

THE INCLUSIVE FRAMEWORK OF THE ABMOVE! PROJECT: ENHANCING MATHEMATICS LEARNING THROUGH ACTIVE BREAKS

Maria Moscato¹, Valeria Di Martino¹, Clarissa Sorrentino²,
Federica Raho², Rosa Bellacicco³, & Francesca Capone³

¹University of Palermo (Italy)

²University of Salento (Italy)

³University of Turin (Italy)

Abstract

Neuroscience and cognitive theories have shown the deep connection between mind, body, and interaction with the environment, forming the basis of the embodied cognition paradigm. This perspective, consistent with 20th-century philosophical and pedagogical traditions, emphasises the role of kinesthesia in cognitive development and learning. Recent studies highlight the effectiveness of active breaks - short periods of physical activity during lessons - particularly in mathematics education. Building on this foundation, the ABMOVE! project, within the framework of the Italian PRIN 2022 PNRR initiative the Italian PRIN 2022 PNRR Project *Inclusive Didactic for Enhancing Math Learning and Reducing Math Anxiety: Efficacy of Active Breaks in the Classroom* (Mission 4, Component 2), promotes the integration of curriculum-based active breaks in primary school math teaching. The project follows an Educational Design Research approach and is grounded in the Universal Design for Learning approach, aiming to ensure inclusive, accessible, and participatory learning for all pupils. This paper presents the programme's inclusive structure and evaluates its outcomes through teacher feedback and data analysis. The results provide valuable insights into the efficacy of the inclusive strategies adopted, offering guidance for potential improvements and further refinement of inclusive approach in future teaching practices.

Keywords: *Active breaks, inclusive teaching, mathematics, primary school, universal design for learning.*

1. Theoretical framework: Active breaks as pedagogical tools for embodied learning

Contemporary education increasingly recognises the link between pupils' well-being and the integration of neuroscience and educational psychology findings on the connection between movement and cognition. The embodied cognition paradigm views the mind as rooted in sensorimotor interaction (Shapiro, 2019; Wilson & Golonka, 2013), aligning with 20th-century pedagogy that emphasises bodily experience as fundamental to learning (Dewey, 1938; Merleau-Ponty, 1945; Varela et al., 1991). Ceciliani (2018) emphasises how cognitive functions are profoundly integrated within the sensorimotor system and develop through concretely lived experiences, thereby overcoming the historical mind-body dichotomy. Within this theoretical framework, active breaks emerge as effective pedagogical tools for integrating bodily activation and learning (Masin, Coco, Russo, Dallolio & Ceciliani, 2023), counteracting sedentary behaviour and improving classroom climate (Monacis, Colella & Scarinci, 2020). Research classifies these breaks (Lander, Contardo Ayala, Mazzoli, Lai, Orr & Salmon, 2024), highlighting their impact on executive functions and emotional regulation (Bellacicco, Capone, Sorrentino & Di Martino, 2025), influenced by frequency and duration and their successful integration with curriculum and educator involvement (Vazou & Skrade, 2016). According to Watson, Timperio, Brown, Best and Hesketh (2017), classroom-based physical activity generally manifests in three distinct forms: *active breaks*, which are short physical activity bouts interrupting academic instruction; *curriculum-focused active breaks*, integrating curriculum content into these brief activity sessions; and *physically active lessons* integrating physical activity into non-physical education subjects, such as mathematics. Attention to the embodied approach is proving particularly promising from an inclusion perspective, suggesting that, despite the limited representation of pupils with Special Educational Needs in research, active breaks can promote behavioural regulation and enhance school inclusion (Piepmeier et al., 2015).

2. Embodied learning and UDL for inclusive mathematics

Mathematics education presents challenges for inclusive learning, especially for students with diverse needs (Healy & Ferreira dos Santos, 2014). Traditional approaches can increase cognitive fatigue and math anxiety, limiting engagement, with effects varying by teaching methodology (Ashcraft & Moore, 2009). Despite the link between physical activity and cognition, few interventions integrate movement into mathematics (Cecchini & Carriedo, 2020). Research lacks specifically designed active breaks for mathematical learning and inclusion (Bellacicco et al., 2025), particularly those addressing executive functioning and math anxiety. It is precisely within this context of promoting inclusive practices that value student variability that the Universal Design for Learning (UDL)* framework is situated (Meyer et al., 2014), serving as a methodological and pedagogical guide for the design of flexible and accessible learning pathways, based on the principles of engagement (offering diverse options for involvement, as each learner varies in how they can be inclined and motivated to learn); representation (offering varied options for the representation of content, as learners perceive information presented in different ways); and action & expression (offering multiple options for action and expression, as learners differ in how they can navigate a learning environment and express what they know). Designing active breaks according to UDL principles allows for the amplification of their inclusive and cognitive potential, for example through the bodily representation of concepts or by offering different modalities for demonstrating understanding via embodied activities, transforming movement not only into a tool for well-being but into a lever for constructing truly equitable, motivating and meaningful learning environments for all.

