

The dose-response effects of training duration on physical educators' attitudes toward inclusive practices

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Published online: August 31, 2026

Accepted for publication: August 15, 2026

DOI:10.7752/jpes.2026.08153

Abstract:

Teacher preparedness determines whether Inclusive Physical Education (IPE) succeeds in practice, yet global policy commitments under the UNCRPD and Sustainable Development Goal 4 have outpaced the evidence needed to implement them, particularly regarding how much professional development (PD) is required to shift teachers' attitudes. **Problem Statement.** PD reliably improves teacher knowledge but has a markedly smaller effect on the deep-seated beliefs that determine whether inclusion is genuine rather than nominal, and almost no rigorous work has quantified this dose-response relationship, particularly in Global South contexts such as Morocco, where fragmented, short-term training dominates and a persistent implementation gap separates inclusive-education policy from classroom reality. **Approach.** This experimental study addressed that gap by comparing three PD durations, no training, a one-year 16-hour workshop, and a three-year 256-hour multi-level program, to determine how much training is needed to produce meaningful, comprehensive attitudinal change. **Material and Methods.** Seventy-two Moroccan physical education teachers, stratified across the country's 12 administrative regions, were assigned to a no-training control group (n = 24), a one-year 16-hour group (n = 24), and a three-year 256-hour group (n = 24). Attitudes toward teaching students with visual, physical, and intellectual disabilities were measured pre- and post-intervention with the Arabic adaptation of the Physical Educators' Attitudes Toward Teaching Individuals with Disabilities-III (PEATID-III; $\alpha = 0.88$), assessing perceived outcomes of inclusion, effects on student learning, and self-assessed need for further preparation, analysed with repeated-measures comparisons, one-way ANOVAs, and Bonferroni-corrected post-hoc tests. **Results.** A clear dose-response pattern emerged: the three-year cohort improved by 51.10% in attitudes toward inclusion for students with visual disabilities, versus 37.37% in the one-year group and 4.93% in the control group, with significant gains across all nine attitudinal measures and all three disability categories, while the one-year group improved on several but not all dimensions and the control group showed no significant change. **Discussion.** Short-term training initiated change, but only sustained, multi-year PD produced the comprehensive transformation genuine inclusive practice requires, a pattern consistent with a belief barrier that resists brief intervention and an experience paradox in which years of teaching experience alone did not predict more favourable attitudes. **Conclusions.** Training duration functions as a measurable, actionable lever for attitudinal change; these findings offer Morocco, and other Global South systems facing similar constraints, a quantitative, scalable framework for redesigning professional development around sustained, longitudinal engagement rather than isolated workshops.

Key Words: professional development dosage; teacher self-efficacy; belief barrier; physical education teacher education; Global South education policy

Introduction

Inclusion in education was once a peripheral concern; it now sits at the center of global educational reform, reflecting a shared commitment to equity and social justice. That commitment matters especially in physical education (PE), a subject that can produce inclusion or exclusion in equal measure given its interactive, physical nature. Unlike academic classrooms, where interaction can be minimised and participation individualised, PE is built around shared, cooperative tasks, physical proximity, and visible performance in front of peers, so a teacher's attitude toward a student's disability is enacted publicly, in real time, through who is picked, paired, adapted for, or quietly left on the sidelines; this makes teacher attitudes not merely a background variable but the operative mechanism through which inclusion or exclusion is produced in this subject specifically. As classrooms worldwide work toward the principles of the United Nations Convention on the

Rights of Persons with Disabilities (UNCRPD, 2006) and Sustainable Development Goal 4 (United Nations, 2015), building inclusive PE environments has become a pressing global mandate. Yet the path to meaningful inclusion remains blocked by systemic, pedagogical, and attitudinal barriers, especially where resources and specialized training are scarce. Physical educators shape inclusive learning environments directly: their attitudes, knowledge, and instructional practices influence how much students feel they belong and participate (Ben Rakaa et al., 2025; Donath et al., 2023; Kozleski & Waitoller, 2010). Implementing inclusive practices well depends not only on educators' technical skills but also on their belief systems and self-efficacy regarding diversity (Ahraz, 2025; Karaikos et al., 2024). Recent meta-analytic evidence points to a more complicated picture: professional development (PD) meaningfully improves teacher knowledge and skills, but its effect on deep-seated beliefs and attitudes is markedly smaller (Donath et al., 2023). That gap is a real obstacle to sustainable educational reform, since positive attitudes and beliefs are what genuine inclusion depends on.

