comprise the structure of the individual stages of active learning. The first element is experience, which involves various forms of engagement with representations through concrete materials, visual aids, or symbols. This stage focuses on actively investigating and exploring mathematical and science-related situations centered on selected problems to solve.

These experiences are accompanied by movement and physical activity that are not random or incidental. Rather, physical activity must be directly connected to the topic being studied and should not be regarded as a form of relaxation or a break during lessons. Physical activity is an important part of the learning experience that builds understanding of mathematical and scientific concepts (McCann, 2016; Nathan & Walkington, 2017).

One Example of Such an Activity is the Living Numbers Game

Students were given T-shirts with numbers ranging from 0 to 24. First, they lined up in ascending order, and then in descending order. Next, they were asked to find the person whose number was greater than theirs by two, three, four, or five. The final task was to form groups whose numbers added up to 24. This fun, physical activity also required logical thinking. Interesting problems and insights emerged. The children quickly noticed that when looking for a number greater by two, the class split into two groups that could be named even and odd numbers. When searching fora number greater by three, they found that they divided into three groups, with even and odd numbers alternating (Boaler et al., 2016).

The Second Element of the Learning and Moving Method is Reflection

Children must analyze their experiences — summarize their observations and insights, discover principles, describe relationships, explain phenomena, and identify the causes and conditions of their actions. Teachers support students by asking questions that stimulate thinking and using exploratory talk, or "thinking aloud" (Barnes, 2008; Mercer, 2000). Learning through talk can take place not only in language lessons, but also in mathematics, science, and other subjects. Exploratory talk is useful when students connect new information with prior experiences, discover something new, formulate hypotheses, negotiate, justify their positions, modify ideas, explain their reasoning, and reflect.

The Third Element of the Method is Building Knowledge and Understanding

Previous experiences, together with reflective thinking that builds on them, lay the groundwork for constructing knowledge and understanding new concepts. A variety of cognitive activities, supported by movement and communication, form the basis of knowledge structures that manifest in different applications. With the teacher's guidance, students can verbalize and present what they have learned in a generalized form at this stage. The final element of the method involves applying acquired knowledge by using understanding in practical contexts, applying it to new situations, and solving problems.

In the Learning and Moving method, learning is understood as a process rooted in the interaction between the body and its environment. Knowledge is not solely acquired through abstract thinking, but rather, it is connected to physical actions and emotional engagement. Embodied cognition reflects the scientific method by encouraging students to learn in ways that mirror scientists' active, practical processes of exploring the natural world. Movement is treated as a tool that supports symbolization, modeling, and the internalization of knowledge — an instrument of cognitive processing and the construction of reality (Kirsh, 2013). Research indicates that movement and gestures enhance the learning of scientific concepts (Weisberg & Newcombe, 2017) and that embodied learning helps students understand complex scientific ideas better.

Example: Structure and Properties of Water

Experience: This exercise demonstrates the structure of a water molecule, its movement, and its behavior in the presence of other water molecules.

Reflection: "Water molecules are constantly connecting with one another — they want to be as close as possible. What could be the result of this?"

Constructing Knowledge: A water molecule consists of one large oxygen atom and two small hydrogen atoms. The hydrogen atoms are always connected to the oxygen atom in the same way. A water molecule is a dipole, meaning it can attract other water molecules. Because of this property, water exhibits many interesting characteristics.

Supporting the Learning and Discovery Process Through Movement (Embodied Learning):

- ✓ Allows students to experience scientific phenomena directly.
- ✓ Reinforces abstract concepts through physical interaction.
- ✓ Helps ground abstract scientific principles in sensory and motor experiences, making them more accessible and comprehensible.
- ✓ Encourages students to take an active role in their learning.
- ✓ Accommodates diverse learning styles, particularly benefiting students who may struggle with purely abstract or symbolic forms of representation.
- ✓ Engages multiple cognitive pathways – visual, auditory, and kinaesthetic – to enable a more holistic understanding.

References

Barnes, D. (2008). Exploratory talk for learning. In: N. Mercer, S. Hodgkinson (eds.), *Exploring Talk in School. Inspired by the Work of Douglas Barnes* (pp. 1–16). SAGE Publications, https://doi.org/10.4135/9781446279526.n1.

Boaler, J. (2016). *Mathematical Mindsets. Unleashing students' potential through creative math, inspiring messages and innovative teaching*. Jossey-Bass/Wiley.

Boaler, J., Chen, L., Williams, C., Cordero, M. (2016). Seeing as understanding: the importance of visual mathematics for our brain and learning. *Journal of a o Applied and Computational Mathematics*, *5*(5), 1000325, https://doi.org/10.4172/2168-9679.1000325.

Bruner, J.S. (1966). *Toward a Theory of Instruction*. Cambridge: Harvard University Press.

Dąbrowski, M., Kondratek, B. (2017). The effects of the playing with pictograms package. *Edukacja*. *5*, 84–98.

Filipiak, E. (2012). *Rozwijanie zdolności uczenia się. Z Wygotskim i Brunerem w tle*. Gdańsk: GWP.

Kirsh, D. (2013). Embodied cognition and the magical future of interaction design. *ACM Transactions on Computer-Human Interaction*, *20*(1), 3, https://doi.org/10.1145/2442106.2442109.

Klus-Stańska, D. (2002). *Konstruowanie wiedzy w szkole*. Olsztyn: UWM.

Klus-Stańska, D. (red.) (2024). *Dydaktyka i jej paradygmaty. Różnorodne światy szkoły.* Warszawa: WN PWN.

McCann, R. (2016). Physical Education + Math = Positive Results. *Physical and Health Education Journal*, *82*(2), 1-5.

Mercer, N. (2000). *Words and Minds. How we use language to think together*. London-New York: Routledge.

Michalak, R. (2020). Konstruktywistyczna perspektywa wczesnej edukacji przyrodniczej. *Problemy Wczesnej Edukacji*, *4*(51), 99–113, https://doi.org/10.26881/pwe.2020.51.08.

Nathan, M., Walkington, C. (2017). Grounded and embodied mathematical cognition: promoting mathematical insight and proof using action and language. *Cognitive Research: Principles and Implications*, *2*(9), https://doi.org/10.1186/s41235-016-0040-5.

Weisberg, S., Newcombe, N. (2017). Embodied cognition and STEM learning: overview of a topical collection in CR:PI. *Cognitive Research*, *2*(38), https://doi.org/10.1186/s41235-017-0071-6.

Żytko, M. (2021). *Edukacja w dialogu*. Warszawa: Wolters Kluwer Polska.

1. NAME OF ACTIVITY: UNITS, TENS, BAG MODEL

Duration: 60 minutes

Teaching objective (operationalized):

- Students count counters using various counting ways (in 2s, 5s, 10s)
- Students count complete tens
- Students compare numbers using a bag model

Materials:

Counters of various colors, string bags, dry erase plates or paper sheets and felt tip pens.

Part 1: Experience/Operation

The activity takes place in a classroom. The teacher arranges Students in 2-3 person groups, distributes counters and a few bags per group. Each group is given counters of one color only (blue, red, green, etc.).

Task: Students count how many counters there are on their desks and record their sums. Counters are to be grouped in 10s – each ten is put in a bag. Each bag has to be filled with exactly 10 counters.

The teacher does not want to distribute many bags at once so that Students have to ask for extra bags, which is an opportunity to talk individually to Students (How many bags have you got? How many counters does it make? How do you know?)

Post-Operation Discussion

Once there are only bags and a few counters left on the desks, the teacher asks the following questions:

- Have you managed to pack all your counters in the bags?
- How many counters do you need to fill up another bag?
- How many counters do you have in total? How have you counted it?
- Tell me how many bags 145 counters make?

Part 2: Comparison/ Reflection

The teacher asks the following questions:

- Who has the most bags? Which group? Who has the fewest?
- Who has the most counters in total? What decides it?

The teacher wants to check which counters (colors) make the largest sum. The teacher asks Students how they can tell that. Students propose and demonstrate their ideas using materials. The teacher does not force solutions upon them. Students can perform the following operations:

- They count all the counters of each color.
- They arrange the bags in rows for comparison.

