NEW TECHNOLOGIES FOR INCLUSION AND PSYCHO-PHYSICAL WELL-BEING IN THE CLASS GROUP

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ABSTRACT

This study analyzes the effectiveness of an innovative educational intervention based on the integration of digital and assistive technologies within the classroom group and, to this end, a playful-motor educational intervention based on the use of new digital technologies was designed and implemented, adopting a quasi-experimental design. Two fifth-grade primary school classes were involved, each including students with special educational needs (SEN); one was the experimental class (n = 25), which participated in the educational intervention based on the integration of new educational technologies, and the other was the control class (n = 24), which followed traditional activities. The results showed greater pre-post improvements in the experimental group in terms of participation, cooperation, and psycho-physical well-being, given the exploratory nature of the study and the involvement of two intact classes, these findings should be interpreted as preliminary evidence of an association between the integrated intervention and the observed outcomes.

KEYWORDS
Inclusion; educational technologies;
cooperative learning; special educational needs.

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1. Introduction

In recent years, in educational contexts, the use of digital technologies has become increasingly central, playing a key role in teaching and learning processes and in promoting inclusive and participatory school environments. In this regard, the field of motor and sports activities represents a privileged context for fostering relational development, psycho-physical well-being, and social participation, especially in primary school and in the presence of students with Special Educational Needs (SEN). It is within this perspective that the theories of Embodied Cognition are situated, emphasizing the role of the body and action in cognitive and learning processes; movement and bodily experience, therefore, constitute central elements in cognitive, emotional, and relational development (Shapiro, 2019; Johnson, 1999).

Therefore, ludomotor activities represent a meaningful educational context in which learning and corporeality are closely interconnected. Moreover, scientific literature highlights how ludomotor activities can foster not only the development of motor skills, but also the improvement of social, communicative, and emotional abilities, contributing to the construction of positive relational dynamics within the classroom group (Castro-Alonso et al., 2024).

In this regard, Kurt Lewin's theories of group dynamics (1951) highlight how individual behavior is, in fact, strongly influenced by the relational climate and the social interactions that develop within the group to which one belongs. Therefore, the classroom group assumes a fundamental educational function, configuring itself as a potential space for cooperation, participation, inclusion, and shared construction of learning (Poupore, 2026).

With regard to the inclusion and participation of students with SEN, the Cooperative Learning model by David W. Johnson and Roger T. Johnson (1991) emphasizes how cooperative and ludomotor activities can promote positive interdependence, shared responsibility, and peer support among students, fostering inclusive processes within the classroom group. In this regard, the scientific literature, from the socio-constructivist perspective of Lev Vygotsky (1978), highlights the central role of social interaction in learning processes, thus attributing value to collaborative activities and educational contexts based on tutoring and peer mediation.

Despite the extensive literature on the educational value of motor activities, studies that analyze in an integrated way the effectiveness of ludomotor interventions supported by digital and assistive technologies in primary school,

with particular attention to inclusive dynamics within the classroom group, are still limited.

In light of these considerations, this study analyzes how, through the game of bocce integrated with digital and assistive technologies, it is possible to reduce communicative, motor, and participatory barriers. In this sense, the educational project structured a hybrid learning environment in which aspects of traditional teaching are naturally and intentionally integrated with digital tools, promoting authentic inclusion processes. The aim of the study, therefore, is to promote students' psycho-physical well-being, fostering inclusion, active participation, and cooperation within the classroom group. The activities were proposed to primary school students and were designed to ensure accessibility and full participation of students with SEN. A workshop-based and cooperative approach was adopted, grounded in learning by making and cooperative learning, in order to enhance students' active involvement in the construction of game materials, in the management of activities, and in peer interaction.

The design of the activities followed the Universal Design for Learning (UDL) model, developed to promote accessible and flexible learning environments capable of responding to student diversity through multiple means of engagement, representation, and participation.

The integration of digital and assistive technologies within educational pathways fully aligns with this perspective, as it helps reduce learning barriers and promotes the active participation of all students. Moreover, in the design of the activities, another reference model was Inclusive Physical Education (Inclusive PE), which highlights how physical education can serve as an effective tool to promote social inclusion, participation, and a sense of belonging within the classroom group (Block, 2016; Lieberman & Houston-Wilson, 2009).

