Body Percussion and Educational Processes: Embodied Perspectives and Teaching Applications with ADHD Students

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Abstract
The research investigates the effectiveness of Body Percussion as a motor-musical practice in education, with particular attention to pupils with ADHD**,** within the paradigm of Embodied Cognition, which emphasizes the role of the body in cognitive, emotional and relational processes. The sample involved 106 primary and secondary school students: 75 included in the experimental group, subjected to weekly two-hour workshops for four months, and 31 in the control group, engaged in motor activities without musical components. The integrated analysis, based on quantitative and qualitative data (ANOVA with repeated measures, pre/post t-tests and systematic observations), showed significant improvements in the experimental group in almost all the macro-areas analysed, in particular motor-musical technique, involvement, inclusion and group cohesion (Cohen's d = 0.65-1.39), while the control group showed no relevant changes. The subgroup with ADHD also benefited above all in social cohesion and active participation. The results confirm Body Percussion as an inclusive methodology that promotes cognitive development, social-emotional skills and psychophysical well-being.

Keywords*:* Body Percussion; ADHD; Embodied Cognition; experimental research; inclusive educational methodology

Article submitted: 30/09/2025; accepted: 25/11/2025

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The article is the result of the joint work of all the authors. However, it is possible to attribute to M. Mazzella par. 1-2-3-6, to A. Fogliata par. 4-5 and to A.Ambretti par. 1-6 who also is the scientific supervisor of the article.

Excellence and Innovation in Learning and Teaching (ISSNe 2499-507X), 2025, 2

Doi: 10.3280/exioa2-2025oa21751

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1.Introduction

Contemporary society is going through a double transformation: on the one hand, the increase in social inequalities; on the other, the rapid and pervasive spread of digitization, both elements that profoundly influence the education of the new generations and our daily lives, increasingly marked by a constant acceleration.

This condition, as Rosa observes, leads to a new type of alienation compared to the past: no longer imposed from the outside, but self-induced, the result of our progressive inner detachment (Rosa, 2015; Rivoltella, 2023). Faced with these dynamics, there is a need to rethink educational models, identifying approaches capable of addressing these challenges and promoting a more interconnected and inclusive society; it is essential to rethink movement education as a form of reconnection with the bodily self and the surrounding environment.

In the educational field, the body has always been at the center of numerous reflections and experimental studies until the recent birth of a new paradigm, Embodied Cognition, which has shown and emphasized the close relationship between movement, learning enhancement and cognitive functions. Studies such as those of Barsalou (2008) and Wilson (2002) show that learning is most effective when it involves the body, because physical actions help build mental meanings. Neuroscientific theories also emphasize the importance of situated and embodied learning (Barsalou, 2008; Diamond, 2013) and aligns with what is highlighted by the theory of Embodied Cognition which sees the body as an integral part of mental processes (Wilson, 2002; Varela et al.,1991). As is well known, in fact, human development is the result of the interactions between body, movement and environment (Damiani et al., 2015), where the subject and one's own learning process are placed at the center (Dewey, 1968), in terms of self-knowledge as well as knowledge of the other. According to Granja de Souza Campos (2006, pp. 54-55), the body plays a fundamental role in the personal, emotional and relational integration of the individual. Actively including it in learning paths means rethinking educational methods, adopting an approach in which perception and sensory experience take on central importance. This point of view opens new possibilities for educators, also in the context of artistic and recreational practices recently experimented in Latin America. In addition, the use of the body associated with percussive rhythm and music amplifies the multisensory itineraries attributed to it. The Body Percussion method revolves around three pillars: music, movement and language. “Musical and motor play” and “didactics of conduct” (Delalande, 1993) encouraged in the laboratories transform the learning context by creating a "zone of proximal development" (Vygotskij, 1993) in which students can

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reach the maximum degree of development of their potential. Rhythm and music are phenomena shared by all human beings, regardless of nationality, gender or age. They create inclusive spaces, capable of uniting people beyond individual differences and their background.

