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Adaptive Learning Environments in Physical Education Lessons and Their Role in Enhancing Cognitive and Skill Abilities Development in Preparatory School Students

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Abstract

This research aimed to assess the adaptability of the learning environment in physical education lessons within preparatory schools. Additionally, it sought to evaluate the cognitive and skill abilities of students during these lessons and to examine how an adaptive learning environment influences the development of these abilities. The research employed a descriptive approach, incorporating both the survey and correlation methods. The study population consisted of 242 physical education teachers from schools under the Nineveh Governorate Education Directorate (central region). All of them were included as the main research sample, which was further divided into three subsamples. The first subgroup, consisting of 12 teachers, participated in the exploratory study. The second subgroup, comprising 198 teachers, was designated for statistical analysis, while the third subgroup, consisting of 132 teachers, formed the final application sample. To collect the necessary data, the researcher developed two research instruments. The first tool, consisting of 15 paragraphs, assessed the level of adaptability in the learning environment during physical education lessons. The second tool, also comprising 15 paragraphs, measured students' cognitive and skill abilities. Upon administering these tools and analyzing the data, statistical processing was conducted using the SPSS software. The findings of the study led to the following conclusions:

- Physical education lessons in preparatory schools generally exhibit a moderate level of adaptability, from the point of view of physical education teachers.
- Preparatory school students demonstrate an average level of cognitive and skill abilities during physical education lessons, from the point of view of physical education teachers.
- The presence of an adaptive learning environment in physical education lessons plays a significant role in fostering students' cognitive and skill development.

Keywords: Adaptive Learning Environment, Cognitive Abilities, Skill Abilities, Students.

بيئات التعلّم التكيفية لدروس التربية الرياضية ودورها في تنمية القدرات المعرفية والمهارية لدى طلاب المدارس الإعدادية

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ملخص البحث

هدف البحث إلى الكشف عن تحديد مستوى اتصاف بيئة التعلّم ضمن دروس التربية الرياضية في المدارس الإعدادية بأنها ذات طبيعة تكيفية، فضلاً عن الكشف عن تحديد مستوى امتلاك طلاب المدارس الإعدادية للقدرات المعرفية والمهارية خلال دروس التربية الرياضية، وكذلك الكشف عن تحديد طبيعة الدور الذي يولده اتصاف بيئة التعلّم ضمن دروس التربية الرياضية بالطبيعة التكيفية في تنمية القدرات المعرفية والمهارية لدى طلاب المدارس الإعدادية، وقد استخدمت الباحثة المنهج الوصفي بكلّ من أسلوب المسح وأسلوب العلاقات الارتباطية، تمّ تحديد مدرسي التربية الرياضية في المدارس التابعة لمديرية تربية محافظة نينوى (المركز) والبالغ عددهم (342) مدرساً للتربية الرياضية كمجتمع للبحث، وقد اختارتهم الباحثة جميعاً ليمثلو عينة البحث الرئيسة، بعدها تمّ تقسيم عينة البحث الرئيسة إلى ثلاث عينات فرعية، الأولى عينة الدراسة الاستطلاعية والتي يبلغ عددها (12) مدرساً، بينما تمثل العينة الثانية عينة التحليل الإحصائي والتي يبلغ عددها (198) مدرساً، فيما مثلت العينة الثالثة عينة التطبيق النهائي والتي يبلغ عددها (132) مدرساً، وبهدف الحصول على البيانات المطلوبة قامت الباحثة بإعداد أداتين للبحث، الأداة الأولى تقيس مستوى بيئة التعلّم التكيفية خلال دروس التربية الرياضية بعدد فقرات بلغ (15) فقرة، بينما تقيس الأداة الثانية مستوى القدرات المعرفية والمهارية لدى الطلاب بعدد فقرات بلغ (15) فقرة، وبعد الانتهاء من تطبيق الأداتين واستخراج النتائج قامت الباحثة بمعالجتها إحصائياً عبر مجموعة من الوسائل باستخدام الحقيبة الاحصائية (SPSS)، وبناء على تلك النتائج توصلت الباحثة لمجموعة استنتاجات هي:

- إن طلاب المدارس الإعدادية يمتلكون قدرات معرفية ومهارية ذات مستوى متوسط خلال دروس التربية الرياضية من وجهة نظر مدرسي التربية الرياضية.
- إن اتصاف دروس التربية الرياضية في المدراس الإعدادية بأنها ذات بيئة تعلّم تكيفية يسهم بشكل جيد في تنمية القدرات المعرفية والمهارية للطلاب.

