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Developing multiple intelligences, passing accuracy, and ball control skills through a differentiated learning strategy in female students

Waheb Razzaq Jebur[1ABCD], Nabil Kazim Haribed[1ADE], Sanaa Abdul Al-Ameer Al-Kikani[2BDE], Mohammed Hasan Shaalan Obed[2BDE], Ali Abdul Kadhim Oudaa[1BDE]

[1] *College of Physical Education and Sports Sciences, Al-Qasim Green University, Iraq*
[2] *College of Physical Education and Sports Sciences, Al-Mustaqbal University, Iraq*

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Abstract

Background and Study Aim: In modern sports education, the development of both cognitive and motor skills is an important component of effective training. Multiple intelligences and futsal-specific abilities, such as passing accuracy and ball control, are key elements that support students' overall performance. Although differentiated learning strategies are applied in educational practice, their relative effectiveness in enhancing these domains remains a subject of practical interest. The aim of this study was to assess the effectiveness of a differentiated learning strategy in improving multiple intelligences and futsal-specific skills (passing accuracy and ball control) among female students.

Material and Methods: Forty students participated during the 2024–2025 academic year at Al-Qasim Green University, Iraq. Thirty students were randomly assigned to an experimental group (n = 15) and a control group (n = 15), while ten students took part in a pilot study. A structured 12-week training program (24 sessions, 90 minutes each, twice weekly) was designed based on differentiated instruction principles. Outcomes were assessed using the Multiple Intelligences Scale, the Ball Passing Accuracy Test, and the Ball Control Test.

Results: ANCOVA revealed significant group effects across all variables. The experimental group outperformed the control group in multiple intelligences ($F = 112.788$, $p < 0.001$, $\eta^2 = 0.807$), passing accuracy ($F = 65.139$, $p < 0.001$, $\eta^2 = 0.707$), and ball control ($F = 105.828$, $p < 0.001$, $\eta^2 = 0.797$). Estimated marginal means confirmed these findings, with higher post-test scores for the experimental group (MI = 147.8 vs. 142.7; PA = 11.5 vs. 9.5; BC = 6.2 vs. 4.6).

Conclusions: Differentiated learning strategies tailored to students' intelligence profiles proved highly effective in enhancing both cognitive (multiple intelligences) and motor (passing and ball control) domains. These findings highlight the pedagogical value of integrating adaptive instructional models into sports education curricula.

Keywords: differentiated instruction, multiple intelligences, passing accuracy, ball control, sports science education

Introduction

The integration of cognitive and motor development has become a central focus in contemporary approaches to physical education and sports training. In the context of team sports such as futsal, success depends not only on technical proficiency but also on the ability to process information, adapt to dynamic situations, and coordinate complex movements. Passing accuracy and ball control represent fundamental motor skills that determine both individual effectiveness and collective performance. At the same time, multiple intelligences provide a framework for understanding how diverse cognitive capacities influence learning, decision-making, and skill acquisition in sports education. Such an approach highlights the need to view sports training not only as physical practice but also as a process shaped by mental and social factors.

Within this context, the concept of multiple intelligences offers a valuable framework for linking cognitive development with motor skill acquisition. In recent years, sports education has increasingly emphasized holistic approaches that integrate cognitive, emotional, and physical development [1, 2, 3]. Central to this perspective is Gardner's theory of multiple intelligences, which expands the traditional concept of intelligence to include bodily-kinesthetic, interpersonal, intrapersonal, and visual-spatial domains [2, 4]. This framework is particularly relevant in sports science, where performance requires not only physical execution but also cognitive, social, and emotional engagement to achieve optimal outcomes [3, 5]. While numerous studies support the benefits of fostering multiple intelligences in education, conventional sports training programs often remain focused on physical abilities alone [4, 5, 6]. Such a narrow focus risks

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neglecting individual learning preferences and cognitive strengths, potentially limiting both engagement and skill acquisition. In futsal, a technically demanding and fast-paced sport, skills such as passing and ball control require adaptive teaching methods that align with learners' cognitive profiles [7, 8, 9]. Mastery of these skills demands not only repetition but also individualized instructional approaches that cater to the diverse learning needs of students.

Building on this perspective, it becomes essential to consider how instructional methods can be adapted to align with the diverse profiles of learners. One approach that directly addresses this challenge is differentiated instruction.