For Dalcroze, the use of rhythmic body movement represents an effective means of promoting the development of musical sensitivity, improving motor coordination, stimulating concentration and increasing awareness of one's own body (Jaques-Dalcroze, 1921). His pedagogy, based on *rhythm,* laid the foundations for approaches such as Body Percussion, where rhythm is experienced in the body even before it is thought or played. Also, for Carl Orff (1978), the body is one of the first musical instruments available to the child. In his method, called *Orff-Schulwerk*, the use of body rhythm is central to developing musical skills through play, improvisation and movement. Body Percussion is fully part of this educational line, where the musical experience is born from doing, from the body in action; in Body Percussion, in fact, the rhythm is not only listened to or repeated, but acted, lived and internalized through movement. In addition to the bodily and cognitive aspect, Body Percussion has a strong relational value. When practiced in a group, it requires listening, synchronization, and cooperation. It is necessary to agree with others, to respect common time, to recognize one's own space and that of others. This type of activity strengthens not only prosocial skills, but also empathy and a sense of belonging. In this sense, rhythm is transformed into a shared language, non-verbal but deeply communicative. It is a way to "talk to the body", to express emotions, moods, ideas, even without words.

The pedagogy of Loris Malaguzzi, founder of the Reggio Emilia approach, moves precisely in this direction. For him, children learn through a hundred languages, among which the body and rhythm are fundamental tools. The time of learning, according to Malaguzzi, is not linear or standardized, but follows the internal rhythm of the child, which must be listened to and valued (Edwards et al., 1998).

Body Percussion, with its flexibility and inclusive nature, fits perfectly with this idea of education. From an educational point of view, Body Percussion: develops awareness of the body in space and time; stimulates motor coordination and concentration; strengthens motor memory and sense of sequence; enhances creative expression and self-confidence; it promotes socialization, through cooperative and synchronized group activities, creating well-being in the classroom.

Furthermore, it is a democratic and accessible practice, which does not require expensive tools or special technical skills: anyone, with their own body, can participate. Rhythm, in Body Percussion, is much more than a regular succession of sounds. It is a living, embodied and relational experience. It is a

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way to learn with the whole body, to communicate, to get in tune with others. It is a bridge between pedagogy, neuroscience and art. The research described below aimed to investigate how much musical-motor activity such as Body Percussion considered in its various aspects, can positively influence the performance of pupils on their cognitive development, on training and as an agent of change to determine in themselves psychophysical well-being and overcoming barriers determined by stress, anxiety, fears and isolation with a view to inclusion (ref.). Above all, we wanted to evaluate the benefits on pupils with ADHD. The main symptoms of ADHD, such as poor attention, hyperactivity, and impulsivity, tend to appear early, typically in preschool or early school, and in some cases even earlier (Barkley, 2006). This disorder can impair the child's daily life, hindering learning, social relationships and adaptation to routines, with negative consequences on academic performance and interactions with peers (DuPaul & Stoner, 2014). Children with ADHD often experience difficulties in social relationships due to impulsivity, inattention, and hyperactivity, which can lead them to rash behavior and difficulty respecting the rules of games, resulting in rejection or marginalization by peers (Hoza, 2007). This social exclusion can impair self-esteem and foster feelings of loneliness, increasing the risk of developing depression and anxiety disorders (Mikami, 2010; Schatz et al., 2001). In this perspective Body Percussion is placed, an embodied activity that can improve executive functions and emotional regulation by developing in these students a strong sense of group cohesion thanks to the involvement of this game, which is not only musical motor, but also therapeutic for these students.

2. Experimental research

The present experimental research is therefore aimed to evaluate the effectiveness of Body Percussion as a motor-musical practice capable of promoting harmonious psychophysical development, school inclusion and cognitive enhancement in primary and secondary school pupils with a focus on pupils with ADHD. The intervention is based on the embodied approach that recognizes the body as a mediating device of knowledge (Carlomagno et al., 2014), enhancing learning through doing and bodily experience. In this context, the body has been conceived as a musical instrument, capable of activating cognitive, emotional, relational and sensory processes, also in relation to artistic expressiveness and psycho-emotional well-being.

The intervention was divided into several levels:

- Teacher training through dedicated meetings and support materials for active and inclusive teaching.

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- Activation of interdisciplinary laboratories, designed to actively involve students in bodily-musical activities.
- Curricular integration of the proposed activities, with attention to pupils with disabilities, especially with ADHD or special educational needs.
- Use of digital tools (videos) to support the use and replicability of activities.
- Involvement of families through information meetings and collection of informed consent in compliance with the legislation on the protection of minors.