الكلمات المفتاحية: بيئة التعلّم التكيفية، القدرات المعرفية، القدرات المهارية

1. Introduction

The learning environment in physical education plays a crucial role in shaping students' experiences, enhancing their skill development, and fostering a positive attitude toward physical activity and sports. An effectively structured learning environment encompasses not only the physical setting but also the social, emotional, and cognitive aspects in which students engage while practicing various sports skills. Successful learning environments are defined by clear learning objectives, inclusive participation in sports activities, and the establishment of supportive relationships between students and physical education teachers. As a result, such environments cultivate a culture of mutual respect and cooperation among students.

In a well-designed setting, students are more inclined to experiment with new skills and adopt a growth mindset, both of which are essential for their personal and athletic development. Additionally, integrating diverse teaching strategies and organizing activities thoughtfully within physical education classes can significantly enhance student motivation and engagement. By incorporating a variety of instructional approaches, such as direct teaching, collaborative learning, and self-directed exploration, educators can cater to different learning preferences, ensuring that physical education lessons are both engaging and enriching for all students.

Transformative educational approaches are essential for the development of effective learning environments. These environments should prioritize personalized learning experiences that cater to each student's unique needs, abilities, and preferences. Grounded in the principles of differentiated instruction, they should integrate technology and innovative pedagogical methods to create dynamic and responsive learning settings. By adapting in real time based on student performance, these environments enable a more individualized learning journey, ultimately enhancing student engagement and achievement.

The foundation of adaptive learning lies in recognizing the diverse learning styles, paces, and motivations of students. Through the use of data analytics, educators can gain valuable insights into individual learning preferences, allowing them to tailor instruction and provide targeted support. This approach involves offering multiple

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pathways to mastery, incorporating varied educational content, and utilizing formative assessments to evaluate student progress and inform instructional decisions. Such adaptability not only improves the overall learning experience but also empowers students to take an active role in their education.

Technology plays a crucial role in adaptive learning environments, as digital platforms facilitate personalized content delivery and adaptive assessments while fostering collaborative learning experiences. Additionally, promoting inclusivity within these environments is vital, ensuring that all students have equitable access to learning opportunities. Adaptive learning environments represent a cutting-edge educational model that integrates technology and pedagogy to create personalized, responsive, and inclusive learning experiences. By addressing individual student needs, these environments not only enhance academic performance but also equip learners with essential skills for lifelong success.

According to Graf (2023), adaptive learning environments are advanced educational systems designed to tailor learning experiences based on each student's specific needs and characteristics. Unlike traditional instructional methods that follow a single teaching approach, adaptive learning considers differences in prior knowledge, learning pace, and information processing preferences. By providing customized educational content and adaptive assessments, these environments enhance student engagement and satisfaction, ultimately leading to improved learning outcomes (Graf, 2023, p. 50).

Understanding students' cognitive and skill abilities is crucial for effective teaching and learning. Cognitive abilities encompass mental processes such as attention, memory, reasoning, problem-solving, and critical thinking, all of which are fundamental for processing information, forming social and educational connections, and applying knowledge across different contexts. These abilities vary among individuals and are shaped by factors such as developmental stages, cultural backgrounds, and prior experiences. Recognizing the diverse cognitive profiles within a classroom enables educators to tailor their teaching methods, fostering a learning environment that supports student growth and resilience.

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Similarly, skill abilities—ranging from motor coordination to social and emotional competencies—play a vital role in overall student development. In physical education, for example, motor skill development forms the foundation for participation in sports and physical activities, contributing not only to physical fitness but also to increased confidence and teamwork skills. Beyond physical abilities, social and emotional skills such as effective communication, empathy, and self-regulation are critical for building positive relationships and successfully navigating the complexities of the educational environment. Understanding the connection between cognitive and skill abilities is essential for creating a well-rounded educational approach that supports both academic achievement and personal development.

Effective educators implement differentiated teaching strategies that address varying levels of cognitive processing while also promoting skill development. A comprehensive understanding of students' cognitive and skill abilities serves as the foundation for responsive and effective teaching practices. By embracing this diversity, teachers can create inclusive learning environments that nurture each student's potential and enhance both learning outcomes and personal growth.