Thus, based on these premises, ludomotor activity is considered a pedagogical and relational device capable of supporting inclusive and participatory educational processes within the classroom group. Given the multimodal nature of the intervention, which combined ludomotor activities, digital and assistive technologies, and cooperative learning, the study was conceived as an exploratory investigation of the overall educational intervention rather than as an assessment of the isolated effect of technology.

2. Materials and Methods

2.1 Study Design

The study adopts a quasi-experimental design with pre-test and post-test measures and a control group, the study adopted an exploratory quasi-experimental design with pre-test and post-test measures and a control group to examine changes associated with a ludomotor intervention integrated with digital and assistive technologies in promoting inclusion, participation, and psycho-physical well-being within the classroom group. The program lasted 12 months, with two weekly sessions of 60 minutes each.

The research involved two fifth-grade primary school classes, both including students with Special Educational Needs (SEN). The experimental and control conditions were defined at the class level in agreement with the school administration and teachers and this class-level allocation was adopted to preserve the natural organization of the school setting and to ensure the feasibility of the intervention within regular curricular activities. In this way, one class was assigned to the experimental group (n = 25, including 4 students with SEN), while the other constituted the control group (n = 24, including 3 students with SEN). Accordingly, the study should be considered exploratory, and the findings should be interpreted with caution, particularly with regard to causal attribution and generalizability. So, a ludomotor educational program was structured based on the integration of digital and assistive technologies within the bocce game activity. The experimental group participated in a structured educational intervention based on the integration of digital and assistive technologies, whereas the control group carried out the same activities using traditional methods, without technological support. Thus, the intervention was implemented in a real school context, ensuring natural integration into the curriculum and the ecological validity of the educational setting.

The students with SEN were already stably included within the classroom group, and this condition allowed for an inclusive management of activities and made it possible to observe the effects of the intervention in an authentic context, evaluating its contribution to the improvement of participation, cooperation, and inclusive dynamics within the classroom group.

2.2 Participants

Overall, the study involved 49 students from two fifth-grade primary school classes. Students with SEN were already stably included in their respective classroom groups and regularly participated in school activities. The sample consisted of 26 males (53.1%) and 23 females (46.9%), and the mean age of participants was 10.4 years (SD = 0.5).

For the study, participants were divided into an experimental group (n = 25), composed of 13 males and 12 females and including 4 students with Special Educational Needs (SEN), and a control group (n = 24), composed of 13 males and 11 females and including 3 students with SEN.

Written informed consent was obtained from the parents or legal guardians of all participating students, data were collected and processed anonymously and confidentially.

2.3 Procedures

The research was conducted during regular curricular school activities and was structured into several phases. In a preliminary phase, the necessary authorizations and informed consent were obtained from the families of the participants, ensuring anonymity and confidentiality of the collected data. One week before the beginning of the program, all participants were invited to a specific briefing to provide information about the program.

Subsequently, both groups underwent an initial assessment (pre-test) aimed at measuring levels of participation, inclusion, psycho-physical well-being, and other variables considered in the study.

Afterwards, the experimental group participated in a ludomotor educational program based on the integration of digital and assistive technologies applied to the bocce game, while the control group carried out the same activities using traditional teaching methods, without the use of technological support.

The intervention was conducted over a period of 12 months, with two weekly sessions of 60 minutes each, for a total of 104 sessions and 104 hours of overall activity.

At the end of the intervention, both groups underwent a final assessment (post-test), using the same instruments employed in the initial phase, in order to identify any changes in the variables under study. In addition, intervention fidelity was monitored throughout the program through a structured implementation checklist completed during the intervention sessions. The

checklist was used to verify adherence to the planned sequence of activities, the duration and frequency of the sessions, the implementation of the prescribed ludomotor activities, the use of the planned digital and assistive technologies, and the application of the cooperative learning strategies described in the intervention protocol. Deviations from the planned protocol were recorded and reviewed to ensure consistency of implementation throughout the intervention period; overall, the implementation checklist indicated high adherence to the intervention protocol, with the planned activities and technological supports implemented across the intervention sessions.

