Study on key factors affecting motor learning among future Physical Education teachers in undergraduate training

Estudio sobre los factores clave que influyen en el aprendizaje motor entre futuros docentes de Educación Física en formación universitaria

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Abstract

Introduction: The acquisition of sport-related skills among undergraduate students enrolled in Physical Education and Sport teacher training programs is influenced by a combination of personal and contextual factors that shape performance, engagement, and motivation.
Objective: This study aims to identify and analyze the key parameters affecting motor skill learning among students enrolled in a bachelor's degree program in Physical Education in north Morocco.
Methodology: A structured questionnaire was administered to 403 students, focusing on their sporting background, motivation, pedagogical preferences, and perceptions of the learning environment. Data were analyzed using descriptive and cross-tabulated statistics.
Results: The findings reveal that prior sport experience, personal motivation, and the quality of teacher feedback are the most influential factors in acquiring motor skills. Most participants expressed a preference for a pedagogical approach that combines demonstration, verbal explanation, and personalized support.
Discussion: The results were consistent with prior work underscoring the roles of previous sport experience, personal motivation, and teacher feedback in motor learning, while adding evidence from a North African university setting. Preference for combined demonstration and verbal explanation aligned with learner-centered pedagogy. Self-reported outcomes and the cross-sectional design limited causal inference.
Conclusion: Structured, frequent, criterion-based feedback integrated with demonstration and guided practice appeared to enhance students' perceived motor learning. Programs should tailor progressions to sport history and strengthen mentoring.

Keywords

Motivation; motor skill learning; pedagogical practices; Physical Education and sport (PES); teacher training.

Resumen

Introducción: La adquisición de habilidades deportivas entre estudiantes de grado en programas de formación del profesorado de Educación Física y Deporte estuvo influida por una combinación de factores personales y contextuales que modelaron el rendimiento, la implicación y la motivación.
Objetivo: Identificar y analizar los parámetros clave que afectan al aprendizaje motor en estudiantes matriculados en un grado de Educación Física en el norte de Marruecos.
Metodología: Se administró un cuestionario estructurado a 403 estudiantes, centrado en su trayectoria deportiva, motivación, preferencias pedagógicas y percepciones del entorno de aprendizaje. Los datos se analizaron mediante estadísticas descriptivas y tablas de contingencia.
Resultados: Los resultados mostraron que la experiencia deportiva previa, la motivación personal, la calidad de la retroalimentación del docente fueron los factores más influyentes en la adquisición de habilidades motoras. La mayoría expresó preferencia por un enfoque pedagógico que combinara demostración, explicación verbal y apoyo personalizado.
Discusión: Los hallazgos fueron coherentes con trabajos previos que subrayan los roles de la experiencia deportiva previa, la motivación personal y la retroalimentación docente en el aprendizaje motor, y aportaron evidencia desde un contexto universitario norteafricano. La preferencia por combinar demostración y explicación verbal se alineó con una pedagogía centrada en el estudiante. El uso de resultados auto informados y el diseño transversal limitaron la inferencia causal.
Conclusiones: La retroalimentación estructurada, frecuente y basada en criterios integrada con la demostración y la práctica guiada parece potenciar el aprendizaje motor percibido del estudiantado. Se recomienda ajustar las progresiones al historial deportivo y reforzar el acompañamiento docente.

Palabras clave

Motivación; aprendizaje motor; prácticas pedagógicas; Educación Física y deporte (EFD); formación docente.

Introduction

Teaching motor skills within an academic framework in Physical Education and Sport (PES) is fundamental to students' holistic development, encompassing physical, cognitive, and psychosocial domains. This process involves more than mastering discrete technical actions; it supports the long-term structuring of the body, fosters the adoption of active lifestyles, and promotes social integration through physical activity (Capel et al., 2020). Motor skill learning in higher education, particularly in PES undergraduate programs, emerges from a dynamic interplay between personal characteristics of learners and the pedagogical conditions in which training is delivered (Schmidt & Lee, 2011). The capacity to design and adapt such training is therefore central to producing competent future teachers who will, in turn, shape the motor development of school-aged youth.