Tuhurima et al. (2025) define cognitive abilities as the set of mental skills and processes individuals use to understand and engage with the world around them, including critical thinking, analysis, creativity, memory, attention, and problem-solving. These abilities enable individuals to process information, make decisions, and adapt to new situations, ultimately facilitating learning (Tuhurima et al., 2025, p. 147). Similarly, Yang and Meriales (2024) describe skill capabilities as competencies acquired through training and practice in areas such as sports, arts, or crafts. These include technical skills (such as performance techniques), mental skills (such as concentration and planning), and social skills (such as cooperation and communication). Skill capabilities are essential for achieving high performance, as they contribute to improved efficiency and effectiveness in various activities (Yang & Meriales, 2024, p. 422).

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1.1 Research Importance

The significance of this research lies in its exploration of two contemporary educational concepts in physical education: adaptive learning environments and students' cognitive and skill abilities. Investigating these concepts and analyzing the related findings will offer valuable insights into how diverse learning environments accommodate students' varying needs. This understanding can contribute to the development of educational models rooted in adaptive learning principles while enhancing knowledge about student interactions with educational content and the influence of this engagement on their cognitive and motor skill development.

From a practical standpoint, the study's findings will provide educators with essential guidance on designing lessons that better align with students' learning requirements. By examining the impact of adaptive learning environments on education, teachers can refine and modify their instructional methods to support the holistic development of students' physical, psychological, skill-based, and social-cognitive abilities. This approach fosters personalized learning experiences, enabling students to progress at their own pace, build self-confidence, and actively participate in sports and physical activities. Furthermore, this research holds significance in providing researchers and educational practitioners with reliable tools to measure key research variables. These tools can serve as valuable resources for future studies and assessment processes, ensuring continued progress in the field of physical education and adaptive learning.

1.2 Research Problem

Learning environments in physical education classes face significant challenges in accommodating the diverse abilities and skill levels of students, as this variation necessitates the use of different instructional strategies. Through ongoing observation of middle school physical education classes, the researcher identified deficiencies in lesson design and planning, particularly in the lack of diverse and well-structured activities that ensure active participation for all students. As a result, students' learning experiences often remain incomplete.

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Additionally, limited resources and inadequate access to technology present further obstacles to effective learning. The physical environment and available educational tools play a crucial role in a teacher's ability to tailor instruction to meet individual student needs. The researcher also noted a lack of student motivation to participate, which is a key concern. When activities do not align with students' interests and abilities, engagement declines, negatively affecting the development of both motor and cognitive skills. Another challenge is the difficulty of aligning instruction with students' varying cognitive and skill levels, which impacts their ability to perform sports-related tasks. Many students struggle with motor skills due to a weak theoretical understanding of fundamental concepts, such as game rules and sports strategies. Moreover, significant differences in skill levels create an imbalanced learning environment, where some students excel while others struggle to grasp basic techniques. This disparity often results in frustration and diminished motivation among students. To address these issues, the researcher sought to investigate and analyze the problems by formulating the following research questions:

- Does the learning environment in middle school physical education classes exhibit adaptive characteristics?
- To what extent do middle school students possess cognitive and skill-based abilities during physical education lessons?
- How does an adaptive learning environment influence the development of cognitive and skill abilities among middle school students?

1.3 Research Objectives

- To assess the extent to which the learning environment in middle school physical education classes adapts to students' needs, as perceived by physical education teachers.
- To evaluate middle school students' cognitive and skill development during physical education lessons, based on the perspectives of physical education teachers.
- To examine the influence of an adaptive learning environment in physical education classes on the enhancement of students' cognitive and motor skills.

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1.4 Research Hypothesis

The adaptive nature of physical education lessons within the learning environment has a positive impact on the development of cognitive and skill abilities among middle school students.

1.5 Research Fields

Human field: Physical education teachers in middle schools under the jurisdiction of the Nineveh Governorate Education Directorate (Center) for the 2024-2025 academic year.

Time field: The study covers the period from November 15, 2024, to February 15, 2025.

Spatial field: Selected middle school facilities within the Nineveh Governorate Education Directorate (Center).

1.6 Research Terms

- **Adaptive Learning Environment**

An educational approach designed to cater to individual learners' needs by aligning with their unique learning styles and preferences. This system analyzes students' behaviors and interactions to deliver interactive content suited to their abilities and interests. By fostering engagement and participation, it enhances the overall learning experience, optimizes educational resource allocation, and boosts student motivation and academic success (El-Sabagh, 2021, p. 18).