2.4 Measures

Measurements were conducted in both the pre- and post-intervention phases. The research design included within-group and between-group comparisons, allowing the assessment of the impact of technological integration on inclusive educational outcomes. Data collection was carried out using a multi-method approach, integrating quantitative and qualitative instruments in order to ensure a comprehensive and triangulated evaluation of the intervention outcomes.

In particular, the Strengths and Difficulties Questionnaire (SDQ) was used as a standardized instrument to assess students' emotional and behavioral difficulties and prosocial behaviors. The questionnaire allowed for the detection of possible changes in levels of well-being and socio-relational adjustment between the pre- and post-intervention phases.

In addition, structured observational grids were used to systematically monitor students' behaviors during ludomotor activities. The observed indicators included: (i) active participation, (ii) peer cooperation, and (iii) operational autonomy.

The WHO-5 Well-Being Index, an internationally validated instrument, was also used to assess students' perceived subjective well-being in relation to the activities carried out. The WHO-5 Well-Being Index is a five-item self-report measure of subjective psychological well-being. In the present study, its use in children aged approximately 10 years was supported by evidence of its applicability and psychometric properties in school-age children (Domenech et al., 2025; Topp et al., 2015; Allgaier et al., 2012).

This tool allowed the perceptual dimension of well-being to be integrated with behavioral and observational data.

2.4.1 Strengths and Difficulties Questionnaire (SDQ)

The Strengths and Difficulties Questionnaire (SDQ) is a standardized questionnaire used to assess emotional and behavioral functioning in children and adolescents. It allows the analysis of five main dimensions: emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior (Goodman, 1997). In particular, in the present study, the teacher-report version was used to detect any changes in students' behaviors between the pre- and post-intervention phases.

2.4.2 WHO-5 Well-Being Index

The WHO-5 Well-Being Index is a self-report measure of psychological well-being consisting of five items that assess perceived well-being over the past two weeks (WHO, 1998). The questionnaire is widely used in both educational and clinical settings due to its simplicity and strong psychometric validity. In particular, in the present study, it was used to identify any changes in students' perceived well-being in relation to the educational intervention.

2.4.3 Observational grids

Structured observational grids were used for the systematic recording of students' behaviors during ludomotor activities. The observed indicators included active participation, peer cooperation, and operational autonomy. Observations were conducted by two independent observers using a structured grid, and the reliability of the observations was verified through the calculation of inter-rater agreement using Cohen's Kappa coefficient, whose values are interpreted according to the Landis and Koch (1977) scale (values between 0.61–0.80 indicate substantial agreement, while values between 0.81–1.00 indicate almost perfect agreement).

2.5 Intervention

The educational intervention was structured into a sequence of progressive phases, with the aim of integrating ludomotor activities with digital and assistive technologies within an inclusive pathway focused on students' active participation and cooperation, through a gradual transition from guided activities to situations of increasing autonomy. The main educational strategies included cooperative learning and learning by making, applied according to the principles of Universal Design for Learning (UDL) within ludomotor activities.

The main objective of the educational program was to promote students' well-being through the creation of a hybrid learning environment capable of fostering inclusion, cooperation, and participation within the classroom group. The pathway was organized into six operational phases, each designed to achieve specific objectives related to the development of relational, motor, and social skills.

Throughout all phases of the intervention, students were systematically observed using structured observational grids completed by two independent observers, in order to monitor the evolution of participation, cooperation, and inclusion levels throughout the educational process. In addition, during the entire project, the control group participated in ludomotor bocce activities using traditional methods, without technological support, thereby maintaining a conventional teaching approach.

- Phase *1: Introduction and Activation*
  Objective: *to activate motivation and present the learning context.*

  In this phase, the educational project and the bocce game were introduced as the reference ludomotor activity. Students in the experimental group were involved in a guided discussion on the rules of the game and the procedures for its execution. The integration of digital and assistive technologies (interactive whiteboard (IWB), tablets, text-to-speech, and pointing devices) that would be used throughout the program was also presented.