From a psychological standpoint, research has consistently shown that personal factors – including intrinsic motivation, prior sports experience, and individual engagement – play a decisive role in the acquisition and reinforcement of motor skills (Deci & Ryan, 1985; Vallerand & Losier, 1999; Wulf & Lewthwaite, 2016). The Self-Determination Theory (Deci & Ryan, 1985) highlights the importance of autonomy, competence, and relatedness in sustaining motivation and engagement in learning contexts. Similarly, the OPTIMAL theory of motor learning (Simpson et al., 2024; Wulf & Lewthwaite, 2016) emphasizes the combined effect of autonomy-supportive conditions, an external focus of attention, and enhanced expectancies on optimizing skill acquisition. In physical education settings, intrinsic motivation is directly linked to persistence, enjoyment, and the willingness to engage in deliberate practice (Standage et al., 2012), making it a critical driver of both immediate performance and long-term learning.

Past sports experience enriches learners' motor repertoires and facilitates skill transfer by providing a repertoire of movement patterns, tactical knowledge, and confidence in physical performance (Hodges & Franks, 2002). In the context of teacher education, such experience not only accelerates technical learning but also shapes professional identity and pedagogical style (Fitton-Davies et al., 2021). Moreover, prior engagement in competitive or recreational sports has been shown to correlate with higher self-efficacy and adaptability in acquiring new motor skills (Chow et al., 2021).

Contextual factors are equally influential. Among them, the quality, modality, and timing of feedback are central to effective motor learning (Treschman, Stylianou, & Brooks, 2024). Augmented feedback, whether verbal, visual, or a combination, can enhance performance by directing learners' attention to key aspects of the movement (Jaszczur-Nowicki et al., 2021). Recent findings suggest that combined verbal–visual feedback produces superior short-term performance gains, while reduced and more targeted feedback may benefit long-term retention (Jaszczur-Nowicki et al., 2021). In physical education, formative feedback has also been associated with increased motivation, autonomy, and engagement when delivered constructively and immediately (Hinojosa-Torres et al., 2025). Beyond feedback, supervision quality encompassing clear task structuring, timely intervention, and personalized guidance plays a pivotal role in scaffolding learners' progression (Moon, 2022). A recent study confirms these effects and underlines that the nature, frequency, and contextualization of feedback play a determining role in engagement and motor learning (Chorney & Leong, 2023).

The learning environment further shapes outcomes. Supportive, inclusive, and well-resourced settings encourage experimentation, persistence, and self-regulation, whereas overcrowded classes, limited infrastructure, and lack of equipment can significantly hinder progress (Berdai et al., 2023). Collaborative and active-learning approaches, such as flipped classrooms and project-based tasks, have been shown to enhance both motor competence and social skills in PES contexts (Felgueras Custodio & Delgado Pintor, 2021; Baena Graciá et al., 2012).

While these dynamics are well documented internationally, there is a lack of research investigating their interaction in the Moroccan context. PES teacher education in Morocco faces persistent challenges, including structural disparities between institutions, heterogeneous student profiles, and unequal access to pedagogical resources (Bouabdallah et al., 2023; UNESCO, 2024; Harfouf, 2021). Undergraduate PES students, typically aged 18 to 25, enter training programs with widely varying levels of sports experience, physical literacy, and motivation. Upon graduation, they are expected to teach in middle and high schools across the country, often in settings with limited facilities and large class sizes. In such conditions, the ability to provide effective feedback, foster motivation, and adapt to diverse learner needs

become critical professional requirements. These challenges also include gender inequalities and the need for inclusive perspectives in PES teacher training, as shown by the critical analysis of Mujica Johnson et al. (2024).

Moreover, recent educational reforms aimed at modernizing PES training have not fully bridged the gap between theoretical instruction and the practical demands of the profession (Berdai et al., 2023). As a result, there is a pressing need to examine how personal and contextual factors combine to influence motor learning in Moroccan PES programs. Such understanding can inform targeted interventions in teacher preparation curricula, thereby enhancing both the scientific knowledge base and the practical readiness of future educators.