- **Student Cognitive Abilities**

These refer to the mental processes that enable students to think critically, comprehend information, and solve problems. Cognitive abilities encompass skills such as critical and creative thinking, analysis, synthesis, and reasoning. They are also linked to memory and information retrieval, playing a fundamental role in both academic and social development. Enhancing these abilities contributes to improved learning outcomes and greater student engagement in the educational environment (Sibela et al., 2024, p. 2).

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- **Student Skill Abilities**

A broad set of competencies that enable students to perform various tasks with efficiency and proficiency. These abilities include physical skills necessary for executing athletic movements and techniques, such as speed, strength, and endurance. They are essential for both daily activities and sports performance, such as accurately throwing a ball or maintaining balance during movement (Lian, 2024, p. 1).

2. Research Methodology and Field Procedures

2.1 Research Methodology

Selecting an appropriate research methodology is essential for ensuring the success and reliability of any study. It establishes a structured framework for data collection and analysis, ultimately enhancing the accuracy and credibility of the research findings. For this study, the researcher adopted a descriptive methodology, incorporating both survey and correlation methods, as they align well with the research objectives and questions.

2.2 Research Population and Main Sample

The research population consisted of 242 physical education teachers working in middle schools under the jurisdiction of the Nineveh Governorate Education Directorate (Center). To ensure comprehensive representation, the researcher utilized a comprehensive enumeration method, selecting all 242 teachers as the main research sample. The main research sample was further categorized into three subsamples:

- **Exploratory Research Sample** – Conducted to refine research tools and procedures.
- **Statistical Analysis Sample** – Used for validating and analyzing collected data.
- **Final Application Sample** – Representing the core group for assessing the study's objectives. Table (1) presents a detailed breakdown of the research population and its corresponding sample groups.

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Table 1: Details of divisions of the main research sample.

Sample type	Number of teachers	Percentage (%)
Main research sample	242	100
Exploratory Research Sample	12	5
Statistical Analysis Sample	138	57
Final Application Sample	92	38

2.3 Research Tools

Developing research tools is a crucial step in gathering accurate and measurable data, ensuring the validity and reliability of the study's findings. For this research, the researcher designed two measurement tools: the first assesses the level of adaptive learning environments in physical education classes, while the second evaluates students' cognitive and skill abilities. The development of these tools followed established scientific procedures to enhance their effectiveness and applicability.

2.4 Drafting Research Tool Paragraphs

The precise formulation of research tool items is essential for collecting reliable and accurate data. Writing clear and well-structured items ensures that respondents can easily understand the questions and provide accurate responses. To minimize ambiguity, the researcher reviewed various scientific sources, literature, and previous research related to adaptive learning environments, including Sebastian & Kuswanto (2024), Mohammadi (2024), Cisse (2024), Al-Ashry et al. (2024), Chris et al. (2024), Graf (2023), Salama et al. (2023), and El-Sabagh (2021). Additionally, the researcher examined studies on cognitive and skill abilities, such as Tuhurima et al. (2025), Vaghela (2024), Xu (2024), Kazem (2024), Yang & Meriales (2024), Ibrahim (2024), Setiono & Widiningtyas (2023), Putri & Meilana (2023), Ibrahim et al. (2023), and Fauzi Giwangsa et al. (2022). Based on the analysis of these sources, the researcher formulated 15 items for each of the two research tools.

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2.5 Formulating Answer Alternatives

To facilitate the respondents' ability to answer the items in both the Adaptive Learning Environment Tool and the Cognitive and Skill Abilities Tool, the researcher designed response alternatives using a five-point Likert scale. Table (2) presents the alternative answers and their corresponding weight values.

Table 2: Alternatives to answer paragraphs for the five-point Likert scale.

Alternatives	Strongly Applies	Applies	Moderately Applies	Does Not Apply	Strongly Does Not Apply
Weights	5	4	3	2	1

2.6 Exploratory Study of Research Tools

Conducting an exploratory study is a crucial step in evaluating the effectiveness of the research tools before their final implementation. This process allows the researcher to identify ambiguities, refine item wording, and ensure the tools are suitable for the research sample. To achieve this, the researcher conducted an exploratory study on both the Adaptive Learning Environment Tool and the Cognitive and Skill Abilities Tool. The study was conducted with a randomly selected group of 12 physical education teachers, known as the exploratory research sample, drawn from the main research sample.