The intervention took place over a period of four months, with a weekly frequency of two hours per class. The sample included pupils aged between 9 and 12 years, with an average age of about 10.5 years, from classes IV and V of primary school and I and II of lower secondary school with the presence of 8 pupils with ADHD. The principal investigator, authorized by the school director, conducted systematic observations before and after the intervention, to assess changes in terms of psychophysical well-being, relational dynamics and involvement. Although the number of the two groups was not perfectly balanced (experimental group: n = 75; control group: n = 31), a preliminary analysis was conducted to verify their initial homogeneity.

Table 1 - Comparison between experimental and control groups

Variable	Experimental (M ± SD)	Control (M ± DS)	Statistical test	P (value)
Average age (years)	10,4 ± 1.1	10,5 ± 1.0	t(104) = -0.41	0.683
Distribution by gender (% female)	52%	55%	$\chi^2(1, n=106) = 0.09$	0.763
Average pre-test score (macro-area index)	3.12 ± 0.46	3.09 ± 0.43	t(104) = 0.32	0.749

The analyses did not show statistically significant differences ($p > 0.05$) between the two groups, neither in terms of age nor compared to the initial scores.

3. Methods

The analysis focused on eight macro-areas considered relevant to measure the effectiveness of the intervention: emotional, involvement, cohesion, liking,

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breathing, technique, inclusion and technology. A mixed methodology was adopted, combining qualitative and quantitative analysis.

Qualitative analysis

During the activities, structured observations were conducted, aimed at detecting behaviors, interactions and learning dynamics; direct observations in class on the eight macro-areas implemented by the researcher and administration of self-report questionnaires to students and teachers, administered anonymously before and after the intervention.

Since no standardized tools were available in the literature, we proceeded to construct original questionnaires, based on a thematic analysis of the collected open-ended responses, according to the model proposed by Braun and Clarke (2006).

The analysis systematically followed the six phases identified by the authors:

1. Familiarization with data, through thorough and repeated reading of responses.
2. Initial coding, identifying keywords, recurrences, and relevant meanings.
3. Searching for themes, grouping codes into coherent sense nuclei.
4. Review of themes, checking internal consistency and mutual distinction between emerging categories.
5. Theme definition and naming, developing descriptive and interpretative labels.
6. Construction of the overall thematic framework, from which the eight interpretative macro-areas were derived.

These macro-areas were organized as second-level analytical categories, capable of synthesizing emerging themes and providing a systematic reading of the educational implications of the intervention.

Each macro area was defined based on frequency of themes in the data, conceptual relevance to the objectives of the intervention, and descriptive richness of the answers that supported it. The eight macro-areas thus obtained, (Emotional, Cohesion, Satisfaction, Technique, Inclusion, Involvement, Breathing, Technology) constituted the theoretical reference structure for the construction of the questionnaires, allowing qualitative evidence to be transformed into observable and measurable dimensions through coherent items and indicators.

Quantitative analysis

Numerical data were processed with SPSS (IBM SPSS Statistics) by means of descriptive (mean, standard deviation, minimum and maximum values) and inferential analyses.

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The total sample consisted of 106 pupils, divided into:

- Experimental group: 75 students undergoing Body Percussion intervention;
- Control group: 31 students who did not undergo the intervention.

Within the sample, 8 children diagnosed with ADHD were identified (5 in the experimental group, 3 in the control group). A pre-post analysis was also carried out for these subjects on all the macro-areas considered, using the t-test for paired samples. The data were included in the overall dataset and subsequently observed as a subgroup for descriptive analysis and differential trends.

Assessments were performed in the first or second week of the start and end of the work.

A total of 8 class curriculum teachers, 4 support teachers, 2 motor education teachers and 3 music education teachers were involved in the project, supported by the researcher in charge of the project. The teachers were previously trained with teaching materials and introductory meetings focused on the aims, structure and operating methods of the intervention.

The activity of both groups included an intervention divided into sessions within the regular school hours. Specifically, the students of the experimental group participated in Body Percussion workshops that included details shown in Table 2.

