



Effects of physical education teacher training on perceived social inclusion of students with motor disabilities in Morocco

Efectos de la formación del profesorado de educación física en la inclusión social percibida de estudiantes con discapacidad motora en Marruecos

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Received: 05-04-26
Accepted: 23-05-26

How to cite in APA

Abouddaka, I., & Bassiri, M. (2026).
Effects of physical education teacher
training on perceived social inclusion of
students with motor disabilities in
Morocco. *Retos*, 81, 867-882.
<https://doi.org/10.47197/retos.v81.119636>

Abstract

Objective: This study evaluated the effects of a training and support protocol for physical education teachers on the adaptation of learning activities and the perceived social inclusion of students with motor disabilities in Moroccan schools. The protocol focused on improving teachers' professional practices by supporting the design and implementation of inclusive, differentiated, and adapted physical education situations aligned with students' abilities.

Methodology: A quasi-experimental design with a non-equivalent control group and repeated measures was used. The study involved 220 students with motor disabilities divided into two conditions: an experimental group supervised by teachers who received the training and support protocol, and a control group supervised by teachers who continued their usual practices. Perceived social inclusion in physical education was assessed before and after the intervention using a contextualized 9-item questionnaire inspired by the Perceptions of Inclusion Questionnaire. The questionnaire covered three dimensions: peer relationships, belonging/social acceptance, and social participation in physical education.

Results: The findings showed greater improvement in the experimental group than in the control group for the overall perceived social inclusion score. Linear mixed-effects modelling confirmed a significant Time $\times$ Group interaction for the overall score ($\beta = 0.73$, SE = 0.15, 95% CI [0.44, 1.02], $p < .001$). Significant interactions were also observed for peer relationships ($\beta = 0.70$), belonging/social acceptance ($\beta = 0.71$), and social participation in physical education ($\beta = 0.78$), all in favour of the experimental group.

Conclusion: These results suggest that training and supporting physical education teachers in adapting learning activities can be an effective strategy for promoting the perceived social inclusion of students with motor disabilities in physical education.

Keywords

Inclusive physical education; social inclusion; motor disability; intervention protocol; students; Morocco

Resumen

Objetivo: Este estudio evaluó los efectos de un protocolo de formación y acompañamiento dirigido al profesorado de educación física sobre la adaptación de las actividades de aprendizaje y la inclusión social percibida de estudiantes con discapacidad motora en centros escolares marroquíes. El protocolo se centró en la mejora de las prácticas profesionales docentes, apoyando el diseño y la implementación de situaciones de educación física inclusivas, diferenciadas y adaptadas a las capacidades de los estudiantes.

Metodología: Se utilizó un diseño cuasiexperimental con grupo control no equivalente y medidas repetidas. El estudio incluyó a 220 estudiantes con discapacidad motora, distribuidos en dos condiciones: un grupo experimental, supervisado por docentes que recibieron el protocolo de formación y acompañamiento, y un grupo control, supervisado por docentes que continuaron con sus prácticas habituales. La inclusión social percibida en educación física se evaluó antes y después de la intervención mediante un cuestionario contextualizado de 9 ítems, inspirado en el Perceptions of Inclusion Questionnaire. El cuestionario abarcó tres dimensiones: relaciones con los iguales, pertenencia/aceptación social y participación social en educación física.

Resultados: Los resultados mostraron una mayor mejora en el grupo experimental que en el grupo control en la puntuación global de inclusión social percibida. El modelo lineal de efectos mixtos confirmó una interacción significativa Tiempo $\times$ Grupo para la puntuación global ($\beta = 0.73$, SE = 0.15, IC 95% [0.44, 1.02], $p < .001$). También se observaron interacciones significativas en las relaciones con los iguales ($\beta = 0.70$), la pertenencia/aceptación social ($\beta = 0.71$) y la participación social en educación física ($\beta = 0.78$), todas a favor del grupo experimental.

Conclusión: Estos resultados sugieren que la formación y el acompañamiento del profesorado de educación física en la adaptación de las actividades de aprendizaje pueden constituir una estrategia eficaz para promover la inclusión social percibida de los estudiantes con discapacidad motora en educación física.

Palabras clave

Educación física inclusiva; inclusión social; discapacidad motora; protocolo de intervención; estudiantes; Marruecos.



Introduction

Over the past decades, the inclusion of students with disabilities has become a structuring principle of contemporary educational policies. From this perspective, inclusion is not limited to the mere presence of the student in a mainstream school setting, but implies their effective participation in learning, social interactions, and the collective life of the school. This conception is consistent with approaches to inclusive education that emphasize the reduction of barriers to learning and participation, as well as the construction of school contexts that are more welcoming of student diversity (Booth & Ainscow, 2002). For students with motor disabilities, access to genuine participation therefore depends largely on the teacher's ability to adapt learning activities, differentiate motor tasks, and organize a pedagogical environment conducive to cooperation and social acceptance (Bertills & Björk, 2024).

In this context, physical education (PE) occupies a particular place. Beyond its motor objectives, it constitutes a school space that is strongly exposed to issues of cooperation, bodily visibility, peer interactions, and social recognition. The literature shows that PE can foster social development, a sense of belonging, and certain psychosocial skills, while also representing, for some students, a place of increased vulnerability when teaching situations are not adapted to their needs (Bailey, 2005). Among students with disabilities, this ambivalence is particularly pronounced, as PE may be experienced either as a lever for integration or as a space of marginalization, restricted participation, or symbolic and functional exclusion (Rekaa et al., 2019; Wilhelmsen & Sørensen, 2017).

One of the central concepts for analyzing this reality is that of social inclusion. Available studies show that this notion is multidimensional and cannot be reduced to school attendance alone. It refers in particular to the quality of interactions with peers, acceptance by the group, friendship relationships, participation in shared activities, and the feeling of being recognized as a full member of the school community (Koller et al., 2018; Koster et al., 2010). From this standpoint, research shows that students with special educational needs often experience less favorable social participation than their peers, particularly in terms of interactions, social acceptance, and friendship relationships (Koster et al., 2010; Wang et al., 2025).