Recent research in comparable contexts underlines the professional relevance of this inquiry. For example, Moon (2022) demonstrated that differentiating instruction based on learner profiles increased skill acquisition rates and student engagement in secondary school PE. Jaszczur-Nowicki et al. (2021) found that tailoring feedback modalities to the task and learner characteristics significantly improved complex motor skill learning in university students. Similarly, Hinojosa-Torres et al. (2025) showed that formative feedback strategies enhanced student motivation and autonomy in PE classes, with clear implications for teacher training. Additionally, problem-solving prior to instruction – allowing initial self-determined practice – has been shown to improve complex motor-skill performance in javelin throwing (Loibl & Leukel, 2023), reinforcing the value of autonomy-supportive designs in PES.

Against this backdrop, the present study examines the influence of personal factors (age, gender, intrinsic motivation, prior sports experience) and contextual factors (feedback, supervision quality, learning environment) on motor skill acquisition among undergraduate PES students in northern Morocco. Using open-ended questions to capture students' perceptions, pedagogical preferences, and training experiences, this work seeks to identify key drivers that can inform evidence-based improvements to training systems and align pedagogical practices with the realities and expectations of future teachers.

Three hypotheses guide this investigation:

H1: Prior sports experience is a determining factor in the development of students' motor skills.

H2: Structured supervision combining regular feedback and personalized support facilitates motor skill acquisition.

H3: Intrinsic motivation is a key determinant of engagement and progression in motor learning.

To empirically test the first hypothesis, we employed an ordinal logistic regression model, which allows us to examine whether the age of sport initiation, a proxy for prior sports experience, significantly predicts students' perceived improvement in their current motor competence.

Method

This study adopted a quantitative, non-experimental, cross-sectional design with a descriptive and correlational scope. It aimed to explore the needs, expectations, and contextual constraints experienced by undergraduate students enrolled in a Physical Education and Sport (PES) program, and how these factors relate to their perceptions of motor skill development. This design was selected to enable an empirical investigation of associative patterns among variables, without manipulation or intervention, thereby facilitating generalization within the studied context.

Participants

The participants were 403 undergraduate students (aged 18–25 years) enrolled in the Physical Education and Sport bachelor's degree at the Higher Teacher Training College-Tétouan-, Morocco. The sample comprised 54% female and 46% male students. All participants voluntarily completed the questionnaire during scheduled class hours. A convenience sampling strategy was used, as access to the full population was limited to institutional channels.

Prior to data collection, all participants were informed about the objectives of the research, the voluntary nature of participation, and the anonymity of their responses. No identifying information was collected. Participation implied informed consent.

Procedure

Data collection was conducted in April 2025. The questionnaire was administered online via Google Forms during scheduled practical sessions, with the assistance of course instructors to ensure accessibility. The average time for completion was approximately 15 minutes. After verifying the completeness of responses, the data were exported and analyzed using IBM SPSS Statistics v28.

Instrument

Data were collected using a structured questionnaire developed specifically for this study. The content was developed based on a review of relevant literature on motor learning, motivational theories (e.g., Deci & Ryan, 1985), and effective pedagogical strategies in physical education (e.g., Capel et al., 2020; Sweller, 2023). It included the following sections:

- Sociodemographic profile: age, gender, regularity of physical activity, and experience in competitive sports (Vist Hagen et al., 2025).

- Perceived influence of sports experience on motor skill learning.

- Pedagogical preferences (e.g., demonstration, explanation, feedback).

- Perceived quality of PES instruction.

- Motivational sources for improving in PES.

- Preferred learning environments.

Most items used Likert-type scales (e.g., 4-point or 5-point) or multiple-choice formats. A pilot test was conducted with 30 students to assess clarity and internal consistency. The questionnaire showed acceptable internal reliability (Cronbach's alpha ranging from 0.78 to 0.88 across different subscales).

Data analysis

The following steps were undertaken to analyze the data:

Descriptive statistics (frequencies and percentages) were used to summarize the demographic characteristics and overall trends in responses (e.g., sport habits, preferences, and perceptions).