Differentiated instruction has emerged as a promising pedagogical strategy to address diverse learner needs. Grounded in Gardner's theory, it adapts teaching methods and content according to students' dominant intelligences and learning styles [10, 11, 12]. For example, learners with strong bodily-kinesthetic intelligence benefit from hands-on demonstrations, while those with visual-spatial or interpersonal strengths respond better to video analysis or peer collaboration. This tailored approach enhances engagement, motivation, and skill acquisition. However, empirical evidence regarding its effectiveness in motor learning contexts remains mixed: some studies report positive effects on motivation and cognitive outcomes, whereas others note limited transfer to actual skill development [13, 14, 15]. Furthermore, female students, particularly those in their first year of higher education, are underrepresented in research on innovative instructional strategies [16].

Analysis of research findings has shown that differentiated instructional approaches can enhance both cognitive engagement and motor skill development in sports education. At the same time, the interplay between multiple intelligences and specific abilities illustrates the complexity of designing effective pedagogical models. Futsal, with its high cognitive-motor demands and technical complexity, represents a suitable context for examining how adaptive strategies may support skill development. These considerations underscore the necessity of exploring adaptive strategies within the field of sports education.

Therefore, the aim of this study is to examine the effectiveness of a differentiated learning strategy, grounded in the theory of multiple intelligences, on enhancing both cognitive (multiple intelligences) and motor (passing accuracy and ball control) outcomes among first-year female sports science students. It is hypothesized that students in the experimental group will demonstrate greater improvements in multiple intelligences (H1) and futsal passing and ball control skills (H2) compared to the control group, and that the combined impact across cognitive and motor domains will be stronger than with traditional teaching methods (H3)

Materials and Methods

Participants

The study included 40 first-year female students from the College of Physical Education and Sports Sciences, Al-Qasim Green University, Iraq, during the 2024–2025 academic year. Thirty students were randomly assigned to either the experimental group (n = 15) or the control group (n = 15). An additional ten students formed a pilot group to evaluate the instruments and refine intervention procedures.

Inclusion criteria required participants to: (1) be first-year students enrolled during the specified academic year; (2) be physically and mentally healthy, without chronic, neurological, or psychological conditions; (3) be able to fully participate in physical activities without medical restrictions; (4) maintain consistent attendance in both theoretical and practical sessions; and (5) provide written informed consent prior to participation.

Exclusion criteria ruled out students who: (1) had injuries or medical conditions preventing participation; (2) exhibited frequent absences; (3) participated in similar external training programs; (4) failed to comply with study procedures; or (5) voluntarily withdrew from the study.

All participants met the inclusion criteria and attended all sessions. No dropouts occurred during the 12-week intervention. The focus on first-year female students reflects the need to examine differentiated instruction at the early stages of higher education. All 30 participants were included in the final data analysis, ensuring the completeness and reliability of the results.

Ethical Considerations

Written informed consent was obtained from all participants after the study objectives, procedures, and duration were thoroughly explained. Participation was voluntary, and students were free to withdraw at any time without academic or personal consequences. Confidentiality of all data was maintained, and information was used solely for research purposes. The Research Ethics Committee of the College of Physical Education and Sports Sciences, Al-Qasim Green University, approved the study (Administrative Order No. 1343, January 10, 2024).

Research Design

A well-aligned research methodology is crucial for effectively addressing the research problem [16, 17]. An experimental design with two equivalent groups and pre- and post-tests was employed. Students were randomly assigned to the experimental or control group using a lottery system conducted by

an independent researcher who was not involved in data collection or instruction. This procedure ensured allocation concealment and minimized selection bias. Sealed opaque envelopes were used to preserve the randomness of group assignment. The experimental group received the differentiated instruction intervention, while the control group followed conventional futsal training methods. A pilot group (n = 10) was used to verify instrument reliability, session timing, group composition, and instructional materials. Adjustments were made prior to the main intervention.

Instrumentation

Three primary tools were used to measure the study variables: the Multiple Intelligences Scale [18], the Ball Passing Accuracy Test [19], and the Ball Control Test [20]. A summary of these instruments is provided in Table 1.