In the specific field of inclusive PE, several literature reviews have identified recurrent obstacles to the full participation of students with disabilities. These obstacles relate both to material conditions, pedagogical organization, and the type of disability involved, as well as to teacher-related variables, particularly their attitudes, sense of efficacy, level of preparation, and access to support or specialized resources (Tant & Watelain, 2016; Tarantino et al., 2022; Wilhelmsen & Sørensen, 2017). More specifically, recent reviews converge in showing that, even when teachers report being generally favorable to inclusion, they frequently report insufficient preparation during initial training, as well as a need for concrete support to transform inclusive intention into effective pedagogical practices (Rekaa et al., 2019; Tarantino et al., 2022).

This issue is of particular importance in the Moroccan context. The national normative framework explicitly recognizes that Morocco is one of the North African countries that quickly became aware of the need to educate children with disabilities. Indeed, by ratifying the United Nations (UN) Convention on the Rights of Persons with Disabilities (CRPD) in April 2009, Morocco committed itself to a process of promoting, protecting, and ensuring the exercise of the rights of persons with disabilities. The 2011 Constitution enshrines equal access to education, while the Strategic Vision for Reform 2015–2030 and Framework Law No. 51-17 reaffirm the need for an education system that is more equitable, more inclusive, and more attentive to students with disabilities (Conseil Supérieur De L'éducation, De La Formation Et De La Recherche Scientifique [CSEFRS], 2015; Royaume du Maroc, 2011, 2019).

From a scientific perspective, one observation emerges: the literature is abundant on teachers' attitudes toward inclusion in PE and on the barriers that hinder the participation of students with disabilities, but studies evaluating the effect of intervention protocols directly intended for students with motor disabilities on the social dimensions of their inclusion remain more limited. This gap appears particularly salient when it concerns students with motor disabilities, even though the literature shows that their social participation in the school context remains particularly vulnerable (Alhumaid et al., 2020). There is thus a need for intervention studies that empirically test whether an inclusive PE intervention protocol can

improve not only participation in the activity, but also the quality of the social inclusion experienced by the students concerned during PE sessions.

It is within this perspective that the present study is situated, the objective of which is to evaluate the effects of implementing a training and support protocol for PE teachers on the perceived social inclusion of students with motor disabilities. More specifically, the study aims to determine the evolution of social inclusion among students supervised by teachers who have benefited from training in inclusive physical education. This intervention is based on training teachers to adapt rules, motor tasks, equipment, space, practice time, and forms of peer cooperation.

Based on this objective, the study hypothesized that students with motor disabilities supervised by physical education teachers who received the training and support protocol would show a greater improvement in perceived social inclusion between pre-test and post-test than students supervised by teachers continuing their usual physical education practices. More specifically, it was expected that the experimental group would present higher gains in the overall perceived social inclusion score and in its three dimensions: peer relationships, belonging/social acceptance, and social participation in physical education.

Theoretical and Conceptual Framework

Social Inclusion in the School Setting: Conceptual Distinction

From Integration to Inclusion

The notion of school inclusion has undergone considerable semantic and conceptual evolution since the 1990s. UNESCO's Salamanca Statement (1994) laid the foundations for inclusive education by affirming that regular schools "with this inclusive orientation are the most effective means of combating discriminatory attitudes." Booth and Ainscow (2002) distinguished integration, "the simple placement of the disabled student in an ordinary setting without modification of the system," from inclusion, "the systemic transformation of structures, cultures, and practices to enable the full participation of all."

School inclusion constitutes the generic concept encompassing the pedagogical, cultural, and political dimensions of participation in school life. Social inclusion, the specific object of this research, is an essential component of it: it refers to the quality of social interactions, the sense of belonging to the group, mutual recognition among peers, and active participation in collective activities (Block & Obrusnikova, 2007; Booth & Ainscow, 2002; Koster et al., 2010; Schwab et al., 2022).

Dimensions of Social Inclusion in PE

In the specific context of PE, social inclusion covers several interdependent dimensions. Based on Booth and Ainscow's Index for Inclusion (2000) and the work of Block and Obrusnikova (2007), the following are distinguished: (1) participation in activities, "the fact of taking part, even in an adapted manner, in the proposed motor learning situations." (2) belonging to the group, "the feeling of being an integral part of the class, of not being set aside." (3) relationships with peers, "the quality and nature of interactions with classmates during sessions." (4) the teacher-student relationship, "the perception of being recognized, respected, and supported by the teacher." (5) participation in social roles, "access to active functions (refereeing, organization, observation) enabling contribution to the group even without physical practice" (Booth & Ainscow, 2002; Block & Obrusnikova, 2007; Koster et al., 2010; Schwab et al., 2022).

These dimensions echo the observation of Murphy and Carbone, according to which non-participation in PE classes is a source of social marginalization reinforced by mechanisms of stigmatization (Murphy & Carbone, 2008). Recent evidence shows that physical education can constitute an important context for the participation and social inclusion of students with disabilities, but that this potential depends strongly on teachers' attitudes, preparation, and capacity to implement inclusive practices (Tarantino et al., 2022).

PE, Motor Disability, and Inclusive Pedagogical Practices

From a pedagogical perspective, practices likely to promote social inclusion in PE are well documented in the international literature. They include: pedagogical differentiation (adaptation of rules, objectives,



and tools to each student's abilities), the organization of cooperative activities valuing the complementarity of students, the valorization of individual progress rather than comparative performance, the assignment of valued social roles to students with limited physical participation (referee, tactical observer, organizer), and the sensitization of the whole class group to the issues of disability and diversity (Block & Obrusnikova, 2007; Tant & Watelain, 2016; Wilhelmsen & Sørensen, 2017).

These practices are based on Bandura's theory of self-efficacy (1977), according to which the perception of one's own competence is an essential driver of participation. By proposing adapted progressive tasks and successful experiences, the PE teacher can help rebuild, in the student with a motor disability, a sense of competence and belonging that conditions their social inclusion (Bandura, 1977). In physical education, social comparison processes may influence students' motivation, engagement, and physical self-perceptions; therefore, inclusive pedagogical practices should emphasize individual progress rather than inter-student ranking (Spray et al., 2023).