3. Research design

Leveraging these premises, the *ABMOVE! Inclusive Didactics for Enhancing Math Learning and Reducing Math Anxiety: Efficacy of Active Breaks in the Classroom* research aims to strengthen mathematics learning in primary school by integrating curriculum-based active breaks directly within the classroom setting. The intention is to foster a more dynamic, participatory, and inclusive educational experience, while simultaneously promoting the psychophysical well-being of all students. The project was established using a robust Educational Design Research (EDR) methodology (McKenney & Reeves, 2019), following cyclical frameworks that integrate analysis, design, development, and evaluation through iterative phases, involving sequential stages of investigation and conceptualisation. A crucial initial stage involved a systematic review of existing scientific literature on active breaks in relation to executive functions, mathematical learning, and mathematics anxiety (Bellacicco et al., 2025). Concurrently, a thorough analysis of the Italian school context was conducted to understand teachers' perceptions and attitudes regarding the challenges encountered in mathematics instruction, with a specific focus on mathematics anxiety. These two preliminary stages provided a solid empirical basis for the educational intervention structuring. The UDL framework served as a central guiding principle throughout the entire development process, ensuring the accessibility and participation of all students through the provision of multiple means for engagement, representation, and action/expression. The development of the ABMOVE! programme was significantly enriched by the active collaboration of various educational stakeholders, including teachers, school administrators, physical education specialists, and academic experts in the fields of inclusive education and mathematics education. The ABMOVE! programme aims to strengthen mathematics learning in primary school through the integration of curriculum-based active breaks directly within the classroom setting.

4. The ABMOVE! programme

The ABMOVE!† intervention follows a systematically designed protocol involving three weekly active breaks, each lasting 10-15 minutes, integrated during mathematics lessons over a twelve-week period. ABMOVE! is structured logically and modularly, offering differentiated interventions for the first cycle (second and third grades) and the second cycle (fourth and fifth grades) of primary school, aligning with the thematic areas of the mathematics curriculum defined by the National Curriculum Guidelines

* <https://udlguidelines.cast.org/static/udlg3-graphicorganizer-digital-numbers-a11y.pdf>

† ABMOVE! is the acronym that defines the structured format of the individual active breaks designed within the project, providing teachers with all the necessary information for effective implementation. Each activity is organised into seven sections: *Activity* (detailed description of the task with clear instructions), *Be Ready* (preparation of the space and required materials), *Mathematics* (specific learning objectives and key mathematical terms), *On the Move* (motor actions to be performed), *Variations* (adaptations for different skill levels or contexts), *Extra* (suggestions for extensions or interdisciplinary connections), and *Inclusion* (!) (strategies to ensure accessibility and engagement for all students, in line with the principles of Universal Design for Learning).

(MIUR, 2012). Each active break follows a three-part structure: a) an initial phase (ABstart) with a brief, personalised musical cue (2 minutes) to signal the start of the activity and create a motivating atmosphere; b) a central phase (8-10 minutes) involving structured motor activities based on the curriculum's mathematical content, guided by the teacher with the aid of visual and technological tools, such as flashcards; and c) a concluding phase (ABstop) dedicated to mindfulness exercises (2 minutes) to encourage a return to calm and focus, fostering body awareness and emotional regulation. The proposed activities adopt a 'relational' approach to mathematics (Skemp, 1982) that prioritises the exploration of connections and creativity and are based on fundamental motor skills (walking, running, jumping, etc.) supported by scientific research (Barnett et al., 2016).

5. Teachers' perspectives on the program's effectiveness

The implementation phase of the ABMOVE! programme was carried out in 37 primary schools across three Italian regions: Piedmont, Apulia, and Sicily. A total of 139 primary teachers and 3,317 pupils took part in the initiative. Among them, 69 teachers were directly involved in the experimentation with active breaks. Within the methodological design of the ABMOVE! research, a central focus was the evaluation of the programme's effectiveness, aiming to analyse the extent to which the integration of curriculum-based active breaks produced tangible effects on the critical analysis of the voices and direct experiences of the participating teachers, who were recognised as key actors in the success and sustainability of the intervention. Data collection employed a mixed methods methodology with a comparative approach (Creswell and Creswell, 2017), integrating synchronous interaction along with a digital data collection tool. Specifically, monitoring meetings gathered data through open-ended questions, real-time polls (via Mentimeter), and discussions, aimed at exploring teachers' opinions regarding the educational impact of active breaks. The digital data collection tool, completed by individual teachers in the experimental classes after each active break, collected a total of 1149 responses and included open-ended questions and Likert scale questions, with scores ranging from 1 (not at all) to 5 (very much). Descriptive statistics for the scales were processed using SPSS Version 20.0 software. Qualitative data, obtained from open-ended responses and transcripts of the guided discussions, underwent analysis using an inductive approach based on Schreier's (2012) qualitative content analysis model. The initial step involved identifying units of meaning, followed by coding responses using keywords or definitions to establish categories. Subsequently, the organised data was clustered to group similar elements and highlight key emerging themes. This clustering was achieved through the creation of a binary matrix, assigning each respondent the identified response mode, which enabled the calculation of response frequencies. For mere space considerations, the major results obtained will be presented below, along with a concise commentary.