Table 2 - Detail of the activities of the experimental group, modalities and times

N.	Activity	What has been done specifically (Body Percussion)	Minutes
1	Motor and respiratory coordination activities	Body Percussion exercises integrated with the breath: clapping hands during inhalation, finger snaps on exhalation, (small movements coordinated with rhythm and diaphragmatic breathing).	5’
2	Individual and group exercises for rhythmic small cell reproduction	Individual Body Percussion patterns (hands, chest, thighs, feet) and their repetition in groups on imitation of the teacher;	10’
3	Body musical compositions	Creation of short original compositions with Body Percussion: combinations of beats, pops, strokes on the chest and thighs, organized in small creative sequences.	12’
4	Rhythmic sequences combined with music with time changes.	Reproduction of percussive rhythmic movements on music (use of videos on the Lim): clapping of hands and feet, snaps of fingers, strokes on the chest and legs following first slow and then faster tempos (use of the metronome).	10’

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5	Guided use of silence, breathing, and musical pause	Mindfulness activities: rhythmic pauses inserted in Body Percussion sequences, listening to silence, breathing as an integral part of the performance.	8’
6	Integration with verbal and body language	Recitation of rhythmic words/phrases accompanied by Body Percussion: call-and-response games with voice and beats, integration of sound and body gesture.	10’

During all the sessions, the researcher, authorized by the School Director, was present, who carried out systematic pre- and post-intervention observations through a structured observation grid. The pupils of the control group followed, at the same time and with the same frequency, alternative motor activities, not musical, based on elements shown in Table 3.

Tab.3 - Detail of the activities of the control group, modalities and times

N.	Activity	What was done specifically (Control group)	Minutes
1	General motor coordination exercises	Warm-up, walking, stretching, balance exercises and coordinated arm and leg movements	5’
2	Eye-manual activities and throwing/catching games	Games with balls and light objects, throwing and catching in pairs or small groups, manual precision exercises and hand-eye coordination	12’
3	Group games with low cognitive and relational intensity	Simple motor games in groups (passing objects, small walking or slow running competitions), without music.	10’
4	Combined motor sequences in space	Paths of movement in space with walking, changes of direction and simple steps in time to recorded music.	10’
5	Guided use of silence and breathing	Controlled breathing exercises, relaxation breaks and concentration on breathing.	8’
6	Integration with language and movement	Combination of simple verbal commands with body movement (raising arms, bending, moving).	10’

These activities were chosen to control the effects of physical exercise alone, to isolate the specific effectiveness of the rhythmic-musical component of the experimental intervention. All pupils enrolled in the classes involved were included in the study, without restrictive criteria, in compliance with the principles of equity and school inclusion. The only exclusion criterion concerned students with an attendance of less than 75% of the scheduled

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sessions. The data collected from these subjects were excluded from the final analysis, to ensure the reliability of the pre/post comparisons.

For each of the eight macro-areas, standardized survey tools adapted to the school context were used, consisting of:

1. Systematic observation sheets used by the researcher and the reference professors.
2. Self-report questionnaires structured with five-point Likert scales, completed by pupils and teachers.
3. Teacher evaluation grids for monitoring group dynamics, inclusion and perceived interest.

The worksheets and questionnaires were validated through a preliminary phase of readability and comprehension tests, conducted on a pilot group of students (n = 10), to ensure linguistic adequacy and consistency with the age of the participants. All data have been collected anonymously and aggregately, in compliance with current legislation on the protection of personal data (EU Regulation 2016/679 - GDPR). The analysis was conducted on pseudonymized data, stored in a protected digital format. The entire process of data collection, management and analysis was supervised by the researcher, with the support of two referent teachers (one of motor education and one of curricular), in charge of the operational monitoring of the activities.

4.Data analysis

Data processing was carried out using IBM SPSS Statistics, statistical power estimation was carried out with G*Power software.

Before proceeding with the inferential analysis, a verification of the assumptions of normality was carried out. The Shapiro-Wilk test indicated that most of the variables (pre and post scores in the eight macro-areas) had a distribution compatible with normality ($p > 0.05$), allowing the use of parametric tests.

An analysis of the a priori statistical power, conducted with G*Power 3.1, indicated that, with a sample size of 106 subjects, the 2x2 repeated measures design (pre/post × group) guaranteed a power ($1-\beta$) greater than 0.95 for a mean effect ($f = 0.25$, $\alpha = 0.05$), confirming the adequacy of the sample. In addition, before processing the main data, the internal reliability of the self-report questionnaires used for the survey of the eight macro-areas was verified. The Cronbach's alpha coefficient was calculated for each composite scale (consisting of several items), both in the pre- and post-intervention survey. The observed alpha values were satisfactory for all dimensions, with values ranging from 0.72 (Technology) to 0.89 (Involvement), confirming a good internal

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consistency of the measurement instruments. In particular, the dimensions Motor-musical technique (α = 0.86), Inclusion (α = 0.84), and Group cohesion (α = 0.81) showed high reliability, indicating that the included items measured the theoretical reference constructs homogeneously. Therefore, derived scores can be considered reliable for later analysis.