Perceived improvement in current motor competence (question 7 [Q7]: "To what extent do you think your past sporting experience has improved your current motor skills?"; four ordered categories from "Yes, a lot" to "Not at all") was modelled as an ordinal outcome. We used a proportional-odds ordinal logistic regression with a logit link, in which the predictors were (question 4) age of sport onset (<5 years, 6–10 years, 11–15 years, >15 years) and sex (male, female). The proportional-odds assumption was formally tested with the parallel-lines test. Goodness-of-fit was assessed with Pearson and Deviance χ^2 statistics. For each predictor, odds ratios (ORs) with 95% confidence intervals were reported. To facilitate interpretation, OR < 1 indicates a higher probability of providing a more favorable response (closer to "Yes, a lot"), whereas OR > 1 indicates a tendency toward less favorable categories. We set statistical significance at $p<0.05$ (two-tailed) and reported pseudo-R^2 indices (Nagelkerke, Cox–Snell, McFadden) to describe effect size. All analyses were conducted in SPSS v28. The use of an ordinal logistic regression was therefore necessary, as it preserved the rank-order of the dependent variable (Q7) and provided interpretable odds ratios quantifying how the likelihood of reporting stronger perceived improvement varies as a function of age of sport onset and sex. This analytic choice added explanatory power beyond simple comparisons, aligning the statistical model with both the developmental hypothesis of sensitive periods in motor learning and the pedagogical interest of understanding how early trajectories influence university-level perceptions of competence.

- Pearson correlation coefficients (r) were calculated to assess the strength and direction of associations between key variables (e.g., frequency of physical activity and perceived skill acquisition; feedback and satisfaction with instruction).

- A Mann–Whitney U test was employed to compare perceptions of motor skill development between students with and without competitive sports experience. This non-parametric test was chosen due to the ordinal nature of the dependent variable and lack of normal distribution. (Vist Hagen et al., 2025).

The significance level was set at $p<0.05$ for all statistical tests. Graphical visualizations (bar charts and means plots) were used to illustrate key relationships between variables and aid interpretation.

Results

This section presents the results of the survey conducted with 403 students enrolled in the PES program. The data are structured into ten thematic subsections. The goal is to examine the influence of personal and contextual factors on motor learning, while cross-referencing the quantitative data with theoretical insights from scientific literature.

General overview of results

The study sample mainly consisted of students aged between 18 and 25 years, all enrolled in a Physical Education and Sport bachelor's program. 67% reported engaging in regular physical activity (2 to 4 times per week), and 52% claimed to have competitive sports experience. This overall profile reflects a relatively engaged and active population, which provides relevant context for studying motor learning dynamics (Table1; Vist Hagen et al., 2025).

Table 1. General sociodemographic characteristics

Variable / Theme	Main finding	% of respondents
Impact of past sporting experience on motor learning	Past sports experience "greatly improved" motor skills	67%
Pedagogical preferences in motor learning	Preferred mixed approach combining demonstration and verbal explanation	>60%
Perceived quality of PES instruction	Rated instruction quality as "good" or "very good"	75%
Preferred learning environment	Favored learning in small, supervised groups	59%
Main sources of motivation in PES	Personal achievement and competition	49%

Influence of sports experience on learning

The majority of students reported that their past sporting experience had positively influenced their current motor learning, with 67% indicating that it had 'greatly improved' their motor skills and 31% reporting a 'slight improvement', while only 2% perceived no impact. The descriptive pattern in Figure 1 suggests a strong positive association between prior sport exposure and current motor learning. This strong endorsement provides empirical support for Hypothesis H1, which suggests that prior sports experience is a determining factor in motor skill development. These findings are consistent with previous research by Chow et al. (2021) and Schmidt and Lee (2011), who demonstrated that diverse and sustained sport experiences enhance motor plasticity and adaptability to novel technical movements.

Perceived quality of PES instruction and preferred learning environment

Hypothesis H2 predicted that the quality of supervision and the feedback environment would play a decisive role in shaping students' learning experience. This assumption was assessed through students' evaluation of teaching quality and their preferred learning environments. Most students rated the quality of Physical Education and Sport (PES) teaching as either good (50%) or very good (25%), while 19% considered it acceptable and only 6% judged it unsatisfactory. Thus, nearly three-quarters of respondents expressed a positive evaluation of the instructional quality. This high level of satisfaction underscores the central role of structured and meaningful feedback in supporting learner progress and resonates with self-determination theory (Deci & Ryan, 1985), which emphasizes that perceived competence and pedagogical support foster sustained motivation and effective learning.