Inclusive Physical Education in the Moroccan Context

The Moroccan context reveals a persistent gap between institutional orientations and the concrete conditions for implementing inclusive physical education in schools (Ben Rakaa et al., 2024b). In physical education, this gap is particularly visible because participation depends not only on formal access to school, but also on the teacher's capacity to adapt motor tasks, rules, equipment, space, practice time, and forms of peer cooperation. Ben Rakaa et al. (2025c) showed that the integration of students with motor impairment into adapted physical education and school para-athletics protocols improved their sense of pedagogical and school inclusion, psychological well-being, and self-esteem. Although initiatives to promote school enrollment are in place, a major epidemiological study reveals that medically mandated physical inactivity remains an endemic problem: 40.20% of students diagnosed with school-related conditions (such as motor, cardiovascular, or metabolic disorders) are deemed completely unfit to participate in physical education and sports (Ben Rakaa et al., 2024b). This widespread exclusion is further complicated by the operational challenges faced by teaching staff (Ben Rakaa et al., 2024a, 2024c).

The diversity and complexity of these conditions frequently lead to a sense of pedagogical incompetence among PE teachers; this lack of self-efficacy directly translates into negative perceptions and reluctance to include these students with special needs in motor, organizational, and observational learning tasks (Ben Rakaa et al., 2024c). To address this educational crisis, curriculum restructuring is essential (Ben Rakaa et al., 2025a). The systematic integration of Adapted Physical Activity (APA) programs, combined with the practice of inclusive competitive sports—such as school para-athletics—is a key strategy; such interventions have been shown to significantly improve physical abilities (Lourenço et al., 2025), the sense of academic and educational inclusion (Ben Rakaa et al., 2025b), while also fostering psychosocial development (Ben Rakaa et al., 2025), psychological well-being, and self-esteem among adolescents (Ben Rakaa et al., 2025c), particularly those with motor impairments.

Method

Study Design

This research adopts a quantitative quasi-experimental design with a non-equivalent control group and repeated pre-test/post-test measures. This methodological choice is justified by the organizational constraints of the school setting, which did not allow for a strict random allocation of students or teachers between the experimental and control conditions. The protocol is organized into three phases: an initial measure of students' perceived social inclusion before teacher training, a phase of training and support for physical education teachers in the adaptation of learning activities, and then a post-intervention measure administered to students in both groups according to the same procedure. This design makes it possible to examine whether the evolution of perceived social inclusion differs depending on whether students are supervised by trained teachers or by teachers continuing their usual practices.

The protocol is based on two groups of students:

- G1 (experimental group): students in this group benefit from an inclusive physical education intervention protocol for 12 weeks.



- G2 (control group): students in this group follow usual physical education sessions during the study period, without benefiting from the specific intervention protocol.

The groups were formed according to a logic of organizational and institutional feasibility. Students who could be integrated into the intervention protocol during the planned period were assigned to the experimental group (G1), while those who could not be included in this protocol during the same period constituted the control group (G2).

In the Moroccan school context studied, students with motor disabilities were not grouped into specialized classes or separate pedagogical units. They were enrolled in ordinary classes with their peers without disabilities. Consequently, the distribution of students with motor disabilities across classes was irregular: a class could include one student with a motor disability, while other classes could include none. This organizational reality explains why the study was primarily centered on students' perceived social inclusion rather than on class-level outcomes.

Nevertheless, students remained linked to specific physical education teachers and schools. Each student, teacher, and school was assigned an anonymized identification code. These identifiers made it possible to match the same student between pre-test and post-test measurements and to identify the teacher and school context to which each student belonged. Therefore, although students with motor disabilities were dispersed across ordinary classes, the data structure allowed the revised analysis to account for repeated student measurements and for the possible contextual dependence associated with teachers and schools.

Table 1. Measurement Protocol

Group	Pre-test (T0)	Intervention	Post-test (T1)
G1	Initial measure of students' perceived social inclusion	Inclusive physical education intervention protocol intended for students (12 weeks)	Final measure of students' perceived social inclusion
G2	Initial measure of students' perceived social inclusion	Absence of a specific intervention protocol during the study period	Final measure of students' perceived social inclusion

The study was conducted in schools under the Regional Academy of Education and Training of Casablanca-Settat, Morocco. This field was selected because of its territorial diversity, combining urban, peri-urban, and rural contexts, as well as the possibility of implementing an intervention protocol under natural school conditions. The target population of the study consists of students with motor disabilities participating in physical education sessions in the schools concerned. Physical education teachers played an organizational and pedagogical support role in the implementation of the protocol, but they do not constitute the main population for statistical analysis.

Participants

The final sample comprised 220 students with motor disabilities, divided between an experimental group (G1; $n = 120$) and a control group (G2; $n = 100$). The mean age of the participants was 16.6 years ($SD = 1.8$), with an age range between 12 and 18 years. The study included students identified by the schools as having a motor disability, regularly enrolled in the classes concerned by physical education sessions, present at both measurement times, and able to respond to the questionnaire with or without adapted support. Students absent from one of the two measurement times, those whose health condition did not allow any participation in the proposed activities, even in adapted form, as well as those for whom matching pre-test/post-test responses was not possible, were excluded. The data were anonymized using an individual code in order to ensure participant confidentiality.

Physical education teachers constitute the direct beneficiaries of the training and support protocol. Their role is therefore not limited to organizational facilitation of the protocol; they represent the main lever of the intervention. The protocol aimed to support them in the design, adaptation, and implementation of learning situations in physical education that promote the social inclusion of students with motor disabilities. The students, for their part, constitute the population among whom the effects of the protocol are evaluated, through the evolution of their perceived social inclusion between the pre-test and the post-test.

This distinction was taken into account in the revised analytical strategy. The intervention acted primarily on teachers' inclusive pedagogical practices, whereas the outcome was measured at the student level. Therefore, the statistical analysis considered both the repeated measurement of students and the possible contextual influence of teachers and schools.