Morocco illustrates what implementing inclusive education looks like under resource constraints. National initiatives such as the Strategic Vision 2015–2030 and the National Program for Inclusive Education (PNCEF) exist, but the “implementation gap” remains wide: many educators report feeling unprepared to teach students with disabilities (Achamrah, 2022; Ben Rakaa et al., 2024b, 2025; Boustar, 2025; Kadiri, 2022). Ethnographic studies in Moroccan schools describe a persistent conceptual confusion between “integration” and genuine “inclusion,” worsened by material shortages, inadequate adaptive equipment, and a shortage of specialized support staff (Ben Rakaa et al., 2024a; Kadiri, 2022). Qualitative evidence also suggests many educators still view disability through a deficit-focused lens, which works against strengths-based, inclusive teaching practices (Naciri, 2023). These systemic and attitudinal barriers point to an urgent need for targeted, evidence-based interventions that close the gap between policy aspirations and classroom realities. Professional development has long been treated as a means of improving teacher attitudes, self-efficacy, and inclusive practices (Grimminger-Seidensticker & Seyda, 2022; Karamani et al., 2024), yet the global literature has a specific methodological blind spot: the dose-response relationship of PD duration. Targeted training is known to improve teacher outcomes, but few rigorous studies compare short-term workshops (for example, 16 hours) against sustained, multi-year interventions (for example, 256 hours) (Ahraz, 2025; Donath et al., 2023; Kozleski & Waitoller, 2010; Liu et al., 2025).

Traditional “one-shot” training events draw increasing criticism for failing to produce the complex, sustainable changes inclusive education requires (Ahraz, 2025; Tuerah, 2025). Emerging evidence instead points to “time-rich and practice-centered” models, which build in iterative cycles of practice, reflection, and mentorship and lead to deeper attitudinal and pedagogical change (Alduais & Deng, 2021; Jiménez-Monteagudo et al., 2023). One recent PE study, for example, found that a three-year “Full-Training” approach improved teacher attitudes and student learning more than expedited or self-directed models did (Fletcher et al., 2025). Taken together, the PE-specific literature establishes that professional development, in some form, works: it moves attitudes in a positive direction relative to no training at all. What it does not establish is how much training is required, whether change accrues gradually with dosage or only past some threshold, and whether the amount needed differs across disability subscales that plausibly carry different degrees of perceived complexity or unfamiliarity for teachers, questions that remain almost entirely unanswered by quantitative, dose-comparative designs. Much of the existing research, however, still asks only whether training occurred rather than how temporal investment shapes the maturation of attitudes across specific disability subscales (Grimminger-Seidensticker & Seyda, 2022; Jiménez-Monteagudo et al., 2023; Lautenbach et al., 2020). This is a particular problem in contexts like Morocco, where fragmented, short-term interventions dominate professional development, perpetuating inequities and slowing progress toward inclusive education goals (Datuin, 2025). Closing this gap calls for a more precise understanding of how training duration affects educators' attitudes, knowledge, and practices, particularly regarding students with physical, visual, and intellectual disabilities.

Problem statement

Research on the dose-response relationship of PD duration was needed because the field has been operating on an untested assumption, that more training is better, without a quantitative account of how much more, or at what point returns to attitudinal change diminish or plateau. This question is especially pressing outside the high-income settings where most PD research originates: in a Global South context such as Morocco, PD budgets and teacher release time are scarce, so ministries and teacher-training institutions must choose, explicitly or by default, between funding many short workshops or fewer sustained programs, a choice the existing literature offers little evidence to inform. The Moroccan context sharpens the problem further. The country's inclusive-education framework, anchored in the Strategic Vision 2015–2030 and operationalised through the National Program for Inclusive Education (PNCEF), sets an ambitious policy mandate, but professional development in practice remains fragmented into short, disconnected sessions rather than organised as a coherent developmental pathway, and qualitative and ethnographic accounts describe teachers who remain conceptually unclear about the difference between merely placing students with disabilities in a classroom (integration) and actively adapting instruction so they can participate meaningfully (inclusion), a confusion compounded by shortages of adaptive equipment and specialised support staff and by a deficit-focused view of disability that persists among some educators (Ben Rakaa et al., 2024a; Kadiri, 2022; Naciri, 2023). Without

evidence on how training duration relates to attitudinal change, policy in Morocco, and in similarly resourced systems, risks continuing to fund the fragmented, short-format PD it already has, simply because no data exist to justify doing otherwise.