  Explanatory videos were shown to introduce the bocce game and explain its rules in a simple and accessible way. During this phase, pre-intervention assessments were conducted using the SDQ, structured observational grids, and systematic observation. In parallel, the control group underwent the pre-test administration, ensuring equivalent assessment conditions to those of the experimental group.

- Phase 2: *Co-construction of Educational Materials*
  Objective*: to promote collaboration, active participation, and experiential learning.*

  Students in the experimental group participated in the shared construction of the bocce balls following a "*learning by making*" approach. Specifically, the activity was carried out in small cooperative groups, fostering collaboration and problem-solving skills. Students built the balls that were later used in

subsequent game activities, using simple and easily accessible materials, thereby promoting experiential learning processes, creativity, and peer collaboration.

In addition to constructing the bocce balls, students also took part in the design and creation of motor pathways, contributing to the definition of play spaces, operational stations, and activity procedures. These activities were developed according to a learning by making approach, in order to promote active engagement, a sense of group belonging, and student responsibility within the learning process.

During this phase, digital supports were also adopted: the interactive whiteboard (IWB) was used as a visual aid to display models and guide the construction steps, while text-to-speech tools supported the active participation of students with SEN.

- Phase 3: *Familiarization and Learning of Rules*
  Objective: *to acquire the rules of the game and introduce collaborative technologies.*
  Students were guided through a simulation of the bocce game, with particular attention to understanding the rules, which was supported by the interactive whiteboard (IWB), where explanatory videos were projected. Tablets were introduced with applications installed for score management and recording, serving as a support for understanding, active participation, and the sharing of information during game activities. In particular, this aspect allowed the immediate visualization of results during ludomotor activities, promoting real-time feedback processes, greater student engagement, and a more autonomous and transparent management of game dynamics. A pointing device was also introduced and used as an assistive technology to facilitate the participation of students with SEN in the phases of choice, orientation, and target identification, promoting greater autonomy and accessibility to the proposed activities. The combined use of digital and assistive technologies fostered accessibility, active participation, collaboration, and inclusion within the classroom group. Moreover, during this phase, peer collaboration was encouraged through tutoring and reciprocal support activities.

- Phase 4: *Guided Play with Technological Supports*
  Objective: *to develop motor, relational, and inclusive skills.*

In this phase, students were guided through preparatory games aimed at acquiring and consolidating the specific technical gesture of the bocce game. Structured motor pathways were introduced, including eye-hand coordination exercises, spatial-temporal orientation activities, and precision games, progressively adapted to students' abilities. The motor pathways, following the principle of learning by doing, were co-constructed with the students, who actively contributed to the definition and organization of the game itinerary.
Each participant was involved in selecting and arranging motor elements (skittles, hoops, and other materials) as well as technological supports. Thus, student involvement in decision-making processes fostered active participation and peer collaboration, promoting inclusive dynamics and valuing each student's contribution, with particular attention to students with Special Educational Needs (SEN).
The activities followed a gradual progression of difficulty; in this way, the bocce game was carried out with simplified rules under the active supervision of the teacher. Digital technologies were integrated into score management and the visualization of game information through the interactive whiteboard (IWB), which also enabled immediate feedback during activity execution. At the same time, assistive technologies (pointing device, text-to-speech) were used to ensure full participation of students with SEN.

- Phase 5: *Cooperative Play and Progressive Autonomy*
  Objective*: to enhance cooperation, autonomy, and inclusion*.