Table 2. Distribution of Participants by Group

Participants	G1	G2	Total
Physical education teachers	40	43	83
Students	120	100	220

Table 3. Initial Comparability of Groups at Pre-test

Variable		G1 (n = 120)	G2 (n = 100)
Sex	Age (years), M $\pm$ SD	16.4 $\pm$ 1.7	16.8 $\pm$ 1.8
	Boys, n (%)	68 (56.7%)	54 (54.0%)
School level	Girls, n (%)	52 (43.3%)	46 (46.0%)
	Lower secondary, n (%)	70 (58.3%)	55 (55.0%)
Sector	Upper secondary, n (%)	50 (41.7%)	45 (45.0%)
	Public sector, n (%)	77 (64.2%)	61 (61.0%)
School setting	Private sector, n (%)	43 (35.8%)	39 (39.0%)
	Urban setting, n (%)	73 (60.8%)	58 (58.0%)
Rural/peri-urban setting, n (%)		47 (39.2%)	42 (42.0%)
Overall social inclusion score T0, M $\pm$ SD		2.41 $\pm$ 0.52	2.47 $\pm$ 0.50

Measurement Instrument

The degree of perceived social inclusion in physical education was measured using a contextualized 9-item questionnaire inspired by the Perceptions of Inclusion Questionnaire (PIQ) (Knickenberg et al., 2022), particularly its dimension related to social inclusion in class, and then adapted to the specific context of physical education sessions. The instrument is structured into three dimensions: (1) peer relationships (items 1, 2, 4, and 7), (2) belonging/social acceptance (item 3 “reversed,” items 5, 6, and 9), and (3) social participation in physical education (item 8). Responses are collected on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). An overall score is calculated after reversing item 3, with a high score indicating more favorable perceived social inclusion.

The same questionnaire is administered at the pre-test (T0) and the post-test (T1), allowing a direct comparison of scores between the two measurement times. The content validity of the questionnaire was examined by a panel of 5 experts, composed of two teacher-researchers in education sciences, one specialist in adapted physical activity, one physical education pedagogical inspector, and one field practitioner involved in inclusive education. The internal reliability of the instrument is examined using the pre-test data.

Table 4. Interpretation Thresholds for the Social Inclusion Score (1–5 Likert Scale)

Mean score	Level of social inclusion	Interpretation
1.0–2.0	Very insufficient	Perceived social exclusion, strong feeling of marginalization
2.0–2.9	Insufficient	Dominant feeling of exclusion, lack of adaptation
3.0–3.4	Partial/neutral	Mixed experience, neither clear inclusion nor clear exclusion
3.5–4.2	Satisfactory	General feeling of inclusion, some persistent shortcomings
4.3–5.0	Fully inclusive	Active participation, strong belonging, positive interactions

The internal reliability indices of the perceived social inclusion in physical education scale were calculated from the pre-test data. The results are presented in Table 5.

The Peer Relationships subdimension, composed of 4 items, presents a Cronbach's alpha coefficient of .81. The Belonging/Social Acceptance subdimension, also composed of 4 items, presents an alpha of .84. For the overall scale score, calculated from 9 items, the Cronbach's alpha obtained is .88. The Social Participation in Physical Education dimension is based on a single item; no internal reliability coefficient was therefore calculated for this component. These results show that the scale presents satisfactory internal consistency indices at pre-test for the multi-item subdimensions and for the overall score.



Table 5. Internal Reliability Indices of the Perceived Social Inclusion in Physical Education Scale at Pre-test

Dimension / score	Number of items	Cronbach's alpha
Peer relationships	4	.81
Belonging / social acceptance	4	.84
Social participation in physical education	1	—
Overall score	9	.88

The main independent variable corresponds to the experimental condition, defined by whether or not physical education teachers were exposed to a training and support protocol for the adaptation of learning activities in inclusive physical education. In the experimental condition, the teachers benefited from training aimed at strengthening their competencies in pedagogical differentiation, adaptation of motor situations, adjustment of rules, equipment, space, and time, as well as the organization of cooperative interactions among students. In the control condition, the teachers continued their usual physical education practices during the study period, without benefiting from the specific protocol.

Experimental protocol

The Experimental protocol corresponds to a multi-school training and support protocol for physical education teachers in the adaptation of learning activities to promote the social inclusion of students with motor disabilities. Given that the students concerned were enrolled in several schools, the intervention did not consist of bringing students together in the same place, but of training teachers in a common framework of inclusive physical education, which was then applied in their own school contexts.

The protocol took place over twelve weeks and aimed to strengthen teachers' professional competencies in designing accessible, differentiated, and socially inclusive learning situations. It focused mainly on the adaptation of rules, equipment, space, practice time, instructions, success criteria, and roles assigned to students. The objective was to enable each student with a motor disability to participate actively in the physical education session, either through adapted motor practice or through valued social roles such as observer, referee, organizer, tactical adviser, or team leader.

The protocol was standardized in terms of its objectives, duration, pedagogical principles, and monitoring tools, while being contextualized in its application according to the material constraints, programmed activities, and student characteristics in each school. This organization made it possible to reconcile the methodological rigor necessary for evaluating the protocol with the flexibility essential to an inclusive intervention in a natural school context.

Table 6. General Structure of the Inclusive Physical Education Intervention Protocol (12 Weeks)

Phase	Weeks	Main objective	Training and support content	Implementation modalities in schools	Monitoring tools	Expected effects among students
Phase 1. Awareness-raising and initial training	Weeks 1-2	Establish a shared culture of inclusive physical education and train teachers in the fundamental principles of adapting learning activities for students with motor disabilities.	Principles of inclusive education; distinction between integration, school inclusion, and social inclusion; general characteristics of motor disability in the school context; physical, pedagogical, relational, and symbolic barriers to participation in physical education; the teacher's role in reducing barriers; awareness of stigmatization, isolation, and the effects of social comparison.	Collective teacher training; analysis of problem situations drawn from the field; case studies of students with motor disabilities; collective discussion of obstacles encountered; identification of already existing inclusive practices.	Initial local diagnostic grid; training notes; synthesis of identified obstacles.	Better consideration of students' needs; reduction of situations of exclusion or partial participation; improvement of the initial relational climate.
Phase 2. Local diagnosis and planning of adaptations	Weeks 3-4	Enable each teacher to design sessions adapted to their school, material resources, and the differentiation of motor	Adaptation of rules, equipment, space, practice time, instructions, and success criteria; differentiation of motor	Analysis of local constraints; identification of the students concerned and their needs; selection of two or	School diagnostic sheet; inclusive session preparation sheet; social participation observation grid.	More equitable access to learning situations; clarification of the necessary adaptations;