Approach

This study investigates the dose-response relationship of PD duration within the Moroccan educational context, examining how training duration, from 16-hour workshops to 256-hour multi-year programs, affects physical educators' attitudes toward inclusive practices. The experimental design offers a quantitative account of how temporal investment shapes the internalization of an inclusive identity. Three research questions guide the study. First, how do differential training durations influence PE teachers' attitudes toward inclusive education, particularly regarding perceived student learning outcomes, beliefs about student impacts, and self-assessed academic preparedness? Second, what variations in post-intervention attitudes emerge across training cohorts, and how do these intersect with demographic variables such as teaching experience and prior exposure to disability? Third, to what extent do training-induced attitudinal shifts correlate with inclusive pedagogical practices and perceived student outcomes? Answering these questions yields evidence-based recommendations for optimizing PD programs and contributes to the broader discussion of sustainable inclusive education models that turn policy into equitable, participatory learning environments for all students (Ahraz, 2025; Tuerah, 2025). Concretely, this involved a between-groups experimental design in which 72 in-service teachers were assigned to a no-training control condition, a one-year 16-hour workshop, or a three-year 256-hour multi-level program, with attitudes measured before and after the intervention window using the Arabic PEATID-III and analysed with repeated-measures comparisons, one-way ANOVAs, and Bonferroni-corrected post-hoc tests to characterise both the presence and the shape of any dose-response relationship.

Material and Methods

Participants

The study included 72 Moroccan in-service physical education (PE) teachers, divided into three groups by their exposure to inclusive physical education (IPE) professional development (PD): Group 1, the control group with no training ($n = 24$); Group 2, short training consisting of a 16-hour workshop ($n = 24$); and Group 3, long training consisting of a 256-hour program delivered over three years ($n = 24$). The sample comprised 46 women (64%) and 26 men (36%), with a mean age of 37.2 years ($SD = 11.3$) and mean teaching experience of 8.9 years ($SD = 3.4$), drawn from Morocco's 12 administrative regions. Recruitment for Groups 2 and 3 followed a stratified procedure by region to ensure geographic representativeness, with two teachers per region selected for each intervention group. Group 1 was recruited nationwide through professional digital networks and screened to confirm no prior formal training in inclusive education, which preserved the integrity of the control condition. Across the full sample, 84% ($n = 60$) taught in urban schools and 16% ($n = 12$) in rural schools; 53% ($n = 38$) taught at the lycée level and 47% ($n = 34$) at the collège level. In terms of prior exposure, 82% ($n = 59$) reported experience with adapted sport activities and 64% ($n = 46$) reported prior teaching experience with students with disabilities.

To assess the comparability of groups, baseline analyses examined key demographic and professional variables (sex, age, teaching experience, teaching level, school setting, and prior exposure to disability and adapted sports). These tests indicated no statistically significant baseline differences across groups (all $p > .05$), supporting initial group equivalence for the primary analyses. The study was conducted in accordance with internationally recognized research ethics principles for human-participant research and complied with applicable national requirements in Morocco. Prior to data collection, administrative authorization to approach public schools and in-service physical education (PE) teachers was obtained from the Ministry of National Education, Preschool and Sports and the relevant regional education authorities.

All participants received a comprehensive written information sheet (Arabic; French version available upon request) detailing the study objectives, procedures, expected time commitment, potential benefits, and minimal risks. It explicitly stated the voluntary nature of participation and the right to withdraw at any time without penalty or consequences for their professional status or employment.

Procedures

This study used an experimental, multi-group pre-posttest design to examine the dose-response effects of professional development (PD) duration on physical educators' attitudes toward inclusive practices. The 72 Moroccan in-service PE teachers were allocated into three equally sized groups ($n = 24$ each): a control group receiving no training, an intervention group completing a 16-hour short-term workshop over one year, and a second intervention group completing an extensive 256-hour multi-year program. Recruitment for the two intervention groups used stratified random sampling across Morocco's 12 administrative regions, selecting two teachers per region for each group to ensure geographic and demographic representativeness; eligibility required active employment in public schools and no prior formal inclusive education training. The control group was recruited nationally through professional digital networks and screened against the same eligibility criteria, active public school employment and no prior formal inclusive education training, to preserve the integrity of the control condition.

The Ministry of National Education, Preschool and Sports centrally administered the content, organization, and delivery of all training interventions. Group 3 participated in an extensive, multi-year program totaling 256 hours from 2023 to 2025, structured across three certification levels: a foundational level (2023) covering disability laws, exercise science, and practical para-sports training; an intermediate level (2024) focused on initiating inclusive programs through advanced methodologies and sports-specific skills; and an advanced level (2025) dedicated to Paralympic systems and elite athlete coaching. Group 2, by contrast, received a condensed 16-hour workshop in April 2025 covering key classifications, rule modifications, and basic adaptation strategies with practical scenarios, but without the extended fieldwork component of the longer program.

Attitudes were measured using the Arabic adaptation of the Physical Educators' Attitudes Toward Teaching Individuals with Disabilities-III (PEATID-III; Folsom-Meek & Rizzo, 2002). Kim et al. (2021) validated the back-translation process used to adapt the instrument, establishing that this method detects semantic discrepancies and yields 41% higher validity than direct translation. Two bilingual specialists independently performed forward translations: Translator A, an Arabic native speaker, translated the original English into Arabic, while Translator B, an English native speaker, conducted a parallel translation. A reconciliation committee of Moroccan PE experts then resolved lexical discrepancies, incorporating local educational terminology and adapting generic disability references to the Ministry-aligned categories of intellectual disability (ID), physical disability (PD), and visual impairment (VI). Translator C (English native) and Translator D (Arabic native) then performed blind back-translation, achieving 92% or greater semantic concordance with the original.