Validity and Reliability

1. *Content Validity.* The instruments' content validity was evaluated using expert panels and the Content Validity Ratio (CVR) based on the Lawshe method [21]. The Multiple Intelligences Scale and motor skills tests were selected for their methodological rigor and recommendations from previous intervention studies [2]. The Multiple Intelligences Scale had CVR values between 0.751 and 1.000. The Passing Accuracy Test achieved 1.000, and the Ball Control Test 0.857. All values exceeded the minimum acceptable CVR of 0.51, confirming high content validity.
2. *Reliability.* A pilot study with 10 female students assessed internal consistency and test–retest reliability. Cronbach's alpha for the Multiple Intelligences Scale was 0.92, indicating high internal consistency. Test–retest reliability for the Passing Accuracy and Ball Control Tests showed Pearson correlation coefficients of 0.89 and 0.90, respectively. All reliability results were statistically significant ($p < 0.01$).
3. *Cultural and Contextual Suitability.* The Multiple Intelligences Scale and skill-based tests (Ball Passing Accuracy Test and Ball Control Test) were evaluated for their appropriateness for first-year female students in Iraq. The items, instructions, and scoring procedures were reviewed by local experts in physical education and adapted where necessary to align with cultural norms, language comprehension, and sports experience of the participants. This followed recommendations for ensuring assessments are consistent with students' capabilities and experiences [4]. Pilot testing with 10 female students confirmed that the tasks were understandable, engaging, and representative of the targeted motor and cognitive skills. This process ensured valid and reliable assessment within the specific population.

Procedures

Pre-Test. Baseline measurements of multiple intelligences, passing accuracy, and ball control were collected for both groups using standardized protocols.

Intervention. A 12-week structured training program based on differentiated learning principles was implemented from December 1, 2024, to March 1, 2025. Sessions were held twice weekly (Mondays and Wednesdays), totaling 24 sessions of 90 minutes each. The program was designed to enhance futsal-specific motor skills while fostering educational outcomes aligned with multiple intelligences, particularly in the interpersonal, intrapersonal, and bodily-kinesthetic domains.

The intervention was explicitly guided by Vygotskian constructivist principles, emphasizing learner-centered pedagogy. Instructional strategies were intended to scaffold learning, promote active engagement, encourage collaboration and self-reflection, and provide flexible tasks tailored to individual differences in physical, cognitive, emotional, and social abilities. In this way, the program operationalized multiple intelligences in practice [12], as summarized in Tables 2 and 3.

Post-Test. The same instruments and procedures as in the pretest were applied to evaluate changes in multiple intelligences, passing accuracy, and ball control.

Table 1. Summary of the Study Tools

Scale/Test	Purpose	Items/Attempts	Scoring Method	Notes
Multiple Intelligences Scale	Measure various types of intelligence	43 items (5 domains)	5-point Likert scale (1–5); total score 43–215	Domains: physical (kinesthetic), emotional, intrapersonal, social, visual
Passing Accuracy Test	Assess accuracy in passing	5 balls (one trial)	Small circle: 3 pts; Medium: 2 pts; Large: 1 pt; Outside: 0 pts (max 15, min 0)	Distance: 15 m; 3 concentric circles (1.5, 3, 4.5 m)
Ball Control Test	Measure accuracy in stopping the ball	5 attempts	2 pts for correct stop inside square (max 10, min 0)	Test area: 2 × 2 m; player reacts from 1 m behind coach's throw

Table 2. Implementing a Differentiated Learning Strategy

Type of Intelligence	Definition	Role of Differentiated Learning	Application in Futsal Skills
Physical (kinesthetic)	Use of the body to express, move, or solve problems	Content variation and physical activities adapted to different levels (simplification or complexity; movement games)	Using diverse physical drills, movement-based stations, and "learning by doing" activities
Emotional	Regulate emotions, self-motivate, overcome challenges	Creating a flexible and safe environment, offering options for different emotional states, and recognizing individual differences	Using engaging games to reduce stress, allowing downtime, and employing self-assessment to monitor progress
Intrapersonal (self)	Understanding self, strengths, limits, goals	Using self-assessment, providing opportunities for reflection, and offering choices aligned with personal preferences	Allowing students to select their preferred learning style, analyzing their own performance, and engaging in post-performance reflection
Social (interactive)	Effective interaction, leadership, teamwork	Adopting cooperative learning, grouping by skill level, and promoting communication and teamwork	Peer teaching, explaining skills to classmates, and working in small groups to practice and observe
Visual	Analyze visual and spatial information	Using videos, visual aids, diagrams, and imaginative role play	Visualizing passing angles and positioning, analyzing videos, and explaining skills through drawings or gestures