The majority of students expressed a preference for learning in small, supervised groups (59%), followed by individual guided learning (19%), large groups (15%), and, to a much lesser extent, self-learning (7%). Descriptive results point to a supervision-rich learning climate (high teaching-quality ratings and a marked preference for small, supervised groups). The predominance of small-group settings highlights students' demand for close supervision and structured interaction, which are conducive to personalized feedback and collaborative exchanges. This preference is consistent with Vygotsky's (1978)

sociocultural theory, which underscores the central role of guided interaction and scaffolding in optimizing learning within the zone of proximal development.

Pedagogical preferences in motor learning and motivation to improve in PES

Finally, Hypothesis H3 emphasized the motivational dimension, proposing that students' intrinsic and extrinsic motives to engage in Physical Education and Sport would significantly affect their learning. This was explored through their reported sources of motivation and their pedagogical preferences. The majority of students (60%) expressed a preference for a mixed instructional approach combining demonstration with verbal explanation, while 27% favored verbal explanation alone, and 13% relied exclusively on demonstration. Descriptively, most students favored a mixed approach (demonstration & verbal explanation), and motivation was predominantly driven by personal achievement and competition. The predominance of the mixed strategy highlights learners' demand for multimodal input in the acquisition of motor skills. This finding is consistent with cognitive load theory (Sweller, 2023), which emphasizes that engaging multiple sensory channels enhances information processing, reduces cognitive overload, and thereby facilitates more effective learning.

Students' motivation to improve in Physical Education and Sport was predominantly driven by personal achievement (49%) and competition (30%), while a smaller proportion indicated social recognition (15%) or other reasons (6%). This distribution suggests that intrinsic aspirations for self-improvement and competence, alongside competitive challenges, represent the principal motivational levers for this cohort. Such findings resonate with self-determination theory (Deci & Ryan, 1985), which identifies autonomy, competence, and relatedness as central psychological needs underpinning sustained engagement in learning and sport.

Ordinal logistic regression

To test H1 beyond descriptive trends, we estimated a proportional-odds ordinal logistic regression (Q7 as the outcome) with age of sport onset and sex as predictors. The regression model significantly improved fit over the intercept-only model ($\chi^2(5) = 12.683$, p=0 .027). Goodness-of-fit was acceptable (Pearson $\chi^2 = 48.52$, p=0.064; Deviance $\chi^2 = 35.99$, p=0.422). The proportional-odds assumption was not violated (parallel-lines test, p=0.887). Pseudo-R^2 values indicated a small effect (Nagelkerke = 0.038). Table 2 presents the regression coefficients, odds ratios, confidence intervals, and significance levels for each predictor.

Table 2. Ordinal logistic regression for perceived motor improvement

Predictor (vs ref.)	B	SE	OR = exp(B)	95% CI (OR)	p
Age <5 years	-0.671	0.414	0.51	0.23 – 1.15	0.106
Age 6–10 years	-0.682	0.297	0.51	0.28 – 0.90	0.022
Age 11–15 years	-0.360	0.265	0.70	0.42 – 1.17	0.174
Sex (female vs male)	0.095	0.226	1.10	0.71 – 1.71	0.674

Reference categories: Age of onset = >15 years; Sex = male.
Model statistics: $\chi^2(5) = 12.683$, p=0.027; Pearson $\chi^2 = 48.52$, p=0.064; Deviance $\chi^2 = 35.99$, p=0.422; Parallel-lines test p=0.887; Nagelkerke $R^2 = 0.038$.