If Students need more bags, because they created new tens, the teacher checks if they do by telling Students to explain aloud why they need another bag.

Discussion

- How many counters have you got now?
- How many extra bags did you need? Why?

Knowledge building

The teacher rephrases the students' feedback and formulates generalized statements. It is important that Students notice how units and tens relate to each other. When comparing counters, focus on the number of tens of counters at first, not the counters left outside the bags.

Recapping

- What decides which number is higher according to the bag model?

How can we establish this?

Extension (optional)

You can extend your class using the following operations with bags and counters:

- Adding up to and beyond a threshold (creating new bags),
- Subtracting down to and below a threshold (unpacking the bags).

2. NAME OF ACTIVITY: MATCHING NUMBERS TO THEIR DRAWINGS

Duration: 60 minutes

Objectives:

- Introducing icon illustrations for numbers from 1 to 20
- Matching numbers' icon representations with symbol representations
- Arranging numbers in order according to a chosen rule: ascending, descending etc.

Materials

Teaching Resource 1 – A3 sheets: pictographic "number mat" (icon representation of numbers from 1 to 20)

Introduction

You can organize the activities either in a classroom or in the gym. Refer to Students' earlier experience: counting counters, grouping in 2s, 5s, 10s, filling ten-counter bags, comparing numbers.

1. Experience / Operation

The teacher draws the icon for the number 12 on the board: One bag with ten circles inside and two circles next to it. The teacher asks the students what number is shown in the drawing and then elicits ideas about what number 54 would look like. The students draw it.

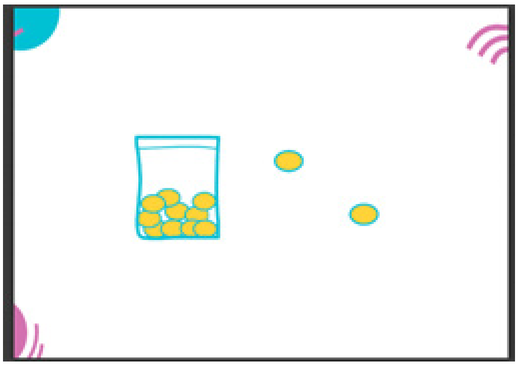


Figure 1. Sheet 12 in Teaching Resource 1

Next, the students stand in a circle. The teacher sticks sheets of paper with numbers written on them (1 to 20) to the students' backs. The students' task is to find their respective numbers (they may not speak while doing so) and find the matching sheet with the corresponding number icon. Then, students arrange the sheets in a sequence according to a rule they set together, such as ascending order, descending order, or order of even numbers. The teacher does not interfere.

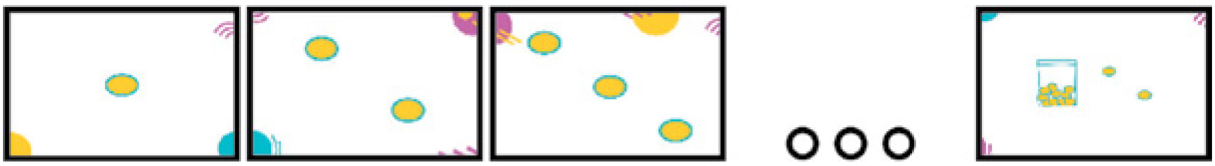


Figure 2. Sample solution - sheets in the ascending sequence

Discussion

Once the sheets are arranged, the teacher asks the following questions:

- What rule did you use to arrange the sheets?
- Were there any other ideas for how to arrange them? What?

Modification

Instead of placing paper sheets on students' backs, the teacher passes out round sheets with numbers on them, leaving some numbers out. Students arrange the numbers to make a number mat in ascending or descending order.

Once finished, the teacher asks the following questions:

- Are all the numbers present in this sequence?
- What should we do to fill in the missing numbers?

Students can choose to:

- Draw the missing sheets (have them pick their own materials).
- Fill in the missing sheets that the teacher has prepared.

The discussion can differ depending on the final shape of the mat the students have put together. For ascending order, propose math operations related to this arrangement.

Examples of operations using the number mat:

- Mary stands on square 20 and walks to square 4. How many steps does she take? How many fewer counters are on square 4?
- You can also create an individual operation worksheet or a pair activity.

Other optional activities:

- Get students to come up with alternative rules for mat arrangement. They do not have to use all the sheets.
- Students can invent their own math riddles for each other to solve using the number mat.

The proposed teaching activities follow a structured learning progression from concrete experience to pictorial (iconic) representation and finally to abstract (symbolic) understanding. Students start by **engaging with physical materials.** They manipulate counters, grouping them into tens, counting them, and packing them into string bags. Through these actions, students begin to **grasp the structure of numbers**, including how tens and ones relate to each other and how quantities can be organized.

Next, students **transition to the pictorial level** by creating drawings that reflect their earlier work with counters and bags. For instance, the number 12 might be depicted as one full bag of ten counters and two loose counters beside it. Students gradually begin to associate numbers with their pictorial representations and order them according to self-defined rules (e.g., ascending, descending, even numbers).This transition helps students construct **visual models** of numbers, deepening their understanding of place value.

Eventually, students **reach the symbolic level,** which is the abstract numerical notation used in everyday mathematics. Because the symbolic form naturally arises from their earlier concrete and pictorial work, it becomes meaningful rather than arbitrary. It becomes **a representation of a familiar structure,** not just a written sign.

The base-ten number system model, introduced through these activities, helps students develop a **deeper, more lasting understanding of numbers.** This model enables students to connect different forms of representation and equips them with the tools necessary for thinking, comparing, and reasoning about numbers with confidence and clarity.

Time: 3 hours

Educational goals

The students:

a) perform the experiment according to the instructions provided (understand verbal, drawn, text instructions),
b) formulate hypotheses, referring to their personal knowledge/results of previous experiments,
c) carefully observe the results of the experiment and write or draw them on the worksheet,
d) negotiate meanings of a simple machine, a inclined plane, an effort, a load, length of the path in groups,
e) explain the course of observed phenomena/processes,
f) use mentioned above concepts in speech/writing,
g) cooperate in a group.

Materials

– for each group: an inclined plane, a dynamometer, a load, two worksheets - one with the graphic task and the second one with instructions on how to do Experiment. Part 2, a tape measure
– alternatively: the films, the texts about the simple machines

Organizational Arrangements for Teacher Before the Activity

The teacher prepares large-sized inclined planes. It is important that each inclined plane has a constant height and interchangeable ramps – one longer and one shorter. The teacher also selects the loads for the experiments, with ropes attached to them. The optimal shape of the load is a sphere, as this minimizes friction between the load and the ramp.

EXPERIENCE

The teacher divides the students into several groups. Each group works at a station where an inclined plane (one of the simple machines) has been prepared. The students carry out their work based on the teacher's oral instructions.

Experiment. Part 1

1. The teacher briefly explains the experiment instruction. In each group the students will perform three tests: they will lift a weight attached to a rope (test A), then will build two inclined planes, as shown in the figures, and will pull the same weight up using the ramp B and C.

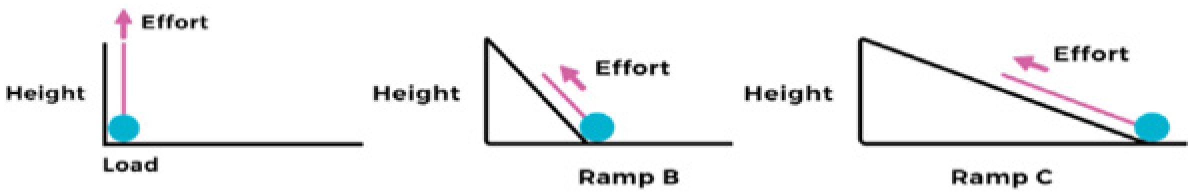


Figure 1. Visual instructions for tests A, B and C

2. The teacher writes down a research question: *When will you use the biggest and when the smallest effort to pull the load up?* The students discuss the problem in their groups and then submit hypotheses.
3. The students perform three trials. Each group member must complete this task individually. During the activity, students exchange observations, compare them, create generalizations and try to explain the results of the experiment.