  Students participated in games in heterogeneous teams, with a progressive increase in autonomy in rule management. Teams were organized by assigning specific roles (e.g., captain, scorekeeper, coordinator, etc.), with periodic rotation of roles in order to promote participatory equity and the development of social and organizational skills. During the activities, digital and collaborative technologies were integrated, in particular tablets and the interactive whiteboard (IWB), used to support strategy planning and the shared visualization of rules and objectives.
  The IWB was also used to provide immediate feedback, fostering awareness of the game process and students' self-regulation. The activities also included moments of guided reflection and simple self-assessment of group work, through problem-solving and cooperation-oriented questions *("how did we work?", "what can we improve?"*), in order to promote metacognitive processes. The adopted approach allowed for the observation of spontaneous

cooperative dynamics, promoting the inclusion of students with Special Educational Needs (SEN) within the classroom group.
This approach also fostered the creation of a hybrid learning environment, in which a traditional bocce game activity was integrated with digital and assistive technologies, promoting innovative teaching methods oriented toward inclusion, active participation, and personalization of the educational experience.

- Phase 6: *Structured Game*
  Objective: *to consolidate skills and evaluate the effectiveness of the intervention.*
  A final team match was carried out with full rules, in which students progressively assumed a greater degree of autonomy in managing rules and game dynamics. The match involved the use of digital technologies to manage scoring and provide immediate feedback on actions, in order to enhance awareness and performance monitoring. In addition, assistive technologies such as the pointing device were used to support the full participation of students with SEN.
  During this phase, post-intervention assessment was conducted using the SDQ, structured observational grids, and systematic observation. The phase concluded with a guided collective reflection on the experience, aimed at promoting the re-elaboration of the activity, awareness of the learning process, and metacognitive considerations regarding group dynamics and learning.

3. Results

The experimental group (n = 25, including 4 students with Special Educational Needs – SEN) and the control group (n = 24, including 3 students with SEN) did not show statistically significant differences at the pre-test in the SDQ and WHO-5 variables ($p > .05$), indicating no statistically significant baseline differences between the groups.

Strengths and Difficulties Questionnaire (SDQ)
The SDQ results showed a significant improvement in the experimental group compared to the control group; in particular, the experimental group showed a reduction in total difficulties scores (M pre = 18.4; SD = 3.8; M post = 13.2; SD = 3.5) and the mean change (Δ) was $\Delta = -5.2$ for the experimental group. An

increase in prosocial behaviors was also recorded (M pre = 6.8; SD = 1.6; M post = 9.1; SD = 1.7,; Δ = +2.3). The control group instead showed minimal changes in total difficulties (M pre = 18.1; SD = 3.7; M post = 17.3; SD = 3.6; Δ = −0.8) and no relevant changes in prosocial behaviors (M pre = 7.0; SD = 1.5; M post = 7.1; SD = 1.5). The comparison between groups was conducted on pre-post changes. The experimental group showed a greater reduction in total difficulties compared with the control group (Δ = −5.2 vs. Δ = −0.8), with a statistically significant difference in change scores, $t(47) = -4.21$, $p < .001$, Cohen's $d = 1.20$. Similarly, the experimental group showed a greater increase in prosocial behaviors compared with the control group (Δ = +2.3 vs. Δ = +0.1), with a statistically significant difference in change scores, $t(47) = 4.88$, $p < .001$, Cohen's $d = 1.39$.

WHO-5 Well-Being Index

A significant increase in perceived well-being was observed in the experimental group (M pre = 52.3; SD = 11.2; M post = 71.6; SD = 10.5; Δ = +19.3), while the control group showed a minimal increase (M pre = 53.1; SD = 10.8; M post = 56.4; SD = 10.6; Δ = +3.3). The comparison between the two groups was conducted on pre-post changes. The experimental group showed a greater increase in perceived well-being compared with the control group (Δ = +19.3 vs. Δ = +3.3), with a statistically significant difference in change scores, $t(47) = 5.19$, $p < .001$, Cohen's $d = 1.48$.