The ANOVA with repeated measures showed significant interactions between Time × Group in multiple dimensions that we report: motor-musical technique: $F(1, 104) = 21.3$, $p < 0.001$, $\eta^2 = 0.17$; involvement: $F(1, 104) = 15.2$, $p < 0.001$, $\eta^2 = 0.13$; inclusion: $F(1, 104) = 18.6$, $p < 0.001$, η^2 0.15; Group cohesion: $F(1, 104) = 12.8$, $p = 0.001$, $\eta^2 = 0.11$.

All effect sizes reported as η^2 refer to partial eta squared (ηp^2), the standard effect size measure for repeated-measures ANOVA.

Table 4 - Anova test results

Macroarea	F(1, 104)	p-value	η² (partial)
Motor-musical technique	21.3	**< 0.001***	0.17
Involvement	15.2	**< 0.001***	0.13
Inclusion	18.6	**< 0.001***	0.15
Group cohesion	12.8	**0.001***	0.11
Liking	3.1	0.081	0.04
Breathing	2.4	0.123	0.03
Emotional	1.6	0.204	0.02

Note: Results from repeated-measures ANOVA (Time × Group interaction).
**p < 0.05. η² values refer to partial eta squared (ηp²).*

The first four dimensions (Motor-musical technique, Involvement, Inclusion, Cohesion) show significant and medium-high effects; therefore, the intervention had a concrete impact on these areas (table 5).

In the experimental group, paired sample t-tests showed significant improvements in all eight macro-areas, with Cohen's d values ranging from 0.65 (liking) to 1.39 (technique), indicating moderate to large effects. In the control group, pre-post changes were not significant ($p > 0.05$) except for small improvements in cohesion ($p = 0.09$, not significant). Comparison between groups on post scores (independent t-tests) showed significant differences in:

- Technique: $t(70.2) = 3.92$, $p < 0.001$, $d = 0.88$; Involvement: $t(73.4) = 3.51$, $p = 0.001$, $d = 0.74$;
- Inclusion: $t(66.9) = 4.07$, $p < 0.001$, $d = 0.89$ (table 6).

To investigate the relationships between the improvements obtained in the different dimensions observed, a Pearson correlation matrix was calculated on the gain scores (pre-post differences) of the pupils in the experimental group ($n = 75$). The results show positive correlations of moderate-high magnitude

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between different macro-areas. In particular, the variable "Motor-musical technique" is strongly correlated with Involvement (r = 0.76), Inclusion (r = 0.66) and Breathing (r = 0.57). Group Cohesion is significantly correlated with Inclusion (r = 0.73) and Emotional (r = 0.49), Similarly, Satisfaction is strongly associated with Involvement (r = 0.82), The Technology dimension, on the contrary, shows weak negative correlations with all other macro-areas (r between –0.13 and –0.24).

Table 5 – Pre-post analysis results for each macro-area in both groups

Macroarea	**Experimental Group**		**Control Group**	
	Cohen's d	p-value (pre-post)	Cohen's d	p-value (pre-post)
technique	1.39	< 0.001	0.05	0.827
Involvement	0.74	< 0.001	0.06	0.772
Inclusion	0.89	< 0.001	0.08	0.649
Group cohesion	0.71	0.002	0.21	0.090
Liking	0.65	0.006	0.18	0.502
Breathing	0.68	0.005	0.17	0.553
Emotional	0.67	0.012	0.15	0.478
Technology	0.66	0.009	0.11	0.622

Table 6 - Comparison between groups on post scores (independent t-tests)

Macroarea	**t (df)**	**p-value**	**Cohen's d**
Musical technique	3.92 (70.2)	< 0.001	0.88
Involvement	3.51 (73.4)	0.001	0.74
Inclusion	4.07 (66.9)	< 0.001	0.89
Group cohesion	1.82 (72.8)	0.073	0.42
Liking	1.25 (75.1)	0.215	0.29
Breathing	1.04 (74.6)	0.301	0.25
Emotional	0.91 (76.0)	0.365	0.22
Technology	0.68 (73.9)	0.498	0.17

Table 7. Correlation matrix between macroarea gain scores (Experimental group)