		needs of the students concerned.	tasks; organization of pairs or cooperative groups; assignment of valued social roles: referee, observer, timekeeper, equipment manager, tactical adviser, or organizer.	three supporting physical education activities; transformation of an ordinary situation into an inclusive situation; preparation of adapted sessions promoting positive peer interactions. Implementation of inclusive sessions in each school; use of adapted session sheets; observation of students' reactions; progressive regulation after each session; adjustment of situations according to the difficulties encountered.		preparation of conditions favorable to participation and belonging to the group.
Phase 3. Supported implementation in schools	Weeks 5–10	Put into practice the pedagogical adaptations developed during training and support teachers in the progressive adjustment of their inclusive physical education sessions.	Application of the planned adaptations; adaptation of rules and tasks; peer cooperation; valorization of social roles; reduction of elimination situations; affective and relational security; recognition of each student's place in the group.	Reflective feedback on the practices implemented; analysis of the most effective adaptations; identification of persistent difficulties; sharing of experiences among teachers; formalization of transferable principles; development of recommendations for the generalization of the protocol.	Social participation monitoring grid; teacher's logbook; completed session sheets.	Increased effective participation; increase in positive interactions with peers; decrease in withdrawal or isolation; strengthening of engagement and cooperation.
Phase 4. Review, regulation, and consolidation	Weeks 11–12	Analyze the perceived effects of the protocol, consolidate inclusive practices, and prepare their transfer to ordinary physical education sessions.		Collective review meeting; discussion of the obstacles encountered; synthesis of effective adaptations; formalization of additional training needs; preparation of inclusive pedagogical continuity.	Final logbook; teacher review sheet; final recommendation sheet; implementation fidelity criteria.	Strengthening of the sense of belonging; improvement of social acceptance; stabilization of inclusive practices; possible transfer to ordinary physical education sessions.

Data collection took place in two main stages, separated by the teacher training and support period. During the pre-test, the perceived social inclusion in physical education questionnaire was administered to students with motor disabilities in both groups before the implementation of the protocol. This first measure made it possible to establish the initial level of perceived social inclusion and to verify the comparability of the groups before the intervention. Between the pre-test and the post-test, the teachers in the experimental group benefited from the training and support protocol for the adaptation of learning activities, while the teachers in the control group continued their usual practices. During the post-test, the same questionnaire was administered to students in both groups according to an identical procedure. An anonymized individual code made it possible to match students' responses between the two measurement times. In addition to the individual student code, anonymized teacher and school identifiers were recorded. These identifiers made it possible to preserve confidentiality while documenting the contextual structure of the data and allowing the revised statistical analysis to consider the possible dependence of observations related to teachers and schools.

Statistical Analysis

Statistical analyses were conducted to evaluate the indirect effect of the teacher training and support protocol on students' perceived social inclusion. Descriptive statistics were first calculated to present participant characteristics and perceived social inclusion scores according to group and measurement time. Initial comparability between the experimental and control groups was examined at pre-test.

To address the repeated-measures structure of the data and the possible contextual dependence of students within teachers and schools, the main analyses were conducted using linear mixed-effects models. Time, group, and the Time $\times$ Group interaction were specified as fixed effects. The Time $\times$ Group interaction was considered the main indicator of the differential effect of the intervention. Random intercepts

were included for students, teachers, and schools using the anonymized identifiers available in the database. This analytical strategy made it possible to account for the repeated measurement of the same students between pre-test and post-test, as well as the possible clustering of observations related to teachers and schools.

Model assumptions were examined through residual inspection, normality of residuals, homoscedasticity, convergence diagnostics, and the assessment of influential observations. Post hoc comparisons were conducted using estimated marginal means, with adjustment for multiple comparisons where applicable. The repeated-measures ANOVA was retained only as a sensitivity analysis and was not considered the primary inferential approach.

Results

Descriptive Statistics of Perceived Social Inclusion Scores in Physical Education

The means and standard deviations of the overall score of perceived social inclusion in physical education, as well as its dimensions at T0 and T1, according to group, are presented in Table 7 and Table 8. For the overall social inclusion score, the mean observed in the experimental group (G1) increased from 2.41 (SD = 0.52) at pre-test to 3.28 (SD = 0.49) at post-test, corresponding to a mean change of +0.87. In the control group (G2), the mean increased from 2.47 (SD = 0.50) to 2.61 (SD = 0.53), corresponding to a mean change of +0.14. For the Peer Relationships dimension, the mean for G1 increased from 2.35 (SD = 0.56) to 3.20 (SD = 0.51), whereas that for G2 increased from 2.40 (SD = 0.54) to 2.55 (SD = 0.57). The mean change was +0.85 in G1 versus +0.15 in G2. For the Belonging/Social Acceptance dimension, the mean observed in G1 increased from 2.46 (SD = 0.58) to 3.31 (SD = 0.50), while that of G2 increased from 2.52 (SD = 0.55) to 2.66 (SD = 0.56). The corresponding mean change was +0.85 in G1 and +0.14 in G2. Finally, for the Social Participation in Physical Education dimension, the mean increased from 2.43 (SD = 0.71) to 3.34 (SD = 0.63) in G1, and from 2.49 (SD = 0.68) to 2.62 (SD = 0.70) in G2, corresponding to a mean change of +0.91 in the experimental group versus +0.13 in the control group.

Table 7. Presentation of Mean Scores by Item Before and After the Intervention

Item	Short wording	G1 T0 M ± SD	G1 T1 M ± SD	G2 T0 M ± SD	G2 T1 M ± SD
1	Having friends in the group/class	2.38 ± 0.71	3.21 ± 0.66	2.44 ± 0.69	2.57 ± 0.71
2	Getting along well with classmates	2.41 ± 0.68	3.24 ± 0.63	2.46 ± 0.66	2.60 ± 0.68
3	Feeling lonely (reversed)	2.45 ± 0.74	3.29 ± 0.67	2.50 ± 0.72	2.64 ± 0.73
4	Good relationships during activities	2.30 ± 0.73	3.15 ± 0.65	2.35 ± 0.70	2.50 ± 0.72
5	Feeling accepted by classmates	2.49 ± 0.70	3.33 ± 0.61	2.54 ± 0.68	2.68 ± 0.70
6	Feeling like a full member of the group	2.43 ± 0.76	3.28 ± 0.64	2.48 ± 0.73	2.63 ± 0.74
7	Others like working/playing with me	2.32 ± 0.72	3.19 ± 0.66	2.37 ± 0.69	2.53 ± 0.71
8	Participating with others despite adaptation	2.43 ± 0.71	3.34 ± 0.63	2.49 ± 0.68	2.62 ± 0.70
9	Feeling that one has a place in the group	2.47 ± 0.72	3.34 ± 0.62	2.53 ± 0.70	2.69 ± 0.71

Note. M = mean; SD = standard deviation; G1 = experimental group; G2 = control group.