Table 3. 12-Week Differentiated Learning Futsal Program

Week	Session	Targeted Intelligence	Futsal Activity/Skill	Differentiated Learning Method
1	1	Physical/ Kinesthetic	Basic passing and ball control drills	Learning by doing, varied movement games, different difficulty levels
	2	Visual	Watching videos of passing and control techniques	Visual analysis, diagramming, skill demonstration
2	1	Emotional	Drills to improve focus and emotional control	Stress-reducing games, self-assessment of emotions during performance
	2	Social	Cooperative and team passing exercises	Cooperative learning, grouping by skill level, role rotation
3	1	Intrapersonal	Identifying strengths and weaknesses in passing and control	Self-performance analysis, evaluation, review
	2	Physical/ Kinesthetic	Tactical passing and control under pressure	Varied movement stations, progressive challenges
4	1	Visual	Planning passing angles and positioning	Mapping, movement visualization, instructional videos
	2	Emotional	Challenges for emotional control during competition	Relaxation strategies, stress-reducing games, confidence enhancement
5	1	Social	Group games to develop accurate passing and ball control	Group learning, cooperation, peer teaching
	2	Intrapersonal	Personal performance review and choosing drills	Self-assessment, activity selection based on personal interests
6	1	Physical/ Kinesthetic	Speed and ball response drills	Fast-paced movement exercises, multiple stations, tactical games
	2	Visual	Video analysis of correct techniques	Learning from video, comparing ideal vs. individual performance
7	1	Emotional	Pressure and competition challenges	Encouraging emotional control, boosting self-confidence
	2	Social	Group play with defined roles	Organizing teams, enhancing leadership and teamwork

Table 3. (Continued)

Week	Session	Targeted Intelligence	Futsal Activity/Skill	Differentiated Learning Method
8	1	Intrapersonal	Individual performance evaluation in passing/control	Self-performance analysis, goal setting for improvement
	2	Physical/ Kinesthetic	Advanced passing and control drills	Complex movement games, multi-level challenges
9	1	Visual	Designing game plans and passing strategies	Using diagrams, passing according to planned strategy
	2	Emotional	Developing patience and discipline during training	Emotional control drills, overcoming mistakes
10	1	Social	Group passing and tactical drills	Small group divisions, role rotation, peer teaching
	2	Intrapersonal	Analysis of strengths and weaknesses after 10 weeks	Self-assessment, progress review, improvement planning
11	1	Physical/ Kinesthetic	Simulated match to apply skills	Learning by doing, applying passing and control under pressure
	2	Visual	Video analysis of match	Performance evaluation, comparison to ideal standards
12	1	Emotional	Managing psychological pressure during competition	Realistic game situations, breathing techniques
	2	Social/ Intrapersonal	Final match with individual and group review	Cooperation, self-assessment, discussion of future improvements

Statistical Analysis

The required statistical assumptions were tested prior to analysis. Normality of the dependent variables was examined using the Shapiro–Wilk test, and all distributions did not significantly deviate from normality ($p > 0.05$). Homogeneity of variances was assessed using Levene's test, which confirmed equality across groups ($p > 0.05$). Linearity between the covariates and dependent variables was verified through scatterplot inspection. The assumption of homogeneity of regression slopes was also met, with no significant interaction effects observed ($p > 0.05$).

Independent-samples t-tests were conducted to assess baseline equivalence between groups. Post-intervention differences were analyzed using ANCOVA, with pretest scores entered as covariates. All analyses were performed using SPSS version 28 (IBM Corp., Armonk, NY, USA) at a 95% confidence level ($\alpha = 0.05$).

Results

Prior to the intervention, baseline measurements were collected to ensure equivalence between the experimental and control groups. Table 4 presents the pretest comparison of multiple intelligences, passing accuracy, and ball control.

As shown in Table 4, no significant differences were observed between the experimental and control groups for any variable at baseline ($p > 0.05$). The 95% confidence intervals included zero, confirming that the groups were equivalent prior to the intervention, as further illustrated in Figure 1.

Following the intervention, posttest measurements were collected to evaluate the effectiveness of the differentiated learning strategy. Table 5 presents the posttest comparison of multiple intelligences, passing accuracy, and ball control.

As shown in Table 5, the experimental group scored higher than the control group on all measured variables. Significant differences were observed in multiple intelligences ($MD = 5.163$, $p < 0.001$), passing accuracy ($MD = 2.076$, $p < 0.001$), and ball control ($MD = 1.522$, $p < 0.001$). The 95% confidence intervals for all differences did not include zero, confirming the reliability of these effects.