Table 1. Descriptive Statistics.

Scale	Mean	Std. Deviation	Median	Min	Max
Effectiveness in reinforcing math learning	3.95	1.04	4	1	5
Motor effectiveness	3.99	1.01	4	1	5
Usefulness of technological support	3.49	1.21	4	1	5
Teacher satisfaction	3.96	1.08	4	1	5
Student satisfaction	4.34	0.96	5	1	5

Data presented in Table 1 indicates an overall positive evaluation of the ABMOVE! programme by teachers. The perceived effectiveness in terms of mathematics learning ($M = 3.95$) and motor activation ($M = 3.99$) was high, suggesting that the active breaks were considered beneficial for reinforcing subject content and integrating the physical-corporeal component. Teacher satisfaction ($M = 3.96$) was also notable, alongside student satisfaction ($M = 4.34$), which highlighted strong engagement. The perceived utility of technological supports ($M = 3.49$) displayed greater variability.

In reference to the qualitative findings (Table 2), the analysis of inclusive enrichments employed by teachers reveals a variety of approaches aimed at supporting the participation of all students. A notable proportion of teachers did not explicitly mention the use of specific inclusive enrichment strategies. However, among the most commonly employed adaptations are pair and/or group work to foster peer support. The adaptation of tasks through simplification and the use of adapted or manipulative materials represent another significant strategy. Personalised visual and technological support, alongside direct teacher intervention, underscores the attention given to individual needs. The adoption of compensatory tools and the provision of opportunities for student choice, although less frequent, indicate an openness towards the principles of Universal Design for Learning (UDL). Regarding the positive aspects of the ABMOVE! programme identified by teachers, the emotional-relational dimension emerges strongly. Student enthusiasm, engagement, and active participation are widely recognised as primary benefits.

The consolidation of learning and the promotion of socialisation and peer collaboration represent further significant advantages. The capacity of active breaks to foster relaxation and anxiety management, alongside improvements in attention and concentration, was also highlighted. Finally, the programme appears to have stimulated curiosity and interest in mathematics, as well as promoting reasoning and reflection. Concerning the negative aspects or challenges encountered, classroom management and maintaining order represent the most significant difficulties reported by teachers. A secondary concern involves a potential lack of focus on mathematical aspects during the activities. Issues related to classroom space, scheduling, and the specific structure of some activities were mentioned less frequently. It is noteworthy, however, that a considerable number of teachers reported no critical issues, suggesting a generally positive acceptance of the programme.

Table 2. Major Themes Emerged from the Qualitative Analysis.

Inclusive Enrichments Used		Positive Aspects Identified		Negative Aspects Identified	
Emerging Theme	Occ.	Emerging Theme	Occ.	Emerging Theme	Occ.
<i>None</i>	140	<i>Enthusiasm, engagement, and active participation of students</i>	374	<i>None</i>	130
<i>Pair or group work to encourage peer support</i>	52	<i>Consolidation of learning</i>	99	<i>Classroom management and maintaining order</i>	99
<i>Simplification and use of adapted materials</i>	19	<i>Socialization, collaboration, and peer support</i>	76	<i>Lack of interest in mathematical aspects</i>	61
<i>Personalized visual and technological support</i>	13	<i>Relaxation and anxiety management</i>	46	<i>Classroom space issues</i>	26
<i>Teacher support</i>	10	<i>Improvement in attention and concentration</i>	39	<i>Specific difficulties related to the structuring of the activity</i>	21
<i>Compensatory tools</i>	8	<i>Development of curiosity and interest in mathematics</i>	27	<i>Integrating break time with lesson and school schedule</i>	18
<i>Modification of movements</i>	8	<i>Promotion of reasoning and reflection</i>	18		
<i>Possibility for students to choose</i>	7	<i>Effectiveness of the activity in achieving learning objectives</i>	17		
		<i>Development of specific skills in mathematics</i>	15		
		<i>Increase in motivation</i>	13		
Tot.	257	Tot.	724	Tot.	355

6. Conclusions

The ABMOVE! project demonstrates the potential of integrating active breaks, designed within the Universal Design for Learning framework, to enhance mathematics learning in primary school settings. The findings highlight the positive perceptions of teachers regarding the programme's effectiveness in promoting both mathematical understanding and student engagement. By incorporating movement into the curriculum, ABMOVE! not only addresses the need for a more dynamic and inclusive learning environment but also contributes to the growing body of evidence supporting the link between physical activity and cognitive development. While acknowledging the challenges related to classroom management and the integration of active breaks, the study underscores the importance of providing teachers with structured support and resources to effectively implement such interventions. Ultimately, ABMOVE! offers valuable insights into creating equitable and engaging learning experiences that cater to the diverse needs of all students.

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