REFLECTION

The teacher asks questions and encourages students to answer, looks for interesting problems that appear in students' statements and follows them up.

- *What interesting things did you notice?*
- *What were your hypotheses? Did everyone think the same way?*
- *Did you correctly predict the effects of your actions? Were your hypotheses confirmed?*
- *What sense helped you notice the difference in the force you used in each trial?*
- *How much difference did you feel by touch?*

MODIFICATIONS

If the teacher works with preschool children, he/she can use only the first part of the experiment without taking measurements. The teacher can also use the educational opportunities to organize discussions, for example, when children build driveways for cars – some longer and less sloping, others shorter but steeper, or when they play on the slide.

IMPORTANT

This part of the lesson allows students to learn about simple machines through movement and sensory experiences. Students manipulate objects and perform actions, using their eyes to observe inclined planes in different positions and their sense of touch to feel the effort required to complete a task. At this point, it is worth recalling the concept of embodied learning, which is based on the idea that "cognition is inherently embodied, meaning that our thinking is deeply intertwined with our physical interactions and experiences in the world" (Danish et al., 2020).

Embodied learning emphasizes the importance of physical activity, sensory experiences, and a well-organized environment in the process of knowledge construction (Gallagher, 2011). It facilitates a deeper understanding of objects, phenomena, and processes explored in science classes, as students represent and manipulate their ideas through movement, gestures, and interactions with objects and experiments. According to Bruner's theory, students use enactive representation, which involves understanding and remembering information through action and movement. "When students engage in tasks that require bodily involvement, it helps anchor abstract scientific concepts in tangible experiences, making collaboration more meaningful" (Abrahamson & Lindgren, 2014).

An essential element of collaboration is discussion. Speaking allows students to verbalize their thoughts, enabling them to be analyzed, organized, and communicated to others. During discussions, students use language, which corresponds to Bruner's symbolic representation. Symbolic representation is a mode of representing knowledge in which individuals use language, mathematical symbols, and other abstract codes to understand the world and communicate their understanding to others. This process marks the beginning of building the concept of force.

EXPERIENCE

4. The teacher uses a graphic to present a problem to solve (Worksheet 1). The students' task is to indicate which inclined plane must James and William choose if they want to use the similar effort to bring the wheelbarrows full of rocks to the top of the ramps. The students must remember that James has many more rocks in his wheelbarrow than William.

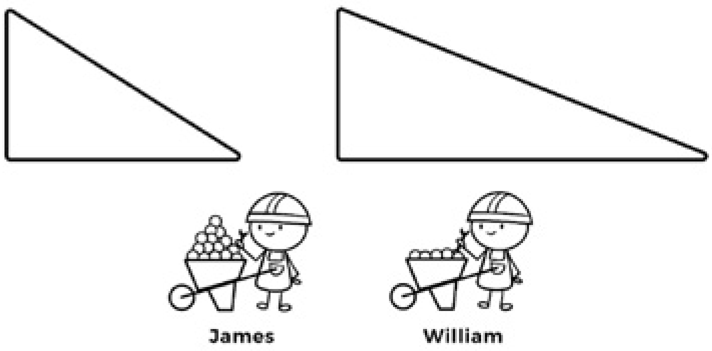


Figure 2. The graphic task for the students

REFLECTION

The students discuss the problem in groups, provide a solution, and explain their proposals.

IMPORTANT

In the problem described above, the teacher appealed to the iconic representation. In Bruner's theory of cognitive development, iconic representation is the second stage, filling the gap between the concrete (action and moving) and the abstract (symbols). In this way of thinking and learning, knowledge is stored and processed through visual images and mental pictures.

EXPERIENCE

The students receive Worksheet 2. They do this part of the experiment independently using the written instructions.

Experiment. Part 2

5. In each group the students weigh the load using the dynamometer and check the result on the scale in grams (g). Then they try to lift the load to a specific height (test A) and measure the effort required to do this using a dynamometer. The measurement is taken while the load is moving upwards. The result is recorded on the scale in newtons (N). Both results are recorded on the worksheet.

6. The research question is: *When will you use the biggest and when the smallest effort to pull the load up – using the ramp A or using the ramp B? Try to estimate the value of the effort in both cases.* The students discuss the problem, form hypotheses together, and write them down on the worksheet.
7. The students pull the load up to a specific height using ramp B and C. During each trial the students measure the efforts needed to perform these tasks using the dynamometers. The most important rules of the experiment are as follows: the load is pulled up very slowly and evenly, the dynamometer is set parallel to the ramp, the students check the effort on the dynamometer while the load is moving. The students use the scale in newtons (N). They put data in the table.
8. Then they measure the height of the inclined plane (A) and the lengths of ramps B and C. They enter the results in the table on the worksheet (in cm). An example table is shown below. During the experiment, students spontaneously begin to discuss their observations among themselves.

The length of the path that the load has travelled	The effort needed to pull the load up
A ....cm	A ....cm
B ....cm	B ....cm
C ....cm	C ....cm

Table 1. Summary of the results of Experiment. Part 2.

REFLECTION

The teacher encourages students to ask their classmates questions about the experiment. At the end of discussion the following questions are asked: *What are your conclusions from the experiment? How does your simple machine (inclined plane) make easier for a person to do work? Give us examples from your experiences.*

MODIFICATIONS

The teacher can prepare experiments for students in which they will study other simple machines, e.g. first-class lever, second-class lever, stationary and movable pulley.

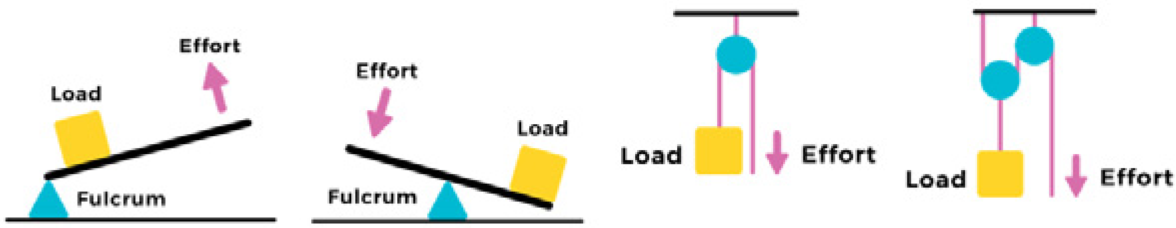


Figure 3. Examples of other simple machines to experiment with: first-class lever, second-class lever, stationary pulley, stationary and movable pulley

IMPORTANT

The students were physically active, used visual instructions, but first of all, took measurements and discussed the results and conclusions from the experiment. This experience involves stages of Bruner's representations: action-based, image-based and language-based. Symbolic representation is the final stage, building upon the previous two, but all of them support the construction of the concept of a simple machine in the learners' mind.

UNDERSTANDING - BUILDING KNOWLEDGE

The teacher organizes students' statements from the previous stage of the lesson, explains what a inclined plane is, who invented it and how it makes easier for people to perform various types of work. The teacher should include students in this summary.

IMPORTANT

Simple machines are defined as idealizations of real mechanical devices. They were already known in antiquity. The most famous scientist associated with simple machines was Archimedes. The final canon of them was established by Galileo, who defined simple machines as lever, inclined plane, pulley, windlass, wedge, screw. The basic simple machines are the lever and the inclined plane. The principles of operation of all other machines can be explained using the idea of these two.

An inclined plane is a flat surface, tilted at an angle to the horizontal, on which various objects can lie, slide, roll, etc. This device allows us to reduce the effort needed to lift an object, but it increases the distance the object travels. The work done by a smaller driving force over a longer path is equal to the work of a greater useful force over a shorter path (the principle of conservation of energy).