These results indicate that the differentiated learning strategy had a substantial positive impact on students' multiple intelligences, passing accuracy, and ball control. The findings support the effectiveness of individualized instruction in enhancing both cognitive and motor skills in the context of the study, as illustrated in Figure 2.

To assess the effect of the 12-week differentiated learning program while controlling for pretest scores, ANCOVA was conducted. Table 6 summarizes the results.

As shown in Table 6, the ANCOVA results indicate that the experimental group significantly outperformed the control group across all measured variables. This demonstrates the effectiveness of the differentiated learning strategy. In multiple intelligences (MI), the experimental group showed a substantial improvement compared to the control group ($F = 112.788$, $p < 0.001$, $\eta^2 = 0.807$), reflecting enhanced cognitive abilities among female students. In passing accuracy (PA), the experimental

Table 4. Pretest Comparison of Study Variables Between Groups

Variable	Control Group (Mean ± SD)	Experimental Group (Mean ± SD)	t	p	95% CI of Difference
Multiple Intelligences	140.53 ± 3.93	141.20 ± 3.49	0.492	0.627	−2.11 to 3.44
Passing Accuracy	8.99 ± 0.14	8.92 ± 0.09	0.031	0.975	−0.088 to 0.086
Ball Control	4.14 ± 0.15	4.21 ± 0.23	0.945	0.353	−0.078 to 0.211

Table 5. Posttest Comparison of Study Variables Between Groups

Variable	Control Group (Mean ± SD)	Experimental Group (Mean ± SD)	MD	t	p	95% CI of Difference
Multiple Intelligences	142.68 ± 1.63	147.84 ± 1.57	5.163	9.075	<0.001	4.145 to 6.182
Passing Accuracy	9.45 ± 0.77	11.53 ± 0.70	2.076	7.679	<0.001	1.540 to 2.612
Ball Control	4.64 ± 0.42	6.16 ± 0.38	1.522	10.676	<0.001	1.215 to 1.828

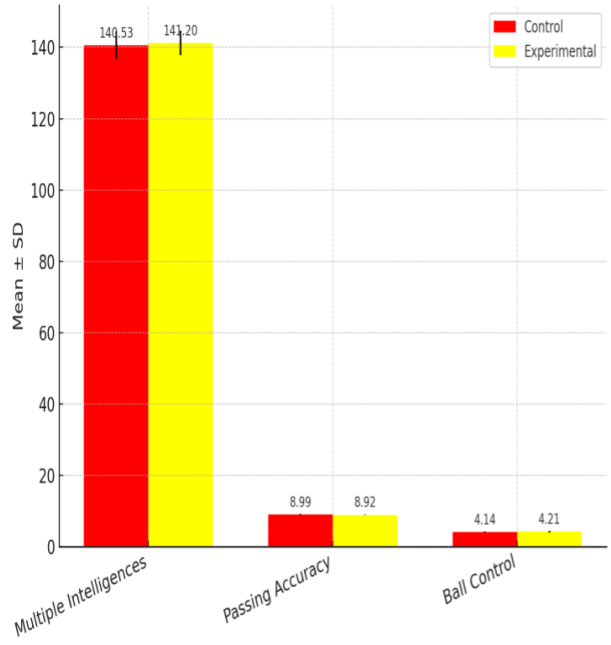

Figure 1. Bar chart of pretest comparisons between experimental and control groups.

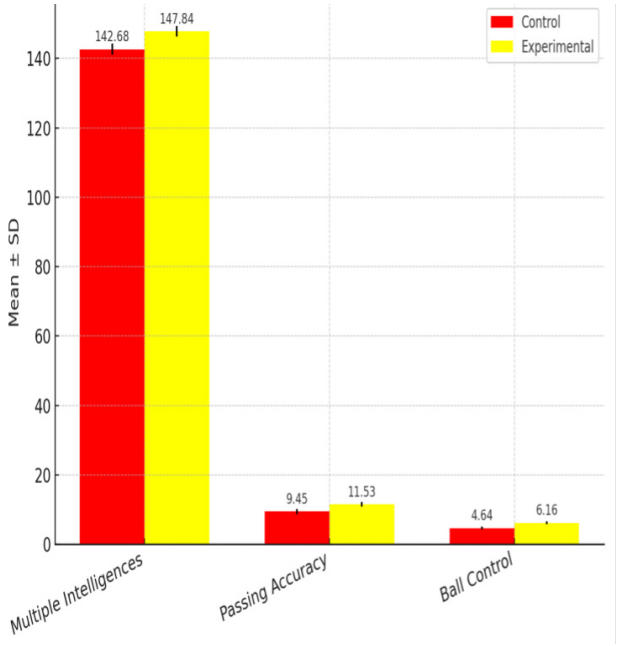

Figure 2. Bar chart of posttest comparisons between experimental and control groups.