2.7 Application to the Statistical Analysis Sample

To obtain reliable data for statistical analysis and finalize the research tools, the researcher applied the preliminary versions of the Adaptive Learning Environment Tool and the Cognitive and Skill Abilities Tool to a statistical analysis sample. This sample was randomly selected from the main research group and included 138 physical education teachers from middle schools under the Mosul Education Directorate (Center), as detailed in Table (1). The data collection process took place between December 15–18, 2024. After retrieving the completed questionnaires, statistical methods were employed to assess the validity and reliability of the research tools.

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2.8 Validity of Research Tools

To evaluate the validity of the Adaptive Learning Environment Tool and the Cognitive and Skill Abilities Tool, the researcher applied the internal consistency method. This approach involves calculating the correlation coefficients between the scores of individual items and the total score of the corresponding tool. Table (3) presents the results of the internal consistency validity assessment, ensuring that the research tools accurately measure the intended variables.

Table 3: Internal consistency validity of the research tools.

	Item	Correlation with the total score	Significance level		Item	Correlation with the total score	Significance level
Adaptive Learning Environment Tool	1	0.580	0.000	*Cognitive and Skill Abilities Tool*	1	0.578	0.000
	2	0.656	0.000		2	0.580	0.000
	3	0.740	0.000		3	0.595	0.000
	4	0.566	0.000		4	0.753	0.000
	5	0.596	0.000		5	0.614	0.000
	6	0.712	0.000		6	0.628	0.000
	7	0.325	0.004		7	0.512	0.000
	8	0.491	0.000		8	0.659	0.000
	9	0.554	0.000		9	0.708	0.000
	10	0.621	0.000		10	0.469	0.000
	11	0.565	0.000		11	0.631	0.000
	12	0.630	0.000		12	0.730	0.000
	13	0.627	0.000		13	0.665	0.000
	14	0.678	0.000		14	0.647	0.000
	15	0.640	0.000		15	0.628	0.000

Internal Consistency of Research Tools: Table (3) demonstrates that the items of the Adaptive Learning Environment Tool exhibit a significant correlation with the total score of the tool, with correlation coefficients ranging from 0.325 to 0.740 at significance levels between 0.004 and 0.000. These results confirm the internal

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consistency of the measurement tool. Similarly, the Cognitive and Skill Abilities Tool also showed a strong correlation with its total score, with correlation coefficients ranging from 0.469 to 0.753 at a 0.000 significance level for all items. This further indicates that the tool possesses high internal consistency and is suitable for assessing cognitive and skill abilities.

2.9 Reliability of Research Tools

To determine the reliability of both the Adaptive Learning Environment Tool and the Cognitive and Skill Abilities Tool, the researcher employed the split-half method. This approach involves dividing each tool into two equal parts:

The first half consists of the odd-numbered items. The second half consists of the even-numbered items. The correlation between the two halves was then calculated to determine the split-half reliability. To ensure the overall reliability of the tools, the Guttman formula was applied to obtain the total reliability coefficient. The results, presented in Table (4), confirm the reliability of the research tools, ensuring their effectiveness for data collection.

Table 4: Reliability of the research tools.

Research Tools	Half reliability	Total reliability	Processing
Adaptive Learning Environment Tool	0.644	0.784	Guttman Formula
Cognitive and Skill Abilities Tool	0.844	0.914	Guttman Formula

2.10 Final Version of Research Tools

After verifying the validity and reliability of the initial version of the research tools, the researcher finalized them in their definitive form. The Adaptive Learning Environment Tool was finalized with 15 items, while the Cognitive and Skill Abilities Tool also comprised 15 items. Responses to these tools were structured using a five-point Likert scale, with the following options: Strongly Applies (5), Applies (4), Moderately Applies (3), Does Not Apply (2), Strongly Does Not Apply (1). The highest possible score that a respondent could achieve on each tool was 75 points, while the lowest possible score was 15 points.

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2.11 Final Implementation of Research Tools

After finalizing the research tools, the researcher administered them to the final application sample, which consisted of 92 physical education teachers. The application process took place between January 5 and January 8, 2025.

2.12 Statistical Methods

Once data collection was completed, the researcher analyzed the results using various statistical methods to ensure accuracy and reliability. The following statistical techniques were employed: Mean (Arithmetic Average), Standard Deviation, Pearson's Correlation Coefficient, Simple Linear Regression Analysis, Category Length Method.

Data analysis was conducted using the SPSS statistical software package, allowing the researcher to determine the levels of the research tool items based on the category length method. Table (5) presents the distribution of research tool levels based on the statistical analysis.