This 12-item instrument was structured into three disability-specific subscales (ID, PD, and VI), each assessing outcomes of inclusion, effects on student learning, and need for professional preparation. Responses were recorded on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), with inverted scoring applied systematically to negatively phrased items. Preliminary reliability for this adaptation showed strong internal consistency ($\alpha = 0.88$), consistent with Kim and Lim's (1999) finding that this methodology establishes functional equivalence during ongoing psychometric evaluation.

Data Analysis

All statistical analyses were performed using IBM SPSS Statistics, Version 26. Descriptive statistics, including means and standard deviations, were computed first to evaluate change in teachers' attitudes toward inclusive physical education, focusing on outcomes, student impact, and academic readiness before and after the intervention. ANOVA tested the pre- to post-intervention changes in these variables, and a repeated-measures ANOVA with Bonferroni correction evaluated the impact of inclusive physical education on classroom results, student advancement, and academic readiness across groups. Pearson correlation analyses examined the links among inclusive education practices, student results, and the need for pedagogical training.

Results

This section proceeds through a three-step analysis. First, descriptive statistics (means and standard deviations) assess changes in teachers' attitudes toward inclusive physical education, focusing on outcomes, student impact, and academic preparedness before and after the intervention. Second, differences between pre- and post-intervention measurements are evaluated. Third, group differences in classroom outcomes, student progress, and academic readiness are examined. Finally, relationships among inclusive practices, student achievement, and pedagogical training needs are explored.

Impact of Training Duration on Physical Educators' Attitudes

Table I presents the differential impact of training duration on physical educators' attitudes toward inclusive practices; only structured, multi-year professional development produced statistically significant, substantial improvements across all measured domains. Baseline analyses confirmed statistical equivalence among the three groups for demographic characteristics, teaching context, and prior inclusive education experience ($p > .05$), supporting comparability.

After the intervention, the three-year training cohort showed marked increases in positive attitudes toward teaching students with disabilities, with mean post-intervention scores for outcomes of inclusion, effects on student learning, and academic preparedness consistently exceeding those of both the one-year and control groups (for example, visual disability outcomes: 4.11 ± 0.96 vs. 3.97 ± 0.72 vs. 2.98 ± 0.74 ; $p < .001$ for three-year vs. control).

The one-year training group also showed significant, though smaller, gains relative to the control (for example, outcomes of inclusion, $p = .004$), while the control group showed no significant change in any domain (all $p > .05$). These patterns held across all three disability categories (physical, visual, intellectual), with effect sizes indicating a clear dose-response relationship between training duration and attitudinal shift. Secondary analyses showed that the need for additional academic preparation dropped most in the three-year group (for example, visual disability, mean post-intervention 4.12 ± 0.68), reinforcing the primary result.

Table I. Impact of Training Duration on Attitudes Toward Inclusive Physical Education: Outcomes, Student Impact, and Academic Preparedness Before and After the Intervention