Qualitative observations

The structured observation grids showed a progressive improvement in the experimental group in terms of active participation, peer cooperation, and operational autonomy. In the experimental group, active participation increased from M = 3.1 (SD = 0.6) at pre-test to M = 4.3 (SD = 0.5) at post-test, peer cooperation increased from M = 2.9 (SD = 0.7) to M = 4.2 (SD = 0.5), and operational autonomy increased from M = 2.8 (SD = 0.6) to M = 4.1 (SD = 0.5). In the control group, active participation increased from M = 3.0 (SD = 0.6) to M = 3.2 (SD = 0.6), peer cooperation from M = 2.9 (SD = 0.6) to M = 3.1 (SD = 0.6), and operational autonomy from M = 2.8 (SD = 0.7) to M = 3.0 (SD = 0.6). The improvements observed in the experimental group were particularly evident among students with SEN, who showed increased levels of participation and social interaction during the intervention. Inter-rater reliability was assessed using Cohen's kappa and showed substantial to almost

perfect agreement across the observational domains (active participation, κ = .84; peer cooperation, κ = .82; operational autonomy, κ = .87).

Overall, the experimental group showed greater pre-post improvements than the control group across the quantitative and observational measures, with results consistent across the different outcome domains.

4. Discussion

The present study has shown how the integration of play-based motor activities with digital and assistive technologies may be associated with positive changes in participation, cooperation, and psycho-physical well-being.

The results obtained from the experimental group, which showed significant improvements, provide preliminary evidence regarding the potential of the proposed approach. In particular, the findings are consistent with the principles of Universal Design for Learning (UDL), according to which learning environments should provide multiple means of engagement and participation in order to respond to student heterogeneity. Indeed, the use of collaborative digital technologies (tablets, interactive whiteboards, scoring applications) and assistive technologies (pointing devices, speech synthesis) has facilitated accessibility to activities and active participation of students with SEN, reducing barriers to learning and participation and creating a more equitable and inclusive educational context. The learning-by-making activities and cooperative play promoted meaningful collaborative dynamics and processes of reciprocal scaffolding; in fact, the results highlight how learning develops through social interaction and peer cooperation. Furthermore, the study emphasizes the central role of the body and motor experience in learning processes, which took place through action, movement, and concrete interaction with the environment, and the integration of technologies did not replace bodily experience but expanded its participatory and inclusive possibilities (Claxton & Poel, 2026). Indeed, in light of the results obtained, the study supports the idea that motor activity can constitute a privileged context for promoting school and social inclusion, enhancing the participation of students with SEN without resorting to separate pathways, but rather promoting a shared and participatory experience within the classroom group.

The study also highlights how cooperative and play-based motor activities foster processes of positive interdependence and social cohesion within the classroom group. The results can therefore also be interpreted in light of Kurt

Lewin's (1951) theory of group dynamics, according to which individual behavior is influenced by the interactions and relational climate of the group. The experimental group therefore showed greater improvements in prosocial behaviors and supported reciprocal collaboration among students, promoting cooperative dynamics and student engagement, with particularly significant effects on the participation of students with SEN.

Despite the positive results, the study presents some limitations. First, the involvement of only two intact classes limits the generalizability of the findings and does not allow the effects of the intervention to be clearly separated from class-level and teacher-related characteristics. Moreover, because the intervention combined ludomotor activities, digital and assistive technologies, and cooperative learning, the specific contribution of each component cannot be isolated. Finally, the absence of a long-term follow-up does not allow verification of the stability of the observed changes over time. Therefore, the study opens the way for future research involving larger samples, different age groups, and additional standardized instruments to further investigate the role of digital and assistive technologies in inclusive motor education contexts. However, overall, the experimental group showed greater pre-post improvements across the quantitative and observational outcomes. Given the exploratory design and the use of two intact classes, these findings should be interpreted as preliminary evidence of an association between the integrated intervention and the observed changes.

5. Conclusion

The results of the present study highlight how the integration of play-based motor activities, digital technologies, and assistive technologies may represent a promising educational approach to promote inclusion, active participation, and psycho-physical well-being within the classroom group. The use of methodologies based on learning by making, cooperative learning, and the integration of collaborative digital tools was associated with the construction of an inclusive, participatory educational environment oriented toward the valorization of individual differences. In particular, assistive technologies have played a significant role in reducing barriers to participation, facilitating the inclusion of students with SEN within the classroom group without resorting to segregating practices.

Therefore, the study suggests the potential value of designing inclusive educational interventions supported by accessible technologies, thereby

creating hybrid learning environments capable of fostering well-being, participation, and the quality of relationships within the classroom group.

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