	Tech	**Inv**	**Incl**	**Coh**	**Like**	**Emot**	**Breat**	**Techno**
Technique	1.00	0.76	0.66	0.49	0.57	0.40	0.57	–0.13
Involvement	0.76	1.00	0.49	0.35	0.82	0.35	0.50	–0.20
Inclusion	0.66	0.49	1.00	0.73	0.40	0.68	0.40	–0.13
Cohesion	0.49	0.35	0.73	1.00	0.32	0.49	0.43	–0.15
Liking	0.57	0.82	0.40	0.32	1.00	0.30	0.45	–0.24
Emotional	0.40	0.35	0.68	0.49	0.30	1.00	0.34	–0.18
Breathing	0.57	0.50	0.40	0.43	0.45	0.34	1.00	–0.19
Technology	0.13	0.20	0.13	0.15	0.24	0.18	0.19	1.00

Note: Correlations are considered statistically significant at $p < 0.05$.

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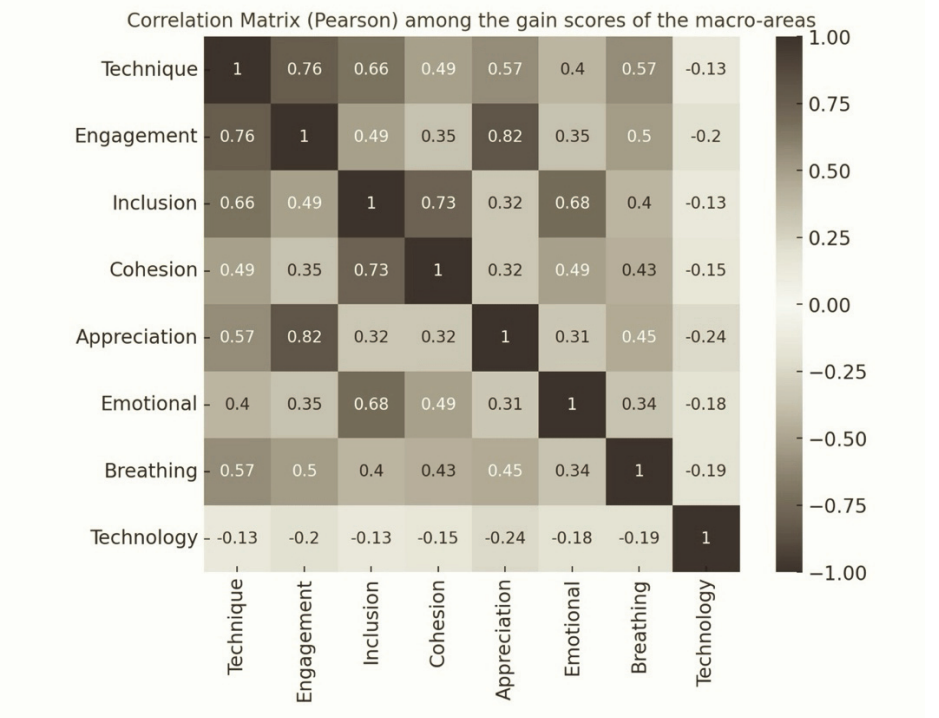
Figure1 – Correlation matrix (Pearson) among the gain scores of the macro-areas



The central macro-areas (Technique, Involvement, Inclusion, Cohesion, Satisfaction, Emotional, Breathing) show moderate or strong positive correlations, suggesting that improvements in one tend to be associated with improvements in the others. Technology appears independent or even slightly negative compared to the other areas → indicates that the gain scores in Technology are not related to the other improvements. This type of matrix is useful for understanding which dimensions influence each other and for planning more targeted interventions.

4.1 Analysis of the subgroup of pupils with ADHD

An exploratory analysis was conducted on the subgroup of children diagnosed with ADHD (n = 8; 5 in the experimental group, 3 in the control group). The data show that all subjects reported improvements in pre/post scores, with a greater magnitude of variation in the experimental group. Social cohesion showed a statistically significant increase ($p < 0.05$), while inclusion showed a trend towards significance ($p = 0.056$). Given the limited number of participants in the ADHD subgroup (n = 8), the results should be considered

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exploratory and not generalizable. These findings are indicative of possible trends that warrant further investigation into larger samples.