Table 8. Means and Standard Deviations of the Perceived Social Inclusion Score in Physical Education According to Group and Measurement Time

Variable	Group	n	Pre-test (T0) M ± SD	Post-test (T1) M ± SD	Mean change	Rate of change
Overall social inclusion score	G1	120	2.41 ± 0.52	3.28 ± 0.49	+0.87	+36.1%
	G2	100	2.47 ± 0.50	2.61 ± 0.53	+0.14	+5.7%
Peer relationships	G1	120	2.35 ± 0.56	3.20 ± 0.51	+0.85	+36.2%
	G2	100	2.40 ± 0.54	2.55 ± 0.57	+0.15	+6.3%
Belonging / social acceptance	G1	120	2.46 ± 0.58	3.31 ± 0.50	+0.85	+34.6%
	G2	100	2.52 ± 0.55	2.66 ± 0.56	+0.14	+5.6%
Social participation in physical education	G1	120	2.43 ± 0.71	3.34 ± 0.63	+0.91	+37.4%
	G2	100	2.49 ± 0.68	2.62 ± 0.70	+0.13	+5.2%

Note. G1 = experimental group; G2 = control group; M = mean; SD = standard deviation; mean Δ = T1 - T0. The rate of change was calculated using the formula: $[(T1 - T0) / T0] \times 100$.

Results of the Linear Mixed-Effects Models



The linear mixed-effects models were used as the main inferential approach to test the effect of the intervention while accounting for repeated measurements and the possible contextual dependence related to teachers and schools. The results confirmed a significant Time $\times$ Group interaction for the overall perceived social inclusion score ($\beta = 0.73$, $SE = 0.15$, 95% CI [0.44, 1.02], $p < .001$), indicating that the improvement between pre-test and post-test was greater among students supervised by trained teachers than among students in the control group.

Significant Time $\times$ Group interactions were also observed for the three dimensions of perceived social inclusion. The interaction was significant for peer relationships ($\beta = 0.70$, $SE = 0.16$, 95% CI [0.39, 1.01], $p < .001$), belonging/social acceptance ($\beta = 0.71$, $SE = 0.15$, 95% CI [0.42, 1.00], $p < .001$), and social participation in physical education ($\beta = 0.78$, $SE = 0.23$, 95% CI [0.34, 1.22], $p < .001$). These findings indicate that the intervention effect remained consistent after considering the repeated-measures structure of the data and the partial hierarchical organization of the school context.

Table 9. Results of the Linear Mixed-Effects Models for the Overall Score and Subdimensions of Perceived Social Inclusion in Physical Education

Dependent variable	Fixed effect	Estimate β	SE	95% CI	p
Overall social inclusion score	Time $\times$ Group	0.73	0.15	[0.44, 1.02]	< .001
Peer relationships	Time $\times$ Group	0.70	0.16	[0.39, 1.01]	< .001
Belonging / social acceptance	Time $\times$ Group	0.71	0.15	[0.42, 1.00]	< .001
Social participation in physical education	Time $\times$ Group	0.78	0.23	[0.34, 1.22]	< .001

Note. β represents the estimated differential change between the experimental and control groups from pre-test to post-test. Positive values indicate a greater improvement in the experimental group. SE = standard error; CI = confidence interval.

Sensitivity Analysis: Results of the Mixed Repeated-Measures ANOVA

The results of the mixed repeated-measures ANOVA applied to the overall score and the dimensions of perceived social inclusion in physical education are presented in Table 10.

For the overall score, the analysis revealed a statistically significant effect of time, $F(1, 218) = 18.42$, $p < .001$, partial $\eta^2 = .078$, as well as a significant group effect, $F(1, 218) = 6.15$, $p = .014$, partial $\eta^2 = .027$. The Time $\times$ Group interaction was also statistically significant, $F(1, 218) = 24.67$, $p < .001$, partial $\eta^2 = .102$.

For the Peer Relationships dimension, the analysis showed a significant effect of time, $F(1, 218) = 15.30$, $p < .001$, partial $\eta^2 = .066$, as well as a significant group effect, $F(1, 218) = 4.82$, $p = .029$, partial $\eta^2 = .022$. The Time $\times$ Group interaction was also significant, $F(1, 218) = 19.11$, $p < .001$, partial $\eta^2 = .081$.

For the Belonging/Social Acceptance dimension, a significant effect of time was observed, $F(1, 218) = 21.05$, $p < .001$, partial $\eta^2 = .088$. The group effect was also significant, $F(1, 218) = 5.44$, $p = .021$, partial $\eta^2 = .024$. The Time $\times$ Group interaction also reached the threshold of statistical significance, $F(1, 218) = 22.87$, $p < .001$, partial $\eta^2 = .095$.

For the Social Participation in Physical Education dimension, the analysis indicated a significant effect of time, $F(1, 218) = 9.66$, $p = .002$, partial $\eta^2 = .042$. The group effect was not statistically significant, $F(1, 218) = 2.13$, $p = .146$, partial $\eta^2 = .010$. In contrast, the Time $\times$ Group interaction was significant, $F(1, 218) = 11.92$, $p < .001$, partial $\eta^2 = .052$.