ANOTHER EXPERIENCE

- The students watch short films or educational programs about simple machines. During the presentation they can answer several questions which are related to the content of the film and are listed on the worksheet.
- The students, individually or in groups, search the Internet, books and magazines for information about simple machines. The students then prepare infographics using the found information.
- The teacher suggests that students create their own ideas for experiments that will help classmates better understand how an inclined plane works. The students can use materials from the classroom or plan research outside the school, for example, building slides for toy cars with different surfaces (smooth/rough), pulling small dump trucks with loads up wheelchair ramps, going down and up slides with different angles of inclination.

NAME OF ACTIVITY: EXPLORING AN ELECTRIC CURRENT

Time: 3 hours

Educational aims

The students:

- capture and pass the ball to partners, dexterously and rhythmically,
- create a graphical simulation of current flow,
- cooperate in a group,
- take an active part in the discussion,
- explain the behavior of free electrons during the flow of direct current in a conductor.

Materials: big or the small balls, two baskets, large and small paper circles; alternatively, videos about electricity.

ORGANIZATIONAL INSTRUCTIONS FOR TEACHERS BEFORE THE ACTIVITY

Basic assumption: during the previous lessons, students learned and understood the concepts of atom and molecule, and also electrification of bodies, electric charge, negative charge, positive charge.

EXPERIENCE

Students sit in a line (cross-legged) holding big balls (for example, volleyballs or footballs). At the teacher's signal, each student places their ball on the knees of the students sitting on the right. The last student throws the ball into the empty box marked with a + sign. At the same time the first student in the line gets a new ball from a helper, who stands next to a basket full of balls (marked with a – sign). The teacher can help the students by slowly tapping the rhythm on a drum, then the game pace can be gradually increased. When all balls are in the last basket, the game can start over. Remember to swap the basket symbols: – sign for an empty basket, + sign for a basket full of balls.

MODIFICATIONS

In this game the students can use small balls, but this version is more difficult and requires more dexterity.

REFLECTION

The teacher places two sets of cards with words on the board. Set 1 contains the words: *ball, children's line, child*. Set 2 contains the words: *atom, free electron, wire, conductor*. The students try to match words into pairs. There is a hidden problem in the task, because the phrase: *children's line* matches two cards from Set 2: *wire* and *conductor*. The teacher asks supporting questions:

What is a ball in this game? (*free electron*)
What is an electron?
What is the line of children? (*wire, conductor*)

What is the conductor?
What is a child? (*atom*)
What is an atom?

At the end the teacher asks summary questions: What did we see during this game? Why at the beginning of the game the first basket had a – sign and the second a + sign? Why do we have to swap the basket markings after the round ends?

EXPERIENCE

The teacher divides the students into groups of four and gives each of them a set of large and small circles cut out of paper. The students' task is to propose a simulation of free electron jumps using movement and graphic elements.

REFLECTION

One member of each group presents a solution. Students compare their proposals and relate them to the previous game.

UNDERSTANDING - BUILDING KNOWLEDGE

The teacher helps students describe the physical phenomena demonstrated in two previous activities. They show how the electric current flows in the wire made of a conductive material. Free electrons (negative electric charge carriers) jump from one atom to another occupying empty spaces on atomic shells for a moment and then they jump further. This creates an orderly movement of electrons in one direction, called a direct current. The actual movement of electrons is from the negative to the positive terminal. However, the established convention for current direction is from positive to negative. When the current changes its direction at certain intervals, it is called an alternating current.

IMPORTANT

The above example once again refers to the theory of embodied learning. "This type of learning, where the body is actively involved, helps ground abstract scientific principles in sensory and motor experiences, making them more accessible and understandable" (Nygren et al., 2023; Shiller, 2019). Embodied learning implies greater student engagement, encourages experimentation, where students formulate hypotheses, observe and measure results, and discuss the conclusions of their experiences. Furthermore, it accommodates different learning styles, including those students who may have difficulty with abstract representations. Similarly, Bruner's theory of cognitive development proposes that learning progresses through three modes of representation: enactive, iconic, and symbolic. They appear at specific stages of a child's development, but accompany people throughout their life. Adults often use symbolic representation, but this does not mean that they do not process information using drawings or gestures.

1. Enactive Representation (action-based), which involves representing knowledge through action and physical experiences, is the earliest form, primarily

used by infants and young children. In the activities described above, the Enactive Representation is activated during motor play with balls.

2. Iconic Representation (image-based) typically occurs in young children (after the age of 1). To understand concepts children begin to use visual images and sensory experiences. An example of this representation is when students create the graphical simulation of the flow of free electrons in a conductor.
3. Symbolic Representation (language-based) is the most advanced form of representation. Knowledge is constructed through language, symbols, and abstract thought. At each stage of the course there is a discussion that promotes the use of speech to build understanding of the phenomenon of electricity. In the activities, the conventional symbols of positive and negative electric charge are also used.

The order of activities is consistent with the order of subsequent Bruner's representations.

ANOTHER EXPERIENCE

- When talking to students, the teacher can use the following analogy: Imagine a river. It flows from the source (+) to the mouth (–). This movement we called a current (*conventional current*). But the water itself is moving from a higher level, marked -, which means that there is an excess of electrons in this place to a lower level, marked +, which means that there is a shortage of electrons at this point (*electron flow*).
- The students could watch videos explaining the phenomenon of electricity and discuss the problems posed in them.
- As part of the implemented project, the teacher can organize a trip to the power plant or a meeting with a specialist in the field of electricity.

IMPORTANT

At this point, it is worth recalling the definition of embodied learning, which is based on the assumption that, "Cognition is inherently embodied, meaning that our thinking is deeply intertwined with our physical interactions and experiences in the world" (Danish et al., 2020). Embodied learning emphasizes the importance of physical activity, sensory experience, and a well-organized environment in the process of constructing knowledge (Gallagher, 2011). It promotes a deeper understanding of the objects, phenomena, and processes explored in science classes.

This happens because students represent and manipulate their ideas through movement and gestures, as well as through interaction with objects and experimentation. According to Bruner's theory, they use *enactive representation*, which involves understanding and remembering information through action and movement. "When students engage in tasks that require bodily involvement, it helps anchor abstract scientific concepts in tangible experiences, making collaboration more meaningful" (Abrahamson & Lindgren, 2014).

An essential element of collaboration is discussion. Speech enables students to verbalize their thoughts, allowing them to analyze, organize, and communicate their ideas to others. During discussion, students use speech corresponding to Bruner's *symbolic representation*, i.e. a mode of knowledge representation in which people use language, mathematical symbols, and other abstract codes to understand the world and communicate their understanding to others. This process marks the beginning of building of the concept of *force*.

References

Abrahamson, D., Lindgren, R. (2014). Embodiment and embodied design. In: R.K. Sawyer (ed.). The Cambridge Handbook of the Learning Sciences. 2nd ed. (pp. 358–376). Cambridge: Cambridge University Press, https://doi.org/10.1017/CBO9781139519526.022.

Gallagher, S. (2011). The Oxford Handbook of the Self. Oxford: Oxford University Press, https://doi.org/10.1093/oxford/9780199548019.001.0001.

Nygren, M.O., Price, S., Jha, R.T. (2023). The role of embodied scaffolding in revealing "enactive potentialities" in intergenerational science exploration. *Science Education*, *108*(2):495–523, https://doi.org/10.1002/sce.21845.

The Movement - Coordination - Learning Combined Method

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Introduction

The modern educational system focuses on the comprehensive development of children, including their physical, cognitive, and social-emotional growth. This is particularly crucial during the early childhood and primary school years, when foundational skills are acquired, intrinsic motivation is cultivated, and self-regulation and social competencies are honed (Hrynevych, 2016; Mandyuk, 2024; Pasichnyk, 2025). The My Place in the World program was created to address the educational, developmental, and upbringing needs of preschool children. A key goal is to foster the growth of children's physical and mental abilities (Pasichnyk et al., 2015; Prystupa, et al., 2014, 2023). The educational reform called Nova Ukrainska Shkola (New Ukrainian School) is based on a competency-driven approach that aims to help students not only acquire knowledge, but also develop important skills. The following skills are emphasized: creativity, communication, entrepreneurship, civic engagement, environmental awareness, and health and wellness (Moskalenko, et al., 2019; Sorokolit, 2019, 2021 a, b, 2022).