5. Discussion

The action research confirmed that the Body Percussion intervention brings significant benefits to the psychophysical development of the pupils, with documented improvements in behavioral, cognitive, emotional and socio-relational areas. The results obtained support on the effectiveness of Body Percussion as a tool for the enhancement of life competences in the school environment and as an inclusive and therapeutic tool for pupils with ADHD.

Inferential and descriptive analyses showed statistically significant improvements in the experimental group between pre- and post-scores in all eight macro-areas analyzed. In addition to the increase in averages, a reduction in the variability of post-intervention scores was also observed, suggesting greater homogeneity in the positive response of students to the intervention.

In the control group, on the other hand, the changes were negligible or not significant, except for a slight increase in cohesion, which was not statistically significant. Inclusion has remained stable, reinforcing the hypothesis that a structured approach such as the one proposed in the project is necessary to substantially affect this dimension.

Overall, the observed differences are supported by robust statistical analyses (ANOVA, t-tests and correlations) and confirm that Body Percussion can act positively on multiple levels of child development and especially for pupils with ADHD. All this is confirmed by the answers given by the pupils and teachers to the questionnaires formulated on the Likert scale, which have strengthened the research by confirming the validity of this musical motor game. In addition, further confirmations have been given by previous research (ref.) where Body Percussion emerges as a concrete educational response to the value of diversity and the cultivation of an ethics of reciprocity; in fact, promising results in the experimental group for some macro-areas analyzed such as: social cohesion (+43% $p \leq 00.5$), active involvement (+25% $p \leq 00.5$), stress management, emotional regulation (+43% $p \leq 00.5$) and inclusion (+25% $p \leq 00.5$) and again 39% of teachers noticed greater spontaneous collaboration between peers even for pupils from different backgrounds. In addition, some research (Gallese, 2007) has shown that learning occurs more quickly and effectively through the body and movement, as well as through experience and intentionality that guide the learning process itself. This also supports the idea that there is a motor area of the brain that is involved in the processes of comprehension and perception; in fact, to understand an observed action,

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individuals activate the same sensory-motor connections that they use to perform and directly control their movements (Rizzolatti and Sinigaglia, 2006). It is therefore evident that learning has a motor basis and that comprehension is not limited only to the symbolic dimension. If applied to the pedagogical context, it can be argued that the bodily aspect cannot be excluded from educational and didactic processes, since the relationship with the other is always mediated by bodily action (Massa, 1983).

The results of the correlation analyses offer a deeper reading of the dynamics between the different dimensions involved in the intervention. The strong associations observed between Motor-Musical Technique and variables such as Engagement ($r = 0.76$), Inclusion ($r = 0.66$) and Breathing ($r = 0.57$) suggest that the improvement of technical-rhythmic skills is not isolated, but is accompanied by an increase in emotional activation, social integration and body awareness. These results confirm the pedagogical value of Body Percussion as a multidimensional practice, capable of simultaneously influencing cognitive, bodily and socio-relational aspects. In particular, the association between Engagement and Satisfaction ($r = 0.82$) reinforces the idea that motivation and perceived pleasure play a central role in students' participatory activation. This dynamic is consistent with the principle that perceived well-being and engagement promote more effective and lasting learning processes. The strong correlation between Inclusion and Group Cohesion ($r = 0.73$) also highlights the effect of the intervention on the relational dynamics of the class group, underlining how the sense of belonging can strengthen the inclusive climate and vice versa. Finally, the weak and systematic negative correlation of the Technology dimension with the other macro-areas (r between -0.13 and -0.24) is interesting, which could indicate a relative marginality of this variable in the context of the project. It is possible that, in an activity strongly centered on the body and direct interaction, the technological element has played an ancillary role, or even, in some cases, an element of distraction or interference with bodily and relational dynamics.

The results for the ADHD subgroup suggest that a structured motor-rhythmic intervention such as Body Percussion may be particularly effective in supporting social and relational self-regulation processes even in subjects with difficulties in attention and behavioral control. However, the limited number of subjects does not allow definitive generalizations; It is therefore recommended to investigate these findings with further studies on larger clinical samples.

In addition, it should be stressed that, although the results are statistically significant, their generalizability must be interpreted with caution. The specific characteristics of the intervention, its duration, structure, and school context, may limit the applicability of the findings to other student populations. Future

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replications in diverse settings are recommended to confirm the broader validity of these results.