Compared with students who started sport after 15 years of age, those who started when they were between 6 and 10 years old had significantly higher odds of reporting more favorable improvement in motor skills (B = −0.682, SE = 0.297, OR = 0.51, 95% CI [0.28–0.90], p=0.022). Students who started before 5 years old showed a similar trend (OR = 0.51, 95% CI [0.23–1.15], p=0.106), but this association did not reach statistical significance. Those who started between 11 and 15 years of age did not differ significantly from the reference group (OR = 0.70, 95% CI [0.42–1.17], p=0.174). Sex was not a significant predictor (OR = 1.10, 95% CI [0.71–1.71], p=0.674). These results indicate that, regardless of sex, an onset of sport between 6 and 10 years of age is associated with a greater likelihood of perceiving current motor competence as "improved a lot" or "improved somewhat." The very early onset group (<5 years) showed a similar pattern, although with less statistical power due to smaller sample size. Results support H1, compared with the >15 years group, starting between 6–10 years of age significantly increases the odds of reporting more favorable motor-learning perceptions (OR=0.51, 95% CI [0.28–0.90], p=0.022), with a similar nominal trend for the <5 years group; sex was not associated with Q7.

Relationships between studied variables

To examine H2 beyond preferences and ratings, we tested whether feedback frequency covaries with instructional satisfaction. Cross analysis of the data revealed several significant relationships between personal and contextual factors and the perception of motor learning.

Students who regularly engaged in physical activity (at least three times per week) reported a significantly greater perception of improvement in their motor skills. This is supported by a strong correlation coefficient (r = 0.68).

A strong positive correlation was observed between feedback frequency and satisfaction (Treschman, Stylianou, & Brooks, 2024) (r=0.71), indicating that supervision/feedback intensity is closely linked to perceived instructional quality, in line with H2 and Capel et al. (2020).

To assess whether pedagogical preferences align with motivational dispositions as suggested in H3, we examined their association. Students who preferred a mixed pedagogical approach (demonstration & verbal explanation) also showed the highest levels of motivation, with a moderately strong correlation (r = 0.65). Descriptive distributions and their associations indicate partial support for H3, with motivation and multimodal preferences moving together. This suggests that alignment between teaching style and learning preference acts as a powerful lever for academic engagement (Sweller, 2023) (Table 3).

Table 3. Significant Correlations Between Personal and Contextual Variables

Correlated Variables	Correlation Coefficient (r)	Interpretation
Regular sports practice ↔ Perception of motor skills	0.68	Strong positive correlation
Feedback received ↔ Satisfaction with instruction	0.71	Strong positive correlation
Mixed preference ↔ Motivation to learn	0.65	Moderate to strong positive correlation

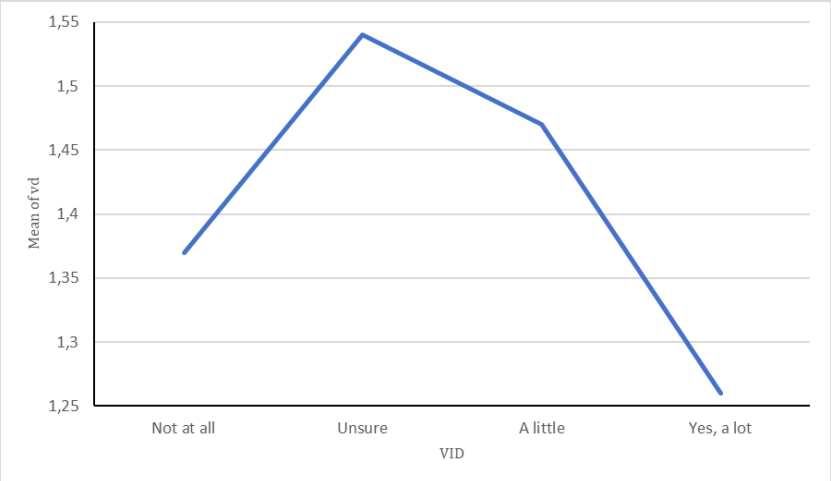
Comparative analysis based on competitive sports experience — see also Vist Hagen et al. (2025).

To further investigate H1, we compared students with and without competitive sport experience using a Mann–Whitney U test to evaluate the effect of competitive sports experience on students' perception of motor skill. This non-parametric test was chosen due to the ordinal nature of the dependent variable (perception of skills, coded on a 0–3 scale) and the absence of a normality assumption (Vist Hagen et al., 2025).

The results revealed a statistically significant difference between the two groups (U statistic = 19,606.0 and $p<0.001$) which aligned with the regression findings and reinforced H1.

Students with competitive sports experience showed a significantly higher perception of their motor skills than those without such experience (Figure 1). (Vist Hagen et al., 2025).