In this paradigm, physical activity occupies a distinctive position as a means of stimulating sensorimotor, cognitive, and emotional functions (Mandyuk et al., 2023, 2025; Pasichnyk et al., 2015). Scientific research in neuropsychology has demonstrated that carefully selected motor tasks can activate the central nervous system, enhancing cognitive functions such as attention, coordination, spatial orientation, emotional state, and vocabulary. Integrating physical exercises into the learning process has proven to be an effective pedagogical strategy (Rokita et al., 2014, 2017).

The Movement-Coordination-Learning method was developed to improve motor skills, mental processes, and essential skills in preschool and primary school children. The main goal is to balance physical activity and educational tasks. This methodology uses equipment, light, and sound signals to impact different sensory systems and keep children highly motivated (Pasichnyk, 2025; Pasichnyk et al., 2024; Prystupa, et al., 2014, 2023).

Movement-Coordination-Learning exercises can benefit teachers, educators, rehabilitation specialists, and parents—that is, anyone interested in fostering a child's harmonious development. The methodology is structured to gradually increase task difficulty to adapt to a child's individual needs. Furthermore, the methodology combines motor activity with fostering a positive attitude toward learning.

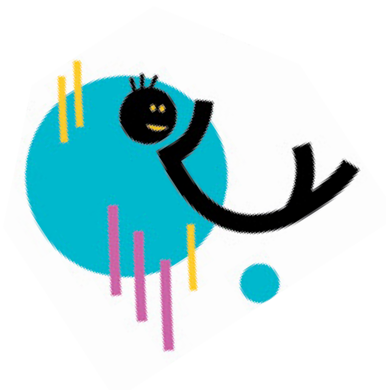
Movement-Coordination-Learning blends physical exercises and coordination tasks with competence-oriented learning tasks, fostering bonds between physical activity and academic skills in children aged 5–10.

The Program Encompasses Three Primary Domains

Domain I: "Smart Ball" integrates various aspects of development, including motor, cognitive, and communication skills. It uses the ball as a universal tool for activities that promote development in different areas.

Domain II integrates physical exercises with competence-oriented tasks to develop the eleven key competencies of the New Ukrainian School educational reform, as well as cross-cutting skills, such as creativity and vocabulary, through physical activity.

Domain III consists of specific physical exercises that stimulate different parts of the central nervous system. These exercises include tasks such as throwing a ball at different targets to enhance accuracy and alter the movement trajectory.



COLORED HUTS

Objective:

to promote the development of attention, thinking, visual memory, reaction time, and spatial orientation.

Equipment:

gymnastic mats, cones, a portable acoustic system

Game description

Place 2-4 mats (depending on the number of participants) in the corners of a sports ground to serve as “huts” that the students must run to. A cone of a specific color (e.g., yellow, red, orange, green) should be placed near each “hut.” This way, each “hut” becomes a corner of a particular color. The students and the teacher stand in a circle facing each other, holding hands. The teacher explains the rules. After ensuring all the students are ready, the teacher announces the color (which can be combined with raising the corresponding card or cone). At the same time as announcing the color, the teacher gives a sound or visual signal. The children then run as quickly as possible to the matching colored corner and stand, sit, or jump on the mat in the “hut.” The teacher selects a new color each time (Fig. 1).

Game variations

To diversify/complicate the exercise, children can start the exercise from different starting positions.

For children with reduced mobility, you can suggest, for example, rolling the ball to the appropriate corner instead of running.

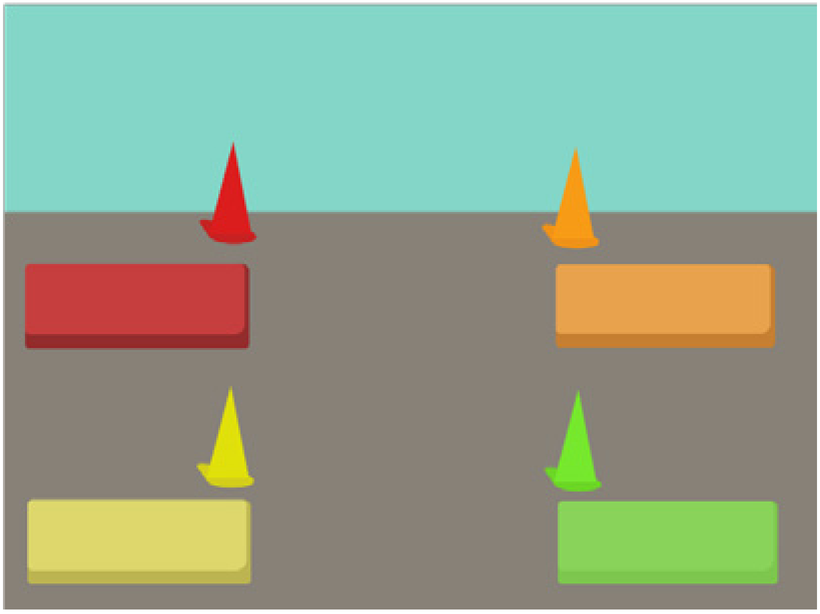


Figure 1. Colored Huts

CLEAN UP THE LAWN!

Objective

to promote the development of environmental awareness, speed, and coordination.

Equipment

empty tin cans, empty plastic bottles, plastic cups, paper cups, plastic bags, paper balls, waste sorting containers labelled: “Paper,” “Metal,” “Plastic,” “Organic.

Game description

The teacher scatters paper balls, empty plastic bottles, plastic cups, paper cups, empty cans, and mock-ups of fruit or vegetables around the playground to represent rubbish. Colored containers with rubbish types are placed at the front of the gym: “Paper,” “Metal,” “Plastic,” “Organic.” The names of the rubbish types are paired with pictograms or colored marks to provide visual signs (Fig. 2).

Each team member chooses a card with a picture of the rubbish type they are to collect. At the teacher’s signal, all players begin the cleanup and gather a specific type of “rubbish” in the correct “container”:

- paper balls and paper cups into the blue container marked “Paper”
- mock-ups of fruit or vegetables into the black container marked “Organic”
- plastic cups and bottles into the orange container labelled “Plastic”
- empty tin cans into the yellow container labelled “Metal”

After collecting all the rubbish, the teacher and children go to the containers and check that each type of waste has been sorted correctly. They discuss artificial and natural materials, both of which need to be disposed of or composted properly. They talk about what they have learned, what they have accomplished, and how they have helped the environment. They also explain why sorting matters, as it strengthens environmental competence.

Figure 2. Clean up the Law

COLORED BALL

Objective

to develop agility, reaction, and coordination; to develop speech and reinforce the knowledge of colors; to train attention, thinking, and teamwork.

Equipment:

balls in two colors (red and yellow, etc.), two large baskets (1 meter in diameter), and marker lines for the teams to start.

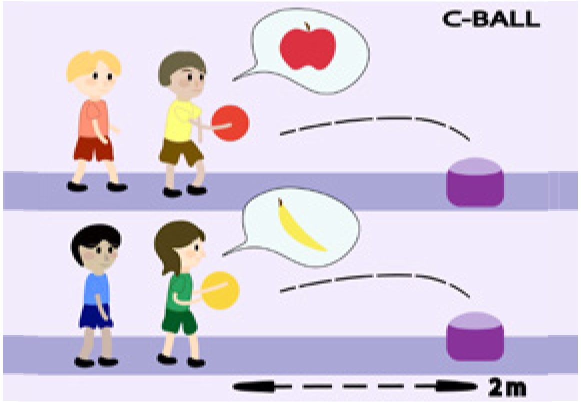


Figure 3. Colored Ball

Game description

Children are divided into two teams: “red” and “yellow”. Each team receives the corresponding colored balls. One player from each team starts. Baskets are placed 2 meters from the start line. At the signal, players throw the ball into the basket and simultaneously name an object of the corresponding color (for example, if the theme is fruit and vegetables: “tomato” for the red team, “banana” for the yellow team). If the word is not repeated, the team earns an extra point. After the throw, the player returns to the end of the line, and the next player takes the place at the start. Team assistants stand near the baskets and return the balls. The game continues until all participants have made their throws. The team with the most points (for accurate throws and correct words) wins (Fig. 3).