In the future, it would be appropriate to explore the role of individual moderating variables (age, gender, sociocultural background, different behavioral disorders) and to provide for longitudinal follow-up to assess the persistence of effects over time. These analyses would make it possible to optimize the intervention and better define its transformative potential within school contexts.

6. Conclusion

The analysis of the results indicates that Body Percussion generates positive effects not only on motor development, but also on an emotional level, with significant repercussions on the overall well-being of pupils, particularly those with ADHD. A crucial aspect concerns the cohesion and involvement that this practice fosters: these dimensions can encourage the development of prosocial attitudes, promoting the inclusion of all children. The construction of a cohesive group through shared action and rhythmic practice therefore seems to have a significant impact on inclusive processes. The study aimed to underline how Body Percussion, based on an educational approach that integrates play, rhythm and movement, is mainly configured as a stimulating and incisive methodology for pupils with ADHD. This practice, in addition to strengthening cognitive, motor and musical skills, is associated with benefits in terms of psychophysical well-being, thus representing a potential tool for educational and therapeutic intervention in school contexts, with effectiveness for students with ADHD and other special educational needs.

The available scientific evidence confirms the relevant role of physical activity as an educational and support tool for pupils with ADHD. Gaping and Etnier (2010) showed improvements in inhibition processes and executive functions, while Pontifex et al. (2013) documented significant increases in attention following aerobic exercise. These observations find further support in the analyses of Valentini and Canini (2020) and Ambrose (2021), who emphasized the benefits of motor activity on attentional control, reduction of hyperactivity and strengthening of higher cognitive skills. In this direction, the review by Valentini and Canini (2020) reiterated the value of physical activity as an educational resource even for children with ADHD who are not undergoing pharmacological treatments.

Within this framework, the role of particular interest is played by activities that integrate motor coordination and rhythmic dimension. The ability to synchronize movement to rhythm, both in simple and complex forms, is in fact

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a determining factor in the development of executive functions and attentional regulation. In this sense, Verret et al. (2012) showed that structured activities, such as dance, promote motor control and concentration in children with ADHD.

Body Percussion is placed in this perspective as an educational and therapeutic practice of considerable potential: using the body as a rhythmic and sound instrument, it combines coordination, rhythm and sensorimotor involvement, promoting self-regulation, sustained attention and emotional well-being. Its integration into school contexts can therefore represent not only an innovative teaching methodology, but also an intervention with therapeutic value, capable of supporting the cognitive, emotional and relational processes of students with ADHD.

In fact, the data that emerged from the mixed analysis robustly confirms the initial hypothesis, highlighting how Body Percussion, understood as a structured motor-musical practice, produces significant and measurable effects on the motor, cognitive, socio-relational and emotional dimensions of students. In the Experimental Group, statistically significant increases were detected in all the macro-areas investigated, with relevance in coordination skills, group cohesion and inclusion, compared to the control group. The recreational-rhythmic approach, integrated into the school routine, is therefore configured as a highly effective pedagogical device, capable of combining psychomotor stimulation, the development of transversal skills and the promotion of an inclusive educational environment. This evidence supports the opportunity to systematically implement Body Percussion interventions in school contexts, both as a tool for enhancing skills and as a lever for the overall well-being of the student and for the improvement in emotional regulation, sustained attention and social participation, of students with ADHD, confirming the findings of international studies (Gapin & Etnier, 2010; Wassenaar et al., 2020; Diamond, 2013).

This study adopted a quasi-experimental design, which offers valuable insights into the educational impact of the intervention but also presents some methodological limitations. The absence of random assignment and the relatively small sample size constrain the internal validity of the findings and limit their external generalizability. Therefore, the results should be interpreted with caution and understood as context-specific rather than universally applicable. Despite this, the evidence collected offers relevant insights into the educational potential of the bodily and synchronic practices analysed that further studies would have to confirm in the future.

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Ethics Committee and Conflicts of Interest

This study was conducted in full compliance with ethical standards, with a focus on research involving minors. The approval was granted by the IRB Ethics Committee of the bio-medical area of the Department of Human, Social and Health Sciences of the University of Cassino and Southern Lazio with prot. 8641 of 8/4/2024. Informed consent was obtained from all participants; for minors, consent has been provided by their parents or legal guardians. All procedures carried out in studies involving minor participants have been in accordance with the Institutional Research Committee's ethical standards and the 1964 Declaration of Helsinki and its subsequent amendments or comparable ethical standards.

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