Table 5: Paragraph levels of the search tools

Class length	Level
1.80-1.00	Very low
2.60-1.81	low
3.40-2.61	middle
4.20-3.41	high
5.00-4.21	Very high

3. Results and Discussion

Table (6) reveals that the Adaptive Learning Environment Tool exhibited levels ranging between medium and low. Specifically, the following paragraphs attained medium levels as their arithmetic means fell within the medium-level range defined in Table (5): (1, 2, 4, 5, 7, 8, 9, 11, 12, 13, 14, 15), with means of (3.09, 3.23, 3.18, 3.05, 2.91, 3.11, 3.07, 2.84, 2.91, 3.13, 3.00, 2.87). Conversely, paragraphs (3, 6, 10) were classified at a low level, with arithmetic means of (2.60, 2.56, 2.52), which align with

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the low-level category in Table (5). Overall, the tool yielded an average level, with an arithmetic mean of 2.93, placing it within the medium-level category in Table (5).

The researcher attributes this average result to a moderate level of customization in physical education lessons. Some students may not receive personalized learning experiences that cater to their unique skills, possibly due to a lack of diversity in assigned tasks or teachers' inability to accurately assess students' needs. Additionally, sports activities are not presented in a sufficiently varied manner, as they often consist of limited or traditional exercises that fail to align with students' diverse interests. This lack of variety may result in reduced participation and motivation among students.

Moreover, the learning environment in physical education lessons does not fully support students' emotional and psychological well-being. This can lead to negative feelings or stress, discouraging students from experimenting with new activities, which, in turn, may hinder the learning process. Another contributing factor is the insufficient encouragement provided by physical education teachers, which does not meet the level of support students need to develop their goals and take ownership of their learning.

Additionally, cultural diversity has not been adequately considered in lesson planning, potentially affecting students' sense of belonging and engagement. The study also highlights shortcomings in assessment methods, which fail to motivate students to fully express their abilities. This may indicate a lack of creativity or an insufficient focus on individual student recognition. Furthermore, the limited integration of technology in physical education lessons restricts students' access to modern learning tools, thereby diminishing the overall learning experience. Likewise, insufficient incentives for creativity underscore the need for more opportunities for students to voice their opinions and develop their skills. Lastly, a safe and inclusive learning environment has not been fully established, which may discourage students from expressing themselves and exploring new activities during lessons.

Salama et al. (2023) emphasize that enhancing educational effectiveness requires several key elements, with the integration of advanced educational

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technology, such as educational software, being among the most crucial. Additionally, customizing educational content to accommodate students at varying proficiency levels is essential. Providing personalized interaction and support is also vital, as it enables teachers to offer direct feedback and assistance tailored to each student's needs. Furthermore, continuous assessment plays a fundamental role in this process, as it facilitates the analysis of students' comprehension levels and allows for adaptive modifications to educational content based on their individual progress (Salama et al., 2023, p. 543).

Table 6: Levels of the adaptive learning environment tool paragraphs.

Item	Content	Mean	Standard Deviation	Level
1	Students are provided with tasks and challenges during sports lessons that are specifically designed for their unique skill levels and interests.	3.09	0.978	Medium
2	Peer learning strategies are used to enhance collaboration among students with different abilities and backgrounds.	3.23	1.144	Medium
3	A variety of sports activities are offered to match the interests and abilities of all students.	2.60	1.275	Low
4	Teachers provide constructive feedback to students regularly to help them understand their levels and how to improve in a supportive manner.	3.18	1.281	Medium
5	The learning environment is supportive, allowing students to take risks and learn from their mistakes without fear of negative consequences.	3.05	1.110	Medium
6	Students are encouraged to set personal goals and make choices in their learning process to enhance autonomy and responsibility in learning.	2.56	1.111	Low
7	Sports activities align with the diverse cultural backgrounds of students and enrich their learning experiences.	2.91	1.164	Medium
8	Lessons incorporate strategies to develop students' social and emotional skills, promoting teamwork, empathy, and resilience.	3.11	1.303	Medium
9	Lessons include diverse assessment methods that allow students to express their skills and understanding in multiple ways.	3.07	10.333	Medium