Game variations

Color Association. Instead of just naming objects, children have to come up with a color association (for example, red might be ‘love’ and yellow might be ‘sun’).

Math Ball. Before throwing, players solve a simple math problem (e.g., 2+1). When the answer is correct, they can throw the ball and name a word.

Flash Ball. This is a speed game: the host names a category (fruit, vegetables, transport, clothing), and players must come up with items only from that category.

Long Word. Players must name an object made up of more than one word (for example, “fire engine” for red or “bright sun” for yellow).

Talking Ball. To develop foreign language skills, children can name objects of the corresponding color in a foreign language.

To boost physical activity, you can add tasks before throwing. For example, “penguin” – walk with the ball while holding it between your knees; “crab” – walk backwards on your palms and feet; jump like a frog or bunny, spin around twice, and then throw. Another variation is the “secret combination” – a player draws a card with a movement that must be performed before throwing (for example, spin – jump – throw). After the game, children can draw a picture based on the words they mentioned. Using balls of different textures, weights, or sizes can also enhance sensory perception.

MAGIC WALL

Objective

to develop physical skills (coordination, speed, agility); sensory perception (visual and auditory perception of colors, shapes, and sounds); cognitive development (memory, attention, recognition of shapes and colors, matching).

Figure 4. Magic Wall

Equipment

The game requires an interactive wall that responds to the contact of balls with it, e.g. a wall installation with projections of colors, shapes, or images, the nature of which could change upon contact with objects. Shapes, numbers, or colors are projected onto the wall using a projector. Balls of different colors with images of geometric shapes.

Game description

Children are divided into teams or take turns playing. The leader explains the task: various images appear on the wall, which must be "caught" with a ball. The more targets the ball "catches," the more points the team or player earns (Fig. 4).

Game variations

Color Explorers. Objects or targets of different colors appear on the screen, and children must hit the "target" of the matching color with the ball.

Shape Hunters. Circles, squares, triangles, and stars appear on the screen. Children must find a ball of the matching color (or with the matching pattern) and "hit" the matching image.

Sound Seeker. When the ball touches the wall, a variety of sounds play (such as barking, rain noise, mooing), and children are tasked with identifying the sound.It is recommended to introduce tasks in a gradual manner, commencing with the simplest ones, e.g. identifying colors. Thereafter, more complex tasks, such as identifying shapes, should be incorporated. Finally, tasks that incorporate sound should be included.

It has been demonstrated that children are capable of performing a number of additional movements during the game. These include jumping, running to the ball, overcoming barriers, rolling the ball, carrying the ball on the palm of the hand, or rolling the ball through a tunnel to the wall. The game may have a time limit, during which children must finish, thus encouraging them to move vigorously and make quick decisions.

FUN MATH

Objective

to develop speed, reaction, coordination, and cognitive abilities.

Equipment

Sports markers numbered from 1 to 10 (2 sets), colored cones, and cards with math problems.

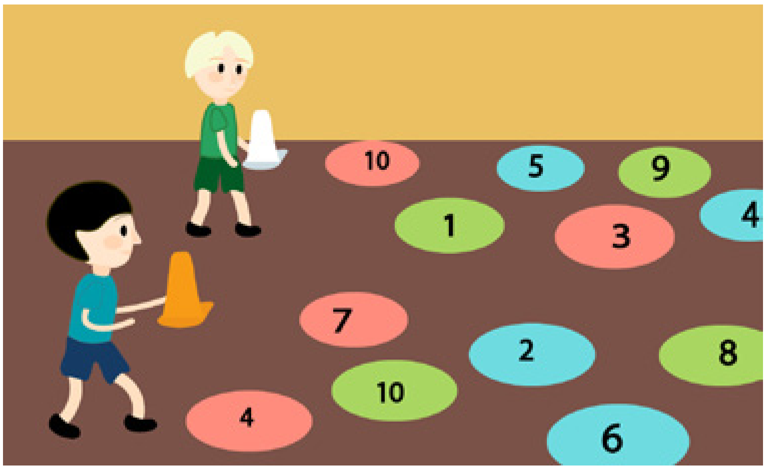


Figure 5. Fun Math

Game description

Children are divided into two teams (for example, orange and white). Depending on the number of participants, white and orange cones are distributed. Sports markers numbered from 1 to 10 are placed in front of the teams in random order. The teacher reads aloud, shows a card with math problems, or displays a math problem on the screen, then the first participant from each team must quickly place a cone on the number that is the answer to the problem and cross the starting line. If the student solves the problem correctly and is the first to return to the team, the team earns two points. If the student solves the problem correctly but is the second to return, the team earns one point. The tasks are then repeated for the next players (Fig. 5).

Game variations

Time Math. Calculate as many math expressions as possible within two minutes. Each participant takes turns running out, calculating the expression, placing the cone, running back, and then the next participant begins. The team with the most correct answers wins.

Find a Pair (adding numbers). The teacher names a number (for example, 9), and the student must find and cover two digits that add up to that number (for example, 4 and 5). You can make it more challenging by using multiplication or subtraction.

Equations. The teacher presents an equation (for example, $\_\_ + 3 = 7$), and the student must select the correct number.

Math Challenge. Before starting, the student calculates the expression (e.g., 6×2), runs to the correct marker, touches it, then returns in a different way (e.g., jumping or crawling).

ACTIVE ENGLISH: MOVE AND SPEAK!

Objective

to develop English communication skills through physical activity; to expand students' vocabulary on the topics of 'movement' and 'sport'; to develop attentiveness, coordination, and teamwork skills.

Equipment

The teacher prepares cards with the names of movements in English (for example, to jump, to squat, to run, to stretch, to hop, to kick, to throw, to catch), along with a ball or small objects to pass, and a timer or music (optional).

Game description

The teacher shows pictures of movements and says the words in English. The students repeat after the teacher and perform the corresponding movements (Fig. 6).

Game variations

What's This? The teacher shows a movement, and the students name it in English.

Simon Says: Jump! Students perform a movement. If "Simon Says" is not said, they do not have to perform the movement.

Catch & Move! A circle game with a ball: One student throws the ball to another and gives the command: "Hop!" The other student performs the action and passes the ball on.

Music Moves. When the music is playing, the children move around; when it stops, the teacher gives a command to be followed.

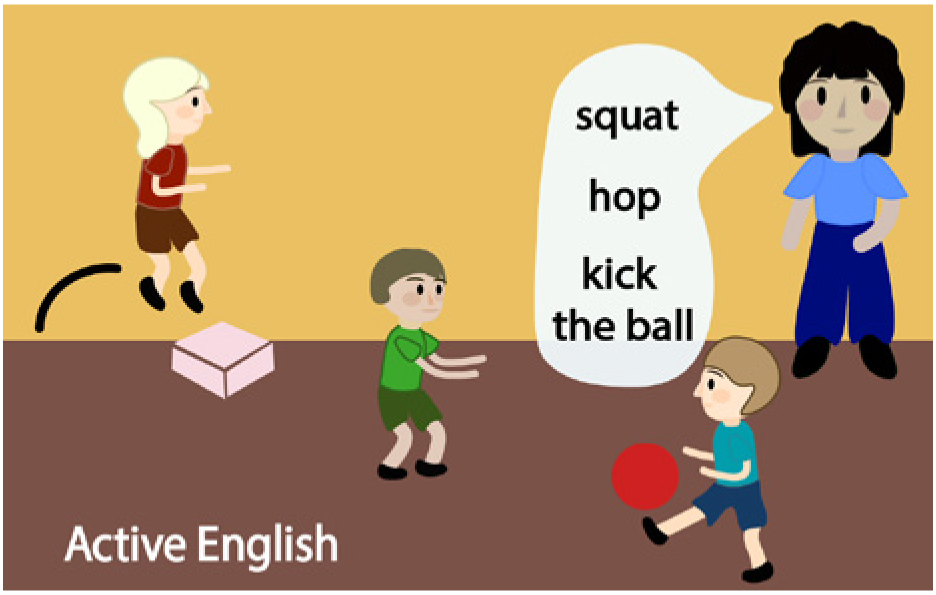


Figure 6. Active English: Move and Speak

METEOROLOGISTS IN ACTION

Objective

to develop competence in the sciences by observing natural phenomena and enhancing physical skills, agility, and reaction time. Additionally, it aims to foster an understanding of the relationship between movement and natural occurrences, as well as to reinforce the knowledge about weather and its impact on the environment.