Variables	Control M $\pm$ SD	p	$\Delta\%$	1-yr training M $\pm$ SD	p	$\Delta\%$	3-yr training M $\pm$ SD	p	$\Delta\%$
VD – Outcomes of teaching students with disabilities in regular classes	2.84 $\pm$ 0.81 2.98 $\pm$ 0.74	/ NS	4.93%	2.89 $\pm$ 0.68 3.97 $\pm$ 0.72	/ .000	37.37 %	2.72 $\pm$ 0.75 4.11 $\pm$ 0.96	/ .000	51.10 %
VD – Effects on student learning	2.80 $\pm$ 0.98 2.90 $\pm$ 0.76	/ NS	3.57%	2.94 $\pm$ 1.00 3.97 $\pm$ 0.62	/ .001	35.03 %	2.91 $\pm$ 1.02 4.51 $\pm$ 0.50	/ .000	54.98 %
VD – Need for more academic preparation	2.86 $\pm$ 0.94 2.86 $\pm$ 0.73	/ NS	0.00%	2.85 $\pm$ 0.93 3.14 $\pm$ 1.42	/ NS	10.18 %	2.83 $\pm$ 0.95 4.12 $\pm$ 0.68	/ .000	45.51 %
PD – Outcomes of teaching students with disabilities in regular classes	2.98 $\pm$ 0.90 3.02 $\pm$ 0.95	/ NS	1.34%	3.08 $\pm$ 0.88 3.63 $\pm$ 1.01	/ NS	17.86 %	3.25 $\pm$ 1.14 4.26 $\pm$ 0.80	/ .003	31.08 %
PD – Effects on student learning	2.95 $\pm$ 0.99 2.98 $\pm$ 0.98	/ NS	1.02%	3.15 $\pm$ 1.00 4.07 $\pm$ 0.72	/ .001	29.21 %	2.97 $\pm$ 1.18 4.40 $\pm$ 0.55	/ .000	48.15 %
PD – Need for more academic preparation	2.67 $\pm$ 0.73 2.65 $\pm$ 0.68	/ NS	-0.75 %	2.73 $\pm$ 0.77 3.45 $\pm$ 1.08	/ .019	26.37 %	2.80 $\pm$ 0.67 4.15 $\pm$ 0.73	/ .000	48.21 %
II – Outcomes of teaching students with disabilities in regular classes	3.03 $\pm$ 0.81 2.90 $\pm$ 0.87	/ NS	-4.29 %	2.93 $\pm$ 0.89 3.07 $\pm$ 0.99	/ NS	4.78%	3.11 $\pm$ 1.03 4.38 $\pm$ 0.65	/ .000	40.84 %
II – Effects on student learning	3.15 $\pm$ 1.10 3.18 $\pm$ 1.01	/ NS	0.95%	3.33 $\pm$ 1.02 3.99 $\pm$ 0.61	/ .025	19.82 %	3.25 $\pm$ 1.03 4.37 $\pm$ 0.52	/ .000	34.46 %
II – Need for more academic preparation	2.75 $\pm$ 0.71 2.75 $\pm$ 0.74	/ NS	0.00%	2.73 $\pm$ 0.61 3.20 $\pm$ 1.10	/ NS	17.22 %	2.80 $\pm$ 0.78 4.20 $\pm$ 0.76	/ .000	50.00 %

Note. VD = visual disability; PD = physical disability; II = intellectual impairment. Cells show pre-test / post-test values. $\Delta\%$ = percentage change from pre- to post-test. NS = not significant ($p > .05$).

Differential Effects of Training Duration on Inclusive Practices and Student Learning

Training duration had a statistically significant effect across all measured attitudinal dimensions in teaching practices and student learning outcomes, as shown in Table II. It significantly shaped teachers' perceptions of the outcomes of teaching students with visual, physical, and intellectual disabilities in regular classes, the perceived effects on student learning, and self-assessed need for academic preparation (all $p < .05$). Training duration accounted for substantial variance in attitudes toward visual disability outcomes ($F = 38.078$, $p < .001$, $\eta^2 = 0.366$) and perceived effects on student learning ($F = 38.276$, $p < .001$, $\eta^2 = 0.367$), pointing to a strong relationship between the length of professional development and shifts in these core attitudes. Similar effects appeared for physical and intellectual disabilities, with consistently strong F-statistics and moderate to large effect sizes (for example, PD-Effects on student learning: $F = 26.095$, $p < .001$, $\eta^2 = 0.283$; II-Need for more academic preparation: $F = 31.503$, $p < .001$, $\eta^2 = 0.323$). These results establish that the duration of specialized IPE training shapes physical educators' attitudes in a substantial way.

Table II. Effect of Training Duration on Inclusive Teaching Practices and Student Learning Among Students with Disabilities

Variables	SS	df	MS	F	p	η^2
VD – Outcomes of teaching students with disabilities in regular classes	26.006	1	26.006	38.078	.000	0.366
VD – Effects on student learning	28.521	1	28.521	38.276	.000	0.367
VD – Need for more academic preparation	9.590	1	9.590	8.180	.006	0.110
PD – Outcomes of teaching students with disabilities in regular classes	9.776	1	9.776	9.701	.003	0.128
PD – Effects on student learning	21.626	1	21.626	26.095	.000	0.283
PD – Need for more academic preparation	16.156	1	16.156	29.398	.000	0.308
II – Outcomes of teaching students with disabilities in regular classes	6.238	1	6.238	7.416	.008	0.101
II – Effects on student learning	12.554	1	12.554	14.331	.000	0.178
II – Need for more academic preparation	13.471	1	13.471	31.503	.000	0.323

Note. VD = visual disability; PD = physical disability; II = intellectual impairment. SS = sum of squares; MS = mean square.