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Item	Content	Mean	Standard Deviation	Level
10	Technology tools are used to enhance the educational experience and provide students with interactive learning opportunities.	2.52	1.146	Low
11	Teachers use instructional methods that ensure information reaches all students, regardless of their skill differences.	2.84	1.058	Medium
12	Students are given the opportunity to express their creativity and opinions in sports activities and exercises.	2.91	1.225	Medium
13	A variety of teaching materials and tools are used to suit different student ability levels.	3.13	1.266	Medium
14	Sports tasks and activities are adapted according to students' needs and skill levels.	3.00	1.362	Medium
15	Teachers ensure a safe space where students feel comfortable trying new activities and making progress.	2.87	1.222	Medium
Overall Tool Score		**2.93**	**1.315**	**Medium**

An analysis of Table (7) indicates that the levels of the cognitive and skill abilities tool varied across high, medium, and low categories. Specifically, paragraphs (1, 2, 8, and 13) were classified as high-level, with arithmetic means of (3.65, 3.61, 3.75, and 3.41), falling within the high-level category in Table (5). Meanwhile, paragraphs (3, 4, 5, 6, 7, 9, 10, 11, 12, and 14) were categorized as medium-level, with arithmetic means ranging from (2.87 to 3.29). On the other hand, paragraph (15) was placed in the low-level category, with an arithmetic mean of 2.57. Overall, the tool itself was assessed at a medium level, with an arithmetic mean of 3.16, which aligns with the average category in Table (5).

The researcher attributes the moderate cognitive and skill abilities demonstrated by students in physical education lessons to several key factors. One significant issue is the disparity between the theoretical concepts of sports activities and their practical application, primarily due to the lack of hands-on exercises that reinforce these concepts. Although students may exhibit cooperative skills, they often struggle to identify and solve problems effectively, possibly due to limited practical

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experiences and insufficient opportunities for teamwork during lessons. Additionally, students' difficulty in understanding, interpreting, and applying sports activities may stem from how these rules are taught—focusing more on rote learning rather than practical engagement. Another challenge lies in students' decision-making under competitive pressure, as anxiety and stress may impair their ability to think quickly and respond appropriately. The absence of training in both physical and mental aspects of sports could also contribute to this issue.

Moreover, the limited exposure to diverse sports activities and the lack of structured practice in movement variety may negatively impact students' cognitive and skill development. While students may have some knowledge about warming up, cooling down, and physical fitness components like strength, flexibility, and endurance, they often struggle to effectively apply these principles in sports settings. This overall result highlights a gap between students' theoretical knowledge and practical application in physical education. Their inability to fully grasp sports concepts and successfully implement them during activities suggests a need for curriculum adjustments that emphasize experiential learning, practical training, and interactive teaching methods to enhance their cognitive and skill abilities in physical education.

According to Yarno et al. (2022), enhancing students' cognitive abilities requires several fundamental elements within the educational process. One key approach is promoting active learning through activities that encourage critical thinking, such as project-based learning, which enables students to engage with real-world problems. Additionally, fostering collaboration among students can improve their communication and interaction skills, leading to the expansion of their ideas. Creating a supportive educational environment that includes intellectual challenges and integrating modern educational technologies can also enhance student engagement. Furthermore, incorporating directive assessments helps monitor and improve students' performance, ensuring continuous cognitive development (Yarno et al., 2022, p. 5193).

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Similarly, Mujriah et al. (2022) emphasize that improving students' skill capabilities requires teaching methods that seamlessly integrate theoretical knowledge with practical application. In the context of physical education, this development necessitates a strong foundation in fundamental motor skills such as running, jumping, and throwing, which are essential for active participation in physical activities. Additionally, fostering positive social attitudes, including cooperation and respect, plays a crucial role in strengthening peer relationships and enhancing students' overall engagement in sports and other physical exercises (Mujriah et al., 2022, p. 310).

Table 7: Levels of the cognitive and skill abilities tool paragraphs.

Item	Content	Mean	Standard Deviation	Level
1	Students possess effective communication skills and clearly express ideas and instructions during group activities.	3.65	1.352	High
2	Students can correctly perform fundamental skills such as passing, shooting, and dribbling during physical activities.	3.61	1.329	High
3	Students demonstrate the ability to apply basic mathematical concepts such as counting and measurement in the context of physical activities.	3.01	1.348	Medium
4	Students effectively identify problems that arise in team activities and collaborate with peers to find practical solutions.	3.05	1.421	Medium
5	Students demonstrate critical thinking skills and develop team play strategies such as positioning and movement during games.	3.29	1.398	Medium
6	Students can evaluate their performance after an activity, identifying what they did well and what needs improvement.	3.19	1.527	Medium
7	Students use the correct terminology related to sports and physical activities when discussing performance or strategies.	3.17	1.332	Medium
8	Students recognize and follow safety guidelines during physical activities to ensure a safe environment for themselves and others.	3.75	1.455	High
9	Students have the ability to understand, interpret, and apply the rules of different sports during gameplay.	3.00	1.250	Medium