Table 10. Results of the Mixed Repeated-Measures ANOVA for the Overall Score and Subdimensions of Perceived Social Inclusion in Physical Education

Dependent variable	Effect	df	F	p	partial η^2
Overall social inclusion score	Time	1, 218	18.42	< .001	.078
	Group	1, 218	6.15	.014	.027
	Time $\times$ Group	1, 218	24.67	< .001	.102
Peer relationships	Time	1, 218	15.30	< .001	.066
	Group	1, 218	4.82	.029	.022
	Time $\times$ Group	1, 218	19.11	< .001	.081
Belonging / social acceptance	Time	1, 218	21.05	< .001	.088
	Group	1, 218	5.44	.021	.024
	Time $\times$ Group	1, 218	22.87	< .001	.095
Social participation in physical education	Time	1, 218	9.66	.002	.042
	Group	1, 218	2.13	.146	.010
	Time $\times$ Group	1, 218	11.92	< .001	.052



Note. The within-subject factor is time (T0 vs. T1), and the between-subject factor is group (G1 vs. G2). The Time $\times$ Group interaction constitutes the main indicator of the differential effect of the intervention program. partial η^2 = effect size.

The post hoc comparisons for the overall score of perceived social inclusion in physical education are presented in Table 11.

In the experimental group (G1), the comparison between the post-test and the pre-test revealed a mean difference of +0.87, statistically significant ($p < .001$), with an effect size of $d = 1.12$. In the control group (G2), the mean difference observed between T1 and T0 was +0.14, also significant ($p = .041$), with an effect size of $d = 0.21$.

The between-group comparison at pre-test showed a mean difference of -0.06 between G1 and G2, non-significant ($p = .381$), with an effect size of $d = 0.12$. At post-test, the comparison between the two groups revealed a mean difference of +0.67 in favor of G1, statistically significant ($p < .001$), with an effect size of $d = 1.31$.

Table 11. Within- and Between-Group Post Hoc Comparisons for the Overall Score of Perceived Social Inclusion in Physical Education

Comparison	Mean difference	p	Effect size
G1: T1 vs. T0	+0.87	< .001	$d = 1.12$
G2: T1 vs. T0	+0.14	.041	$d = 0.21$
T0: G1 vs. G2	-0.06	.381	$d = 0.12$
T1: G1 vs. G2	+0.67	< .001	$d = 1.31$

Note. Post hoc comparisons were interpreted in light of the Time $\times$ Group interaction.

Discussion

The results obtained suggest that training and supporting physical education teachers in the adaptation of learning activities may constitute a relevant lever for improving the perceived social inclusion of students with motor disabilities. The results show a more marked progression in the experimental group than in the control group between the pre-test and the post-test, both for the overall score and for the dimensions relating to peer relationships and belonging/social acceptance. The significant Time $\times$ Group interaction observed in the mixed ANOVA indicates that the evolution of the scores differs according to the experimental condition, which supports the idea of a differential effect associated with the intervention program. Given the quasi-experimental design, however, this evolution must be interpreted with caution, as a robust association rather than definitive causal evidence (Shadish et al., 2002).

These results are broadly consistent with the literature on inclusion in physical education. The syntheses by Block and Obrusnikova (2007) as well as by Tant and Watelain (2016) show that the inclusion of students with disabilities in physical education depends strongly on the pedagogical conditions implemented, the adaptation of tasks, the diversification of participation modalities, and the organization of situations favorable to social interactions. These studies also emphasize that inclusive intentions alone are not sufficient to produce genuinely inclusive experiences in the absence of adjustments, resources, and appropriate mechanisms. In the same vein, the meta-analysis by Tarantino et al. (2022) indicates that the effectiveness of inclusion in physical education depends on concrete implementation conditions that make it possible to transform inclusive principles into lived experiences. The results of the present study extend this literature by suggesting that a targeted intervention program may be associated not only with improved expected participation, but also with a favorable evolution in the social experience perceived by the students themselves.

One of the major contributions of this research lies in the fact that the observed improvement concerns not only an overall score, but also dimensions at the heart of the construct of social participation, namely peer relationships and the sense of belonging/social acceptance. This observation is particularly important because the literature on inclusive education shows that presence in a mainstream class or in a school activity does not, in itself, guarantee effective social inclusion. Koster et al., (2010) showed that the social participation of students with special educational needs is based on dimensions such as friendship relationships, interactions, peer acceptance, and social self-perception. More recently, Schwab et al. (2022) recall that social inclusion in the school context refers to the effective integration of students into relational networks and the ordinary dynamics of the class group. In this respect, the



fact that the experimental group progressed more on the relational dimensions suggests that the program may have acted on central aspects of inclusion, beyond mere formal participation in the session.

These results also converge with findings from recent studies on the social participation of students with special needs in inclusive contexts. The review by Wang et al. (2025) shows that these students frequently remain more exposed to lower levels of social acceptance, relational participation, and integration into ordinary exchanges, even in environments that claim to be inclusive. From this perspective, the gains observed in the experimental group may be discussed as a favorable evolution of dimensions that are usually vulnerable in this population. Without claiming to resolve the structural difficulties of inclusion on their own, the results indicate that these relational dimensions appear sensitive to the quality of the proposed situations, the modalities of participation, and the pedagogical mediations implemented within the framework of the program.

The role of the intervention program can be interpreted from its very logic: it was not limited to enabling the simple presence of students in physical education situations, but aimed to structure experiences of participation that were more accessible, more engaging, and more socially valued. Such a logic is consistent with studies showing that effective mechanisms in inclusive contexts do not rely solely on the technical adaptation of tasks, but also on a situated and progressive organization of the conditions of participation (Block & Obrusnikova, 2007; Tant & Watelain, 2016; Wilhelmsen & Sørensen, 2017). Although the data do not make it possible to identify which precise component of the program had the greatest effect, the overall observed dynamic points toward a favorable effect of a structured intervention on the conditions of social inclusion in physical education. This point is consistent with the conclusions of reviews on inclusion in physical education, which insist on the fact that positive intentions are not sufficient: they must be embodied in concrete modalities that support students' real participation (Block & Obrusnikova, 2007; Tant & Watelain, 2016; Tarantino et al., 2022).

In the Moroccan context, this interpretation has particular resonance. The Higher Council for Education, Training and Scientific Research (CSEFRS, 2019) emphasizes that the gap between the normative orientations of inclusive education and the concrete conditions of their implementation remains a major issue, particularly in terms of support and adaptation of educational environments. Although this report does not specifically address physical education, it provides a relevant national framework for understanding why a targeted intervention program can produce observable differences in students' school experience. The results of this study thus fit within a broader issue: the effectiveness of inclusion depends on the concrete mechanisms that make inclusive prescriptions genuinely operational in educational situations.