Figure 1. Means plot of perceived impact of sports experience by competitive practice



Graphical analysis of the average responses to the question "Have you practiced competitive sports?" (1 = yes, 2 = no), cross-referenced with levels of perceived impact of past sports experience, revealed significant trends. A decreasing relationship was observed: those reporting the strongest impact ("Yes, a lot") were mostly former competitive athletes (mean ≈ 1.25), while those unsure or indicating lesser impact had higher means (closer to 1.5). (Vist Hagen et al., 2025).

These findings support the hypothesis that structured competitive experience fosters the development of motor self-efficacy, aligning with Bandura's (1997) work on self-efficacy and Deci & Ryan's (1985) theory of self-determined motivation.

Overall, the descriptive patterns supported the results and addressed our hypotheses: H1 was supported by both the ordinal model (age-of-onset effect) and the non-parametric contrast by competitive background; H2 was supported by the alignment between supervision-rich environments and the strong feedback–satisfaction association; H3 received partial support through the convergence of motivational profiles with multimodal pedagogical preferences. While effects were modest in magnitude, the triangulation of descriptive and inferential evidence provides a coherent account of how prior sport exposure, supervision/feedback, and motivation shape motor-learning perceptions in this cohort.

Discussion

Our findings indicated that personal and contextual factors are linked to perceived motor learning among Moroccan undergraduates in physical education and sport. Earlier initiation into sport and richer feedback environments are associated with more favorable judgments of progress, while the overall magnitude of effects remains modest. The ordinal model confirms that students who began regular practice in childhood report stronger gains, and the descriptive and non-parametric contrasts align with this pattern as shown in Table 2 and Figure 1. This shows that instructional design and practice histories both matter for perceived learning, although some of the variability remains unexplained.

The age-of-onset signal aligns with evidence that sustained participation relates to superior coordination and transferable motor schemas. Biino et al. (2023) reported that regular participation is associated with enhanced coordination, and Guo et al. (2023) showed that engagement in diversified sport types shapes locomotor and manipulative skills. Classic motor learning accounts by Schmidt and Lee (2011) and by Hodges and Franks (2002) describe how earlier and varied practice supports schema formation, facilitates transfer, and fosters readiness for complex skill acquisition. In a related vein, Chow et al. (2021) emphasize that broad practice histories can ease adaptation to novel tasks. The present results extend these insights to a North African teacher-education context and indicate that student profiles that include early and diversified exposure are linked to stronger perceived gains during university practical sessions.

Supervision and feedback emerged as central levers for progress and engagement. A high frequency of formative cues delivered by a credible supervisor relates to better instructional satisfaction and to stronger perceptions of improvement. Pârvu et al. (2024) reported that immediate and multimodal feedback reduces technical errors during practice, and Jafar et al. (2023) showed that structured training sequences improve coordination and agility in novice performers. Chorney and Leong (2023) stressed that the quality and contextualization of feedback are decisive for sustaining motivation and for consolidating retention, which offers a plausible explanation for the stronger perceptions observed in supervision-rich environments. These findings also resonate with the UNESCO 2024 call to strengthen teacher-education systems and to secure the conditions for high-quality physical education through calibrated guidance and resourcing.

Motivational profiles and pedagogical preferences were in alignment with established theory. When instruction matched learner expectations through a balanced use of demonstration and clear verbal cues, self-reported engagement rose and perceptions of progress improved. This aligns with self-determination theory as described by Deci and Ryan (1985), which highlights the role of autonomy support and competence signaling in sustaining effort. Carcamo-Oyarzun et al (2023) documented positive associations between intrinsic motivation and enjoyment in physical education coursework, and Ruos et al (2025) identified autonomy support as a major driver of sustained participation. Cognitive load theory as updated by Sweller (2023) suggests that well-timed multimodal input reduces unnecessary load and

promotes efficient encoding, which offers a mechanism for the benefits of demonstration combined with concise, criteria-based cues.