Table 6. ANCOVA Results for Differentiated Learning Strategy Effects

Variable	Source	df	F	p	Partial Eta Squared
Multiple Intelligences (MI)	Pre_MI	1	14.266	0.002	0.346
	Group	1	112.788	<0.001	0.807
	Corrected Model	2	67.819	<0.001	0.834
	Group × Pre_MI	1	0.003	0.953	0.000
Passing Accuracy (PA)	Pre_PA	1	3.844	0.060	0.125
	Group	1	65.139	<0.001	0.707
	Corrected Model	2	34.399	<0.001	0.718
	Group × Pre_PA	1	0.302	0.587	0.011
Ball Control (BC)	Pre_BC	1	0.430	0.517	0.016
	Group	1	105.828	<0.001	0.797
	Corrected Model	2	56.048	<0.001	0.806
	Group × Pre_BC	1	1.291	0.266	0.047

group achieved higher scores ($F = 65.139$, $p < 0.001$, $\eta^2 = 0.707$), indicating meaningful gains in motor performance. In ball control (BC), the experimental group also performed better ($F = 105.828$, $p < 0.001$, $\eta^2 = 0.797$), demonstrating improvements in coordination and control.

Although some pretest scores (Pre_MI, Pre_PA, Pre_BC) contributed to posttest variance, interactions with group were non-significant. This finding shows that the benefits of the intervention were consistent across initial skill levels. Overall, the corrected models explained between 71% and 83% of variance across variables. These results confirm both the robustness and the educational relevance of the differentiated learning strategy.

Discussion

The aim of this study was to examine the effectiveness of a differentiated learning strategy, grounded in the theory of multiple intelligences, on enhancing both cognitive and motor outcomes among female sports science students. The results demonstrated that the intervention produced substantial positive effects, with effect sizes exceeding the conventional threshold of 0.8. ANCOVA confirmed significant improvements in all measured variables even after adjusting for pretest scores.

The improvement in multiple intelligences (MI) can be interpreted through Self-Determination Theory (SDT). The intervention fostered autonomy, competence, and relatedness, which enhanced intrinsic motivation and encouraged students to engage deeply with cognitive tasks [5]. This motivational climate likely contributed to the development of individual cognitive profiles, as reflected in the higher MI scores [8, 22].

Gains in ball control and passing accuracy can be explained using Motor Learning Theory and the principles of differential learning. Variable practice conditions encouraged adaptive problem-solving, reinforced motor representations, and enhanced skill transfer [3, 6]. These improvements also align with Vygotsky's Zone of Proximal Development (ZPD). Scaffolded and individualized feedback enabled learners to exceed their baseline competencies, supporting both technical execution and skill progression [12, 23].

These findings are consistent with prior research. Targeted interventions have been shown to enhance multiple intelligences, supporting the MI improvements observed in this study [2, 24]. Personalized learning structures also increase cognitive engagement, which mirrors the present results [12]. For motor performance, adaptive decision-making training in futsal improved technical execution [15, 25]. Enriched practice conditions have additionally been shown to support talent development [23, 26]. Further evidence suggests that structured and adaptive physical education programs contribute to sustainable student engagement and the development of both cognitive and motor skills [1].

Integrating differentiated learning into physical education curricula can create inclusive environments that support both cognitive and motor development. Teacher involvement in curriculum adaptation improves learning outcomes [10]. Adaptive, technology-assisted systems further enhance engagement and achievement [7]. These results highlight the importance of curriculum redesign that incorporates adaptive methods, ongoing assessment, and individualized feedback.

To implement such strategies effectively, curriculum developers and PE instructors should design skill units with varied difficulty levels and align activities with multiple intelligences, such as bodily-kinesthetic, interpersonal, and intrapersonal. Flexible task options tailored to individual abilities should also be provided. Adaptive assessment methods, including self-assessment, peer feedback, and instructor evaluation, are recommended to guide learning. Scaffolded and individualized feedback promotes active engagement, problem-solving, and reflection. This approach ensures that all students benefit from a structured and inclusive learning environment while maximizing both cognitive and motor outcomes.