Equipment

cards featuring images of the sun, rain, wind, thunderstorms, and more.

Game description

the teacher names/shows the students a card with pictures of natural phenomena (Fig. 7).

- ☀ **Sun** – students raise their hands and spin/jump with.
- **Rain** – students run between hiding places (mats or hoops) / jumping over puddles (marks, hoops).
- **Wind** – students run in a snake-like line, mimicking the flow of air currents.
- **Thunderstorm** – students squat and freeze.

Within five seconds, the teacher names another natural phenomenon, and the students change their actions.

Game variations

It can be combined with music or sound effects. Additionally, it can be performed using a ball or ribbons.

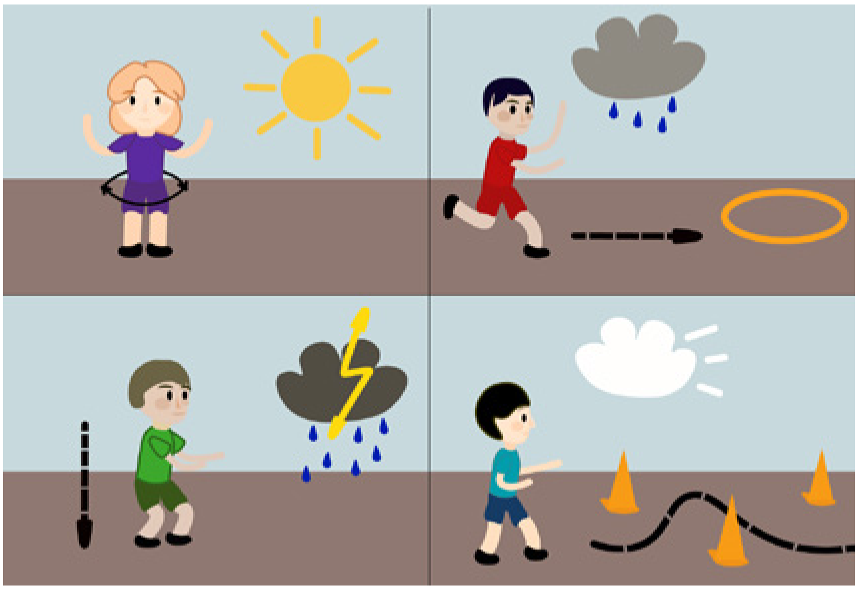


Figure 7. Meteorologists in Action

FREEZE & GO

This game is very popular among children due to the global popularity of the series Squid Game and does not need extensive explanations or visual demos.

Objective

to improve attention, reaction time, explosive power, and speed.

Equipment

gymnastic mats, gymnastic hoops, portable acoustic system.

Game description

Children are usually familiar with the basic rule of this game from various videos: "Run when you hear a sound, freeze when there is silence". If a child keeps moving after a sound or light signal, they receive a "punishment" by being moved behind the other children. The main goal is to reach the hut (gymnastic mats) as quickly as possible (Fig. 8).

Game variations

Freeze When It's Dark! The presence of light signals children to begin moving toward the gymnastic mats. When the light goes out, all children must "freeze".

To enhance the emotional aspect of the exercise and encourage attention development, it is recommended to use false commands, announcing them in a voice familiar to children. For example, you can give commands like "Start!" or "Go!" Even though the signal to move should typically be a song or a light, some children will begin to move regardless. Fake commands can also be signaled with a whistle or a clap.

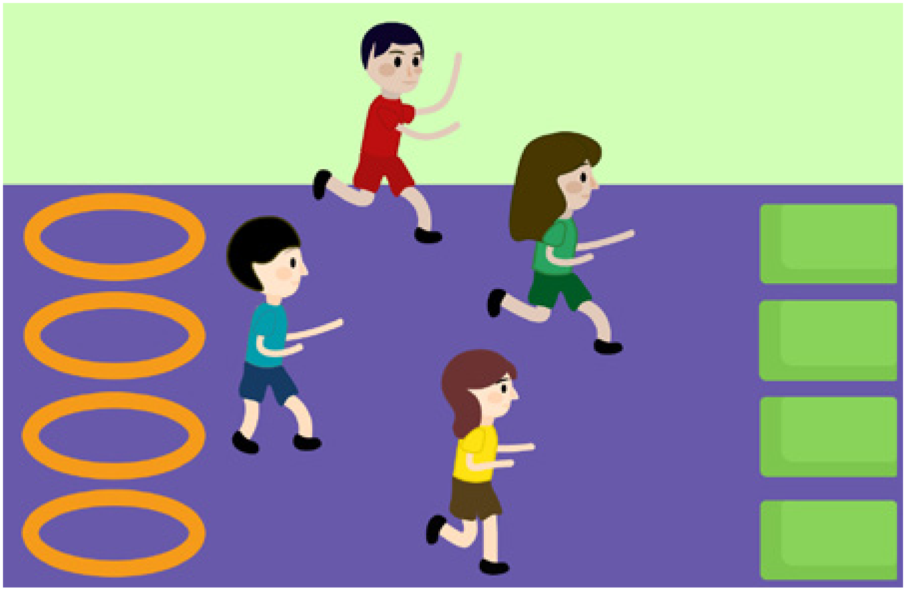


Figure 8. Freeze & Go

CATCH THE BEAT!

Objective

to develop attention, rhythm sense, explosive power, and agility.

Equipment

gymnastic hoops, portable acoustic system, gymnastic mats.

Game description

Figure 9. Catch the Beat

Children line up in front of a track made of gymnastic hoops. Using the gymnastic hoops on the floor, a specific path for the children's movement is created (straight, zigzag, semicircle, etc.). At the end of the hoop track, gymnastic mats are placed, where the children perform their final free jump. An acoustic device is used to set a specific rhythm, which guides the appropriate pace for the jumps.

After ensuring all children are ready to perform the exercise, the teacher activates the metronome at a specific tempo. The first child in the line begins jumping with both feet from hoop to hoop until completing the entire track. Each jump must match the beat of the metronome so that all jumps occur at the same pace. The second child starts only after the first child has jumped into the third hoop. This way, depending on the length of the track, three or more children will participate simultaneously. During the exercise, there is a one-hoop distance between children, which helps prevent interruptions if a student loses the rhythm (Fig. 9).

After finishing, the student returns to the end of the line to wait for another turn. The easiest way to find an audio track with the desired tempo is to search YouTube using the query: "Metronome 50/55/60 beats per minute (BPM)." It is best to start at a slow tempo (50–55 bpm) and gradually increase the speed in later attempts. Once the children understand the exercise, the tempo can be increased to 100 bpm or more.

Game variations

Change the type of jumps (on one leg, backward). The load of the exercise can be adjusted by modifying the following components:

- number of repetitions/duration of the exercise;
- distance (number of hoops);
- movement trajectory;
- exercise pace (speed of rhythm).

CHOOSE A SIDE!

Objective

to develop attention, memory, thinking, explosive power, and agility

Equipment

colored rope/skip rope, cone markers.

Game description

Children line up on the left side of a rope on the floor. Colored ropes or cords mark different sides, matching specific colors, such as yellow, white, and green. Cones of various colors serve as visual landmarks. Students must jump over or stay on the side designated by the teacher. Note that for one color (white in that case), the rope must be placed between the legs in a 'legs apart' position. If a child mistakenly chooses the wrong side, they are eliminated from the game (Fig. 10).

Game variations

- use the English names of colors to expand your English vocabulary
- an equivalent to the "color" sides could be "animal sides" (such as tiger, grasshopper, dog, etc.) or "superhero sides" (like Spider-Man, Batman, etc.). You may also use the English names.