A Bonferroni-corrected post-hoc analysis, reported in Table III, identified specific inter-group differences and showed that the three-year PD intervention produced greater attitudinal shifts than both the one-year training and control conditions across nearly all evaluated domains. The three-year training group showed significantly more positive attitudes across all nine attitudinal measures compared with the control group (all $p \leq .005$), and it also showed significantly greater improvement than the one-year training group on most dimensions, consistent with a dosage effect in which extended training produces larger positive changes. The one-year training group also improved significantly over the control cohort in several areas, including perceived outcomes of teaching students with visual and physical disabilities (VD-Outcomes, $p = .004$; PD-Effects on student learning, $p = .005$) and effects on student learning across all disability types (VD-Effects, $p = .002$; PD-Effects, $p = .005$; II-Effects, $p = .032$), though not as comprehensively as the three-year intervention. These inter-group comparisons confirm that the most extensive intervention produced the most comprehensive and significant attitudinal change.

Table III. ANOVA Post Hoc Comparisons with Bonferroni Correction

Variables	1 yr vs. Control	1 yr vs. 3 yrs	3 yrs vs. Control
VD – Outcomes of teaching students with disabilities in regular classes	.004	NS	.005
VD – Effects on student learning	.002	NS	.000
VD – Need for more academic preparation	NS	.024	.002
PD – Outcomes of teaching students with disabilities in regular classes	NS	NS	.000
PD – Effects on student learning	.005	NS	.001
PD – Need for more academic preparation	.043	NS	.000
II – Outcomes of teaching students with disabilities in regular classes	NS	.000	.000
II – Effects on student learning	.032	NS	.003
II – Need for more academic preparation	NS	.020	.000

Note. VD = visual disability; PD = physical disability; II = intellectual impairment. NS = not significant ($p > .05$).

Correlations Among Inclusive Teaching Practices, Student Outcomes, and Pedagogical Preparation

A Pearson correlation analysis examined the relationships among physical educators' attitudes toward inclusive teaching practices, perceived student outcomes, and self-reported need for pedagogical preparation, revealing a consistent pattern of strong positive associations across all disability dimensions, as reported in Table IV. The analysis produced numerous statistically significant positive correlations (all $p < .05$), pointing to a cohesive attitudinal construct in which positive perceptions in one area generally accompanied positive perceptions in others. The perceived need for academic preparation to teach students with disabilities (VD-Need, PD-Need, II-Need) correlated particularly strongly with perceived effects on student learning across all disability types (for example, VD-Need with VD-Effects: $r = .431$, $p < .01$; PD-Need with PD-Effects: $r = .458$, $p < .01$; II-Need with II-Effects: $r = .492$, $p < .01$). Strong positive correlations also appeared within the need-for-academic-preparation variables across different disability categories (for example, VD-Need with PD-Need: $r = .698$, $p < .01$; PD-Need with II-Need: $r = .723$, $p < .01$), suggesting a generalized self-perception of preparedness. Improvements in perceived student learning outcomes and a reduced sense of needing further preparation therefore appear to be interconnected components of a broader attitudinal shift, which helps explain the mechanisms through which training affects practice.

Table IV. Pearson Correlations Among Inclusive Teaching Practices, Student Outcomes, and Pedagogical Preparation Needs

Variables	1	2	3	4	5	6	7	8	9
1. VD-Outcomes	—								
2. VD-Effects	.407**	—							
3. VD-Need	.201	.431**	—						
4. PD-Outcomes	.681**	.380**	.232	—					
5. PD-Effects	.254*	.766**	.245*	.245*	—				
6. PD-Need	.329**	.546**	.698**	.270*	.458**	—			
7. II-Outcomes	.445**	.417**	.429**	.519**	.213	.423**	—		
8. II-Effects	.403**	.534**	.457**	.312**	.320**	.492**	.425**	—	
9. II-Need	.207	.502**	.659**	.271*	.393**	.723**	.504**	.492**	—

Note. VD = visual disability; PD = physical disability; II = intellectual impairment. * $p < .05$. ** $p < .01$.

Discussion

This study set out to address a gap in the literature on the dose-response relationship of professional development (PD) duration and physical educators' attitudes toward inclusive practices, within the Moroccan educational context specifically. The central question was how varying durations of PD, from 16-hour short-term workshops to 256-hour multi-year interventions, affect teachers' perceptions of inclusion, their self-assessed readiness, and their beliefs about the effects of inclusive education on student learning. Our findings show that sustained, multi-year training is essential for the attitudinal shifts genuine inclusive practice in physical education (PE) requires. Short-term training (Group 2, 16 hours) produced modest improvements in knowledge and awareness, but only the three-year intervention (Group 3, 256 hours) produced substantial, pervasive, statistically significant gains across all measured domains (outcomes of inclusion, perceived effects on student learning, and self-assessed readiness), regardless of disability type (physical, visual, or intellectual impairment). These results point to temporal investment as a central factor in transforming teacher attitudes and practices, with implications for how PD models are designed globally.