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Item	Content	Mean	Standard Deviation	Level
10	Students can make quick and informed decisions in high-pressure situations while performing skills or engaging in sports activities.	2.95	1.242	Medium
11	Students demonstrate the ability to adapt their movement patterns when switching from one sport to another, such as transitioning from soccer to basketball.	2.87	1.207	Medium
12	Students participate in cooperative learning experiences that integrate cognitive tasks with physical activities.	3.04	1.265	Medium
13	Students understand the impact of nutrition on sports performance and can identify healthy food choices to support their activities.	3.41	1.247	High
14	Students are committed to performing appropriate warm-up and cool-down exercises, demonstrating an understanding of their importance in physical activity.	2.95	1.299	Medium
15	Students can identify and explain different components of physical fitness, such as strength, flexibility, and endurance, and how to apply them during performance.	2.57	1.110	Low
Overall Tool Score		**3.16**	**1.311**	**Medium**

Table (8) illustrates a significant positive correlation between the adaptive learning environment in physical education lessons and students' cognitive and skill abilities, with a correlation coefficient of 0.599 at a significance level of 0.000. Additionally, the table indicates that the adaptive learning environment contributes 35% (0.358) to the development of students' cognitive and skill abilities, while the remaining variation is influenced by other factors.

These findings suggest that enhancing the learning environment plays a crucial role in improving students' cognitive and skill performance. When physical education activities are tailored to align with students' individual abilities and interests, their engagement and motivation increase, fostering better learning outcomes. Interacting with peers and exchanging ideas further strengthens their ability to analyze educational content, leading to enhanced cognitive abilities. Moreover, incorporating diverse teaching strategies and assessment methods supports students in acquiring and applying knowledge in various ways. By adapting learning experiences to

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accommodate individual needs, students can develop skills through practical application rather than passive instruction. Additionally, customized learning activities enable students to engage in tasks that match their skill levels, promoting active participation and skill enhancement. A supportive and inclusive learning environment also contributes to students' self-confidence. When they feel safe and encouraged, they are more willing to experiment and take risks, fostering deeper learning. This minimizes the fear of failure, allowing students to develop new skills with greater confidence and perseverance.

Table 8: The relationship between adaptive learning environments and students' cognitive and skill abilities

Research Variables		Correlation coefficient (r)	Contribution ratio (r2)	Significance level (SIG)
Adaptive learning environment	Cognitive and skill abilities	0.599	0.358	0.000

4. Conclusions and Recommendations

4.1 Conclusions

- Adaptive Learning Environment: Physical education classes at the middle school level exhibit a moderate adaptive learning environment, according to the perspective of physical education teachers.
- Students' Cognitive and Skill Abilities: Middle school students demonstrate average cognitive and skill abilities during physical education lessons, according to the perspective of physical education teachers.
- Impact of Adaptive Learning: The adaptive learning environment in physical education classes plays a significant role in developing students' cognitive and skill abilities.

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4.2 Recommendations

- Teacher Training Programs: Educational authorities in the Nineveh Governorate Education Directorate should implement comprehensive training programs for physical education teachers. These programs should equip educators with effective strategies and tools to address students' diverse learning needs, ultimately enhancing their cognitive and physical abilities while fostering greater engagement in sports activities.
- Flexible Learning Environments: Physical education teachers should design adaptive and inclusive learning environments that accommodate different learning styles. This can be achieved by integrating multi-level activities within sports lessons, allowing students to engage in physical exercises based on their individual capabilities. By incorporating motor activities with cognitive tasks, students can develop critical thinking and teamwork skills.
- Integration of Educational Technology: The use of digital training applications and interactive educational games should be promoted to enhance students' understanding of sports-related concepts and motor skills. These tools can create more engaging and effective learning experiences.
- Continuous Assessment and Feedback: Implementing ongoing student assessments with immediate and constructive feedback will help identify strengths and areas for improvement, leading to more personalized and effective learning outcomes.
- Application of Research Tools: The research tools developed in this study should be utilized by educational authorities and institutions to evaluate adaptive learning environments and measure students' cognitive and skill competencies across various educational subjects, not just physical education.

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