You can modify the exercise intensity by adjusting

- repetition count;
- speed of giving commands;
- using gymnastic hoops instead of colored or skip ropes (students will need to jump over gymnastic hoops, which covers a longer distance).

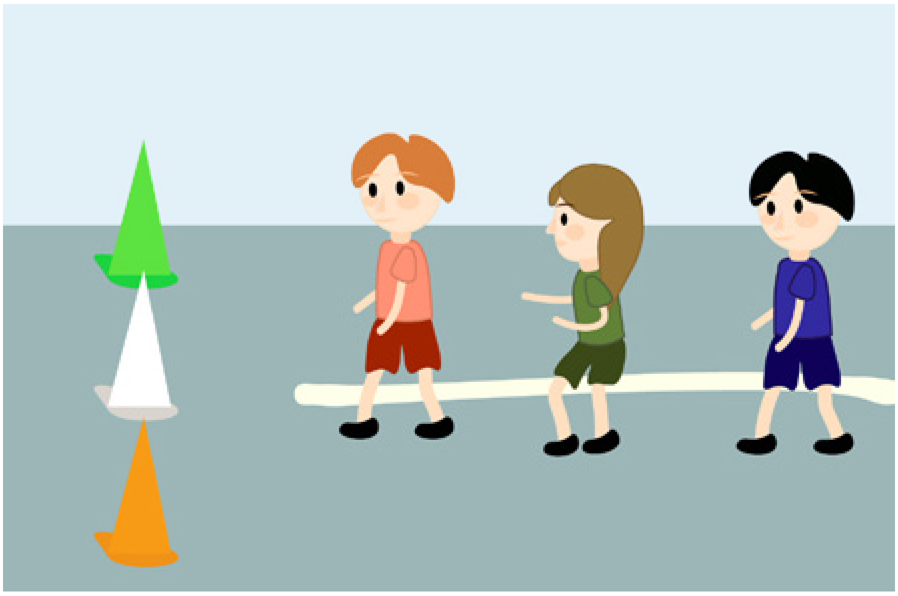


Figure 10. Choose a Side

References

Hrynevych, L. (2016). *The New Ukrainian School. Conceptual Principles of Secondary School Reform* [in Ukrainian]. Kyiv: 40.

Mandyuk, A. (2024). *Theoretical and Methodological Foundations of Forming Schoolchildren's Leisure Culture through the Use of Various Forms of Physical Activity* [in Ukrainian]. Monograph. Lviv: Ivan Boberskyi Lviv State University of Physical Culture.

Mandyuk, A., Pavlova, Y., Rymar, O. (2025). Comparative analysis of the level of physical activity of children in different countries of the world [in Ukrainian]. *Scientific Journal of Mykhailo Drahomanov Ukrainian State University*, *5K*(191), 126–132.

Mandyuk, A., Ripak, M., Rymar, O. (2023). *Conceptual approaches to the use of various forms of physical activity in forming the leisure culture of school-age children* [in Ukrainian]. *Prydniprovia Journal of Sports Science*, *1*, 78–86, https://doi.org/10.32540/2071-1476-2023-1-078

Moskalenko, N.V., Sorokolit, N.S., Turchyk, I.K. (2019). *Key competences in pupils' physical education lessons according to the "new Ukrainian school" reform* **[in Ukrainian]**. *Scientific Journal of the National Pedagogical Dragomanov University. Series 15: Scientific and Pedagogical Problems of Physical Culture (Physical Culture and Sports)*, *5*(113), 223–228.

Pasichnyk, V, Melnyk, V, Levkiv, V, Kovtsun, V. (2015). Effectiveness of integral-developmental balls use in complex development of physical and mental abilities of senior preschool age children. *Journal of Physical Education and Sport*, *15*(4), 775–780, https://doi.org/10.7752/jpes.2015.04118.

Pasichnyk, V., Pityn, M. (2025). *Theoretical and Methodological Foundations of Play Activity of Preschool Children in the Process of Physical Education* [in Ukrainian]. Monograph. Lviv: Ivan Boberskyi Lviv State University of Physical Culture.

Pasichnyk, V.M., Melnyk, V.O., Kovalchuk, L. V. (2024). *Use of innovative games in the physical education of preschool children* [in Ukrainian]. *Olympicus*, *3*, 112–121, https://doi.org/10.24195/olympicus/2024-3.15.

Prystupa, Y., Pasichnyk, V., Vovkanych, A. (2023). *Comprehensive development of abilities of older preschool children using integral developmental balls* [in Ukrainian]. *Scientific Discourse in Physical Education and Sports*, *2*, 37–47.

Prystupa, Y.N., Petryshyn, Y.V., Vynohradskyi, B.A., Petryna, R.L., Pasichnyk, V. M. (2014). *Didactic Ball Games. Educational Manual* [in Ukrainian]. Lviv: Lviv State University of Physical Culture.

Rokita, A., Cichy, I., Wawrzyniak, S. (2014). „Edubal" jako nowa metoda w pedagogii gier i zabaw z piłką – przegląd badań. *Rozprawy Naukowe AWF we Wroclawiu*, *45*, 70–78.

Rokita, A., Cichy, I., Wawrzyniak, S. (2017). *Movement that develops: the use of eduball educational balls in preschool and early school education. Summary of 15 Years of research. Pedagogika Przedszkolna i Wczesnoszkolna*, *5*(2), 183–196.

Sorokolit, N. (2019). *Possibilities of implementation of key competencies of the new ukrainian school in physical education of schoolchildren* [in Ukrainian]. *Prydniprovia Journal of Sports Science*, *3*, 174–186, https://doi.org/10.32540/2071-1476-2019-3-167.

Sorokolit, N.S. (2021a). *Competence-Based Approach in Physical Education* [in Ukrainian]. In: *Current Issues of Science and Education. The XIV International Science Conference* (pp. 146–152). Rome.

Sorokolit, N.S. (2021b). *Ways of Implementing language competencies of the new Ukrainian school in schoolchildren's physical education* [in Ukrainian]. *Scientific Journal NPU named after M.P. Drahomanov. Series 5: Pedagogical Sciences: Realities and Prospects*, *84*(2), 79–93, https://doi.org/10.31392/NPU-nc.series5.2021.84.2.16.

Sorokolit, N.S. (2022). *The ways of implementation of mathematical and informative-communicative competences into physical education of pupils* [in Ukrainian]. *Innovatsiina Pedahohika*, *44*(3), 54–57, https://doi.org/10.32843/2663-6085/2022/44/3.11.

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The monograph *Learning by Moving: Innovative and Interdisciplinary Teaching Methods in Preschool and Primary Education* is a valuable and much-needed study of integrating children's physical activity with knowledge acquisition in various areas of early school education. Its main strength lies in its concrete, practical solutions, which are presented in the form of lesson plans to help readers implement the described methods.

Dr hab. Rajmund Tomik, prof. AWF Katowice

The monograph is particularly relevant and timely. In the era of building a conscious (and multicultural) society focused on development (physical, intellectual, moral, etc.), the authors of the volume search for solutions aimed at profound, qualitative changes in the functioning of educational institutions. The subject matter is fully justified in the context of current socio-pedagogical issues and activities related to formal, informal, and non-formal education. Furthermore, changes in the socio-educational space clearly indicate the need for theoretical research and reflection, as well as practical implementation. Therefore, an important argument for scientific discourse centered on broadly understood learning by moving (education in motion/through motion) includes social and axiological goals and tasks (e.g., health as a value), as well as the factors that determine the level of their implementation. Introducing and developing evidence-based, innovative, interdisciplinary methods that combine learning with physical activity to support students' motor, cognitive, emotional, and social development is a natural foundation for the effectiveness of the described process. This is all the more important because movement is a natural means of expression for children and can increase their internal motivation in the learning process. The volume's quality and the authors' achievement lie in their fairly clear focus on the scope of the title, *Learning by Moving. Innovative and Interdisciplinary Teaching Methods in Preschool and Primary Education,* they have avoided a one-sided approach to individual areas of this issue.

Prof. UZ, dr hab. Mirosław Kowalski