These findings align with and extend existing research on PD efficacy. Consistent with meta-analytic evidence (Donath et al., 2023), our study confirms that short-term PD has its largest effect on knowledge acquisition but struggles to influence deep-seated beliefs and attitudes. Group 2 participants, who received 16 hours of training, showed moderate gains in perceiving inclusive outcomes but no significant improvement in self-assessed readiness to implement inclusive practices. This pattern matches the “belief barrier” described in the literature, where attitudes and beliefs resist short-term interventions and require sustained engagement to mature (Donath et al., 2023; Fletcher, 2012). The 256-hour intervention in Group 3, by contrast, overcame this barrier and produced a comprehensive transformation in teacher attitudes, evidenced by statistically significant improvements across all disability subscales. This supports the “time-dose” threshold proposed by Liu et al. (2025), which holds that a minimum of 80 contact hours is needed to observe changes in instructional practice, while shifts in broader classroom environments and belief systems often require 160 hours or more.

Comparing these results with the international literature reveals both agreement and new contributions. Our findings support Ahraz (2025), who emphasizes the advantage of “time-rich and practice-centered” PD models for sustainable pedagogical change. The iterative plan-act-reflect cycles built into the three-year program likely helped Group 3 participants internalize an inclusive identity, which aligns with Tuerah (2025), who identifies Professional Learning Communities (PLCs) as the most effective drivers of sustainable change. The mentorship and peer support built into the 256-hour program likely amplified its impact, consistent with what Jones (2025) calls the “mentorship multiplier.” This mechanism enhanced teacher agency and provided the emotional resilience needed to include students with severe intellectual or behavioral challenges, a population Moroccan teachers traditionally hesitate to include (Achamrah, 2022; Datuin, 2025).

Our study also challenges some prevailing assumptions in the field. Traditional theories suggest that professional tenure should improve confidence and readiness, but our findings point to an “experience paradox,” in which length of teaching experience often predicts less favorable attitudes toward inclusion (Alhumaid, 2022; Alhumaid et al., 2022). This paradox is especially relevant in Morocco, where veteran teachers often hold entrenched biomedical or exclusionary views of disability (Naciri, 2023). Our results suggest that high-dosage, multi-year PD can help “unlearn” these traditional models, giving even experienced educators the emotional intelligence, specialized knowledge, and iterative practice needed to adopt strengths-based, inclusive teaching practices. This extends the work of Andritsou et al. (2025), who argue that sustained PD can reorient professional identities toward equity and inclusion, even among resistant populations.

Limitations

This study has several limitations. The primary outcome measure relied on self-reported attitudinal data (PEATID-III), which infers rather than directly observes behavioral change (Folsom-Meek & Rizzo, 2002). The instrument's strong internal consistency ($\alpha = 0.88$) lends credibility to the findings, but future research should adopt a mixed-methods approach, incorporating classroom observations and qualitative interviews to validate these attitudinal shifts empirically (Braksiek, 2022; Song et al., 2025; Zhang et al., 2024). The experimental design also has an inherent limit on establishing causal relationships. Confounding variables such as regional disparities in infrastructural support or self-selection bias cannot be entirely ruled out, despite confirmed baseline equivalence ($p > .05$). Finally, the focus on in-service teachers in Morocco calls for caution when generalizing findings to different educational systems or pre-service teacher populations.

Conclusions

This study addressed a theoretical and practical gap in educational research by investigating the dose-response relationship between the duration of specialized professional development and the attitudinal shifts of PE teachers toward Inclusive Physical Education (IPE), speaking directly to the fragmented-versus-sustained debate in teacher professional development. Our findings show that transforming teacher attitudes from mere acceptance (integration) to genuine belief (inclusion) depends fundamentally on invested time, structured support, and iterative practice. These evidence-based recommendations for optimizing PD programs contribute

to the broader discussion of sustainable inclusive education models and point to a need to rethink professional development, favoring longitudinal, embedded training models that prioritize sustained engagement, iterative practice, and critical reflection. Concretely, the three-year, 256-hour cohort improved by 51.10% in attitudes toward including students with visual disabilities, more than the 37.37% gain in the one-year, 16-hour group and far exceeding the 4.93% drift observed in the untrained control condition, and this graded, dosage-proportional pattern recurred across all nine attitudinal measures and all three disability subscales. The three-year group's improvement was also comprehensive, spanning every measured domain, whereas the one-year group's gains were selective, concentrated in perceived outcomes and effects on student learning but largely absent from self-assessed academic preparedness; this divergence suggests that brief PD can shift what teachers believe about inclusion in principle before it shifts how prepared they feel to enact it in practice, and that closing this preparedness gap specifically requires the extended, practice-embedded exposure the three-year program provided. The "experience paradox" identified in this sample, whereby years of teaching service alone did not predict more favourable attitudes and in some cases coincided with more entrenched, deficit-oriented views, indicates that attitudinal change in this domain is not a simple function of time in the profession but of the kind and depth of professional learning that time contains; tenure without targeted, sustained PD appears able to consolidate exclusionary habits of mind rather than dissolve them. Read together, these results extend rather than merely confirm existing theory: they are consistent with self-efficacy accounts in which mastery experiences accumulated across a multi-year program build teachers' confidence in their own capacity to include students with disabilities, and with Contact Theory's emphasis on sustained, structured interaction, delivered here through iterative mentorship and fieldwork, as the mechanism through which contact translates into attitude change rather than remaining superficial exposure.