Sex differences were small and inconsistent once practice exposure and guidance were taken into account, which is consistent with literature that prioritizes instructional design over demographic attributes when explaining short-term learning signals in practical settings. Participation in competitive sport related positively to perceived progress yet with limited magnitude. One interpretation is that competition adds structured repetitions and clearer proximal goals while the day-to-day quality of instructional support during coursework still plays the leading role. The observed pattern also fits a self-efficacy pathway since mastery experiences and credible feedback are known to calibrate beliefs about capability as outlined by Bandura (1997).

Some anticipated links appeared weaker or more variable across subgroups. This may reflect coarse response scales, limited behavioral anchoring of certain items, or local heterogeneity in how tutorials were organized. Strengthening the construct map through more granular descriptors and behaviorally anchored examples would reduce measurement error and sharpen estimates. Aligning item wording with the specific cues used by instructors during feedback would further improve sensitivity to change and would facilitate the interpretation of gains across sessions and instructors.

The study offers several strengths. The sample is large for a single institution, the main outcome is treated with an ordinal model that respects its scale, and the work documents a largely under-reported regional context for teacher education. The limitations include the design being cross-sectional and therefore relying on self-reporting, which captures perceptions rather than performance. Generalizability is constrained by convenience sampling within one institution. Unmeasured confounding variables remain, and the pseudo R squared is very low, which indicates that many determinants of perceived motor learning were not captured by the present instrument and covariates.

Practical implications follow for teacher-education programs. Short and frequent feedback cycles should be institutionalized during practical sessions, with explicit criteria-based language that students can reuse for self and peer appraisal. Early engagement in structured practice should be encouraged and supported by tools that make progress visible through simple checklists and brief reflective notes written immediately after drills. Program leaders can coordinate workshops so that instructors share a common vocabulary for cues and performance standards, which would standardize expectations and reduce variability across groups.

Future research should combine perceptual outcomes with objective assessments using standardized field tests, video ratings by trained assessors, and logs of practice quantity and quality. Longitudinal cohorts would help distinguish transient fluctuations from durable gains. Trials that manipulate feedback frequency, timing, and format would test causality and identify efficient routines for large classes. Mixed-methods designs can connect quantitative signals to the lived experience of students and instructors so that mechanisms are specified with greater clarity and so that the design of feedback ecosystems becomes more actionable.

Conclusions

Earlier sport engagement and abundant feedback supervision are consistently linked to stronger perceptions of motor learning among Moroccan undergraduates in physical education and sport, although the overall magnitude of effects remains modest. This take-home message supports a pragmatic shift toward instructional design, where simple, high-frequency guidance routines deliver cumulative gains in day-to-day practical work. Programs can embed brief feedback windows at the close of each drill and add concise feedforward mechanisms so that the next attempt is purposefully adjusted; they can standardize criteria-referenced cues that state what to do, how to do it, and what success looks like, then reuse the same cues in self and peer appraisal. At course start, instructors can profile students' previous sport engagement to tailor task progressions and set short-term goals that are realistic and motivating, while small, supervised stations can increase purposeful repetitions and ensure that every student receives at least one actionable cue in each cycle. Learning can be made visible through simple checklists and short reflective notes written immediately after practice blocks, and faculty can hold regular workshops to align examples, expectations, and language while reviewing anonymized clips that illustrate

common errors. Leaders can then monitor the utility of these routines across sections, identify inconsistencies, and provide targeted coaching where gaps appear, which stabilizes expectations and reduces variability between groups even in large cohorts and resource-constrained settings.

To consolidate the evidence base and link perception to performance, future work should pair subjective outcomes with objective assessments using standardized field tests, video ratings by trained assessors, and logs that capture both the quantity and the quality of practice. Longitudinal cohorts can separate transient fluctuations from durable gains across semesters, and randomized trials that vary the frequency, timing, modality, and density of supervision can identify cost-effective feedback routines at scale. Measurement can be refined with behaviorally anchored descriptors and finer response scales, which will reduce error and improve sensitivity to change, while multi-site replications across institutions and regions will clarify generalizability and surface contextual moderators such as facility constraints and class size.

Taken together, these steps offer a practical route from perception to performance. By engineering coherent feedback ecosystems that combine timely guidance with structured practice, teacher-education programs can raise the quality of practical learning and prepare future educators who know how to design progress for every student.

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