Limitations

While this study provides valuable insights, several methodological limitations must be acknowledged. The small, homogeneous sample of 40 female students from a single institution limits generalizability to other populations, such as male students, athletes from different sports, or learners from diverse educational and cultural backgrounds, as noted in prior work on population variability [2, 3]. The lack of blinding and reliance on self-reported MI measures may have introduced reporting bias, an issue highlighted in studies addressing self-assessment in education [5, 16]. Long-term follow-up assessments were not conducted, which restricts evaluation of the durability of improvements in MI and motor skills, a limitation also reported in earlier intervention studies [11, 15]. Potential confounding factors, including prior futsal experience, intrinsic motivation, and individual learning preferences, were not fully controlled, though these have been shown to influence learning outcomes [4, 14]. Finally, the absence of qualitative data, such as student reflections, teacher observations, or interviews, constrains understanding of the mechanisms driving the success of differentiated learning strategies, as suggested in research emphasizing mixed-methods approaches [7, 13].

Future Research

To build upon these findings, future studies should

conduct longitudinal follow-ups comparing male and female students using the same differentiated learning framework to examine whether gender influences responsiveness to individualized instruction, as proposed in gender-focused research on pedagogy [3, 23]. Studies that combine quantitative assessments with qualitative data, such as reflections and observations, could provide insight into the psychological and instructional mechanisms through which differentiated learning enhances multiple intelligences and motor skills, as recommended in recent educational research [4, 7]. Additionally, incorporating objective assessments of cognitive abilities and motor skills, along with blinded evaluators, would reduce measurement bias and improve internal validity. This approach is consistent with best practices for strengthening evidence in intervention studies [16, 26].

Conclusions

The findings of this study indicate that differentiated learning strategies can effectively enhance both cognitive and motor outcomes among first-year female sports science students. The experimental group showed significant improvements in multiple intelligences, supporting H1, as well as in futsal passing and ball control skills, confirming H2. The combined effect on cognitive and motor domains was greater in the experimental group than in the control group, consistent with H3. These results demonstrate the integrated benefits of adaptive, student-centered instruction.

Implementing differentiated learning in physical education may support intellectual development and motor skill acquisition while providing a structured and inclusive learning environment. The findings also offer practical guidance for curriculum development. Incorporating adaptive and individualized strategies can strengthen both cognitive and motor learning outcomes in physical education and sports training programs.

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Data Availability Statement

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

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Conflict of Interest

The authors declare no conflict of interest.

AI Tools Usage

The authors declare that ChatGPT, an AI language model developed by OpenAI, was used solely to improve the language, grammar, and clarity of the manuscript. The assistance provided by the AI was limited to enhancing readability, correcting grammatical errors, and refining sentence structures. All ideas, analyses, interpretations, and academic content are the authors' own. The use of ChatGPT was restricted to linguistic and stylistic improvements and did not contribute to the generation of intellectual content.

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Information about the authors:

Waheb Razzaq Jebur; (Corresponding author); https://orcid.org/0009-0003-1767-436X; wahebrazzaq@sport.uoqasim.edu.iq; College of Physical Education and Sports Sciences, Al-Qasim Green University; Babylon, 51013, Iraq.

Nabil Kazim Haribed; https://orcid.org/0000-0002-8834-542X; Dr.nabeel@sport.uoqasim.edu.iq; College of Physical Education and Sports Sciences, Al-Qasim Green University; Babylon, 51013, Iraq.

Sanaa Abdul Al-Ameer Al-Kikani; https://orcid.org/0000-0001-8221-5192; Dr.Sanaa@uomus.edu.iq; College of Physical Education and Sports Sciences, Al-Mustaqbal University; Babylon, Iraq.

Mohammed Hasan Shaalan Obed; https://orcid.org/0000-0002-0591-7577; mohammed.hasan@uomus.edu.iq; College of Physical Education and Sports Sciences, Al-Mustaqbal University; Babylon, Iraq.

Ali Abdul Kadhim Oudaa; https://orcid.org/0009-0002-6630-9695; Dr.aliabid@sport.uoqasim.edu.iq; College of Physical Education and Sports Sciences, Al-Qasim Green University; Babylon, 51013, Iraq.

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