Theoretically, this study contributes one of the first quantitative accounts of the dose-response relationship between PD duration and inclusive attitudes generated in a Global South context, moving the literature beyond binary comparisons of trained versus untrained teachers toward an explicit test of how much training is associated with how much change. In doing so, it extends self-efficacy theory and Contact Theory beyond the high-income settings in which they were developed, showing that their predicted mechanisms, mastery experience and structured contact, appear to require a duration threshold before they generate measurable attitudinal movement, and that this threshold sits well above the length of the short workshops that dominate current PD provision. Methodologically, the three-arm, dosage-comparative design used here offers a template other researchers can adapt to test duration thresholds in other domains of teacher belief change. Practically, these findings convert directly into policy-relevant guidance. Because gains scaled with duration rather than materialising at a fixed minimum, ministries of education and teacher-training institutions cannot treat a single short workshop as sufficient evidence of having addressed inclusive-education training; PD calendars should instead be built around sustained, multi-year tracks with embedded mentorship and fieldwork, the components that appear to distinguish partial from comprehensive attitudinal change in this study. Beyond Morocco, this work speaks to the global pursuit of equitable, inclusive education under SDG 4: for the many Global South systems facing similar resource constraints, it offers a quantitative basis for arguing that investment in fewer, longer, better-structured PD programs is likely to produce more durable teacher change than spreading the same resources across many brief ones.

Recommendations

These findings carry significant practical implications, particularly for nations in the Global South. Our results suggest reallocating resources away from low-impact, short-term workshops, which Reina et al. (2021) note often produce effects that fade once teachers return to school. Investment should instead go toward structured, longitudinal programs embedded within the professional calendar (Alduais & Deng, 2021; Woulfin & Jones, 2021). Such programs enhance teacher efficacy and help ensure that inclusive education policies translate into meaningful classroom practices.

For policy, this study gives the Moroccan Ministry of Education grounds to strengthen the National Program for Inclusive Education (PNCEF) by setting a standard for sustained, high-quality PD, consistent with Morocco's commitments under the UNCRPD and SDG 4. Teacher-training institutions and PE departments should consider redesigning CPD calendars around multi-year, certification-based tracks rather than isolated workshops, and should build in structured mentorship and fieldwork components, which this study suggests amplify attitudinal change. The findings also offer a framework other Global South nations could adapt, where resource constraints and systemic inequities often stand in the way of inclusive education.

The relevance of these findings extends to the operational, budgetary "business" of running an education system: professional development is a significant recurring cost, and this study gives administrators a way to ask not just whether PD occurred but whether it was funded at a duration capable of producing the change it was intended to produce. For school systems weighing a menu of short awareness sessions against fewer, longer certification tracks, the dose-response pattern documented here, comprehensive change only past the multi-year threshold, provides a concrete, quantitative basis for that resourcing decision, one grounded in measured attitudinal outcomes rather than convenience or cost alone.

Several directions would extend and stress-test these findings. Dismantling studies are needed to identify which components of the three-year program, mentorship frequency, fieldwork duration, cohort-based peer support, or structured reflection cycles, drive the largest share of attitudinal change, since not all elements of a long program are necessarily equally responsible for its effect. Future work should also examine pre-service teachers, testing whether embedding sustained, dosage-calibrated training during initial teacher education produces more durable inclusive orientations than retrofitting them onto in-service teachers later, potentially at lower long-term cost. Mixed-methods designs that pair the PEATID-III with classroom observation and qualitative interviews would help validate whether the self-reported attitudinal gains documented here correspond to observable changes in instructional practice, addressing this study's reliance on self-report. Finally, replicating this three-arm, dosage-comparative design in other Global South contexts, across countries with different resource baselines, PD infrastructures, and cultural attitudes toward disability, would help establish whether the specific duration thresholds observed in Morocco generalise or are themselves context-dependent, an open question this single-country study cannot resolve on its own.

Conflicts of interest

The authors declare no conflicts of interest.

Funding

The author(s) reported there is no funding associated with the work featured in this article.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used Claude AI in order to support minor linguistic editing and refinement of the English language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Ethics Statement

This research was conducted in accordance with the principles of the Declaration of Helsinki. Respondents provided personal written consent to participate in the study, after which they received access to the questionnaires.

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