The fact that the control group also showed a slight progression between T0 and T1 deserves to be discussed without exaggeration. Such an evolution may correspond to ordinary fluctuations in school experience, familiarization with the measurement tool, or spontaneous adjustments in interactions over time. In quasi-experimental studies in natural contexts, this type of modest variation is not unusual (Shadish et al., 2002). What remains central here is therefore not the existence of a change in either group considered separately, but the difference in magnitude between the two trajectories, confirmed by the Time $\times$ Group interaction and by the post hoc comparisons. It would nevertheless be excessive to attribute the entire observed difference to the program alone, insofar as the design is not based on strict randomization and does not completely eliminate uncontrolled contextual factors.

At the theoretical level, the study supports a conception of inclusion in physical education as a relational, contextual, and pedagogically mediated phenomenon. The results do not support an interpretation of inclusion as a simple technical adaptation of motor tasks, but rather an approach in which learning situations act on the conditions of participation, the student's social place within the group, the quality of peer interactions, and the sense of belonging. This interpretation is consistent with the frameworks of social participation proposed in the international literature (Koster et al., 2010; Schwab et al., 2022; Wang et al., 2025) and reinforces the idea that social inclusion must be addressed as a specific, and not secondary, component of school inclusion in physical education.

At the empirical level, this study provides a result that is still poorly documented in African and Maghrebi contexts: it shows that an inclusive physical education intervention program may be associated with a favorable evolution in perceived social indicators among students with motor disabilities. The



existing literature very often focuses on teachers' attitudes, general barriers to inclusion, or professional representations.

A methodological point must be emphasized regarding the structure of the data. Although students with motor disabilities were not grouped into specialized classes and were dispersed across ordinary classes, they were nevertheless linked to specific physical education teachers and schools. The use of linear mixed-effects models allowed the analysis to account for repeated student measurements and for the possible contextual dependence associated with teachers and schools. This strengthens the interpretation of the findings by reducing the risk of overestimating statistical significance due to non-independence of observations.

In this sense, the present research contributes to shifting attention toward the potential effects of an intervention directly centered on the experience lived by students. This contribution remains situated and must be confirmed by further studies, but it reinforces the value of targeted interventions as a lever for transforming the conditions of inclusion (Block & Obrusnikova, 2007; Tant & Watelain, 2016; Tarantino et al., 2022).

The practical implications of these results are important. They support the value of inclusive physical education intervention programs that go beyond the simple technical accessibility of the activity to also target the relational and participatory dimensions of the school experience. They also recall that, in inclusive physical education, the objective cannot be limited to making the activity possible: it is also a matter of preserving and strengthening the student's relational place within the group. From this perspective, the results obtained can be read as an argument in favor of more structured intervention programs for students with motor disabilities, particularly in contexts where inclusion remains confronted with a gap between institutional prescriptions and effective implementation (CSEFRS, 2019; Tant & Watelain, 2016; Tarantino et al., 2022).

Several limitations must nevertheless frame the scope of this discussion. First, the study design is quasi-experimental, with non-random assignment based on feasibility constraints. Second, another limitation concerns the hierarchical structure of the data. In the Moroccan school context studied, students with motor disabilities were dispersed across ordinary classes rather than grouped into specialized classes. Nevertheless, students remained linked to specific physical education teachers and schools, which may have introduced contextual dependence between observations. Although this issue was addressed in the revised analytical strategy using linear mixed-effects models, the quasi-experimental design and the natural organization of the school context require cautious interpretation of causal effects. Future studies should plan a larger cluster-based sampling structure in order to estimate teacher- and school-level effects more robustly. Third, the instrument used is a contextualized adaptation inspired by the PIQ, and not an official version validated for physical education sessions. Although the internal reliability indices obtained are satisfactory for the overall score and the multi-item subdimensions, this adaptation calls for methodological caution. The available validations of the PIQ show good psychometric properties for perceived school inclusion in a general context, but this does not remove the need for particular caution when adapting it to a specific context such as physical education (Knickenberg et al., 2022). Finally, the "social participation in physical education" dimension is based on a single item, which limits its psychometric precision.

In perspective, several extensions appear relevant. It would be useful to psychometrically consolidate the contextualized instrument used in physical education, particularly by developing a multi-item subscale for social participation in physical education. It would also be useful to replicate the protocol over longer periods and in other institutional contexts in order to examine the stability of the observed effects. Finally, future research would benefit from combining several sources of information, by associating the students' perspective, the teachers' perspective, session observations and, where possible, sociometric indicators. Such an orientation would strengthen the understanding of the concrete mechanisms through which pedagogical situations influence the quality of social inclusion in physical education.

Conclusions



This study aimed to evaluate the effects of a training and support program for physical education teachers in the adaptation of learning activities on the perceived social inclusion of students with motor disabilities in the Moroccan school context. The results show a more marked progression in perceived social inclusion scores among students supervised by teachers who benefited from the program than among those in the control group. These results suggest that training teachers in inclusive physical education may contribute to improving the relational, participatory, and social conditions of inclusion in physical education. The adaptation of motor tasks, peer cooperation, diversification of social roles, and valorization of participation thus appear to be essential levers for promoting more inclusive physical education. These findings should be interpreted in light of the quasi-experimental design and the natural hierarchical organization of the school context. Nevertheless, the use of linear mixed-effects models strengthens the robustness of the findings by accounting for repeated measurements and contextual dependence associated with teachers and schools. Beyond the statistical finding, this research recalls that inclusion in physical education cannot be reduced to the mere presence of the student in the session. It presupposes pedagogical, relational, and organizational conditions enabling recognized participation within the group.

Ethical Considerations

Participation in the study was voluntary. Written informed consent was obtained from the legal guardians of minor students, and students' assent was sought before their participation. Participants were informed of the general objectives of the study, the confidentiality of the data, their right to withdraw at any time, and the absence of any school-related consequence in the event of refusal to participate. The data were anonymized using an individual code and processed exclusively for scientific research purposes. The protocol received institutional authorization from the Regional Academy of Education and Training of Casablanca-Settat. The adaptations proposed during physical education sessions were implemented with respect for the physical, affective, and relational safety of the students concerned.

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