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Kindergarten Teachers' Attitudes Toward Using AI Applications in Early Childhood Education in the Arab Society of Northern Israel's Triangle

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Abstract
This study examines the attitudes of kindergarten teachers in the Arab society of Northern Israel's Triangle region (the Palestinian interior) toward integrating artificial intelligence (AI) applications into effective early childhood education. The focus is placed on assessing teachers' skills in utilizing these technologies, analyzing related data, and evaluating the availability of supportive infrastructure for successful technological integration. The study adopted a descriptive survey method, with data collected from a purposive sample of 70 teachers, representing a population of 486 teachers in the Northern Triangle region. A questionnaire was employed, divided into three main dimensions: AI strategy, AI data, and infrastructure.
The findings revealed generally positive attitudes toward the use of AI applications, with statistically significant differences in the data dimension according to academic qualification and years of experience. Teachers holding a master's degree or higher, as well as those with ten or more years of experience, outperformed bachelor's degree holders and less experienced teachers in skills related to data analysis and its application in digital education. However, no significant differences were recorded in the strategy and infrastructure dimensions, reflecting the shared impact of institutional and training factors.
The study concludes with recommendations to strengthen the digital infrastructure in early childhood education institutions and to provide specialized training programs for teachers to enhance their ability to employ AI technologies. It also emphasizes the importance of developing digital data analysis skills as a key factor in improving effective educational outcomes in early childhood settings.

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Keywords: Early Childhood Education, Artificial Intelligence Arab Society, Israel

Introduction

In the context of the accelerating global digital revolution, artificial intelligence (AI) has emerged as one of the most transformative technological innovations, reshaping educational approaches and methodologies, particularly in early childhood education, which constitutes the foundation for developing children's cognitive skills and abilities. Numerous studies have highlighted that AI applications in education enhance the quality of the learning process by enabling personalized learning, facilitating the analysis of educational data, and providing interactive and adaptive learning environments that respond to individual learners' needs (Warghi, 2022) [15].
Early childhood education has witnessed significant advancements in teaching methods and tools, with AI becoming one of the key technologies integrated to improve instructional quality. AI applications offer unique opportunities to tailor learning experiences to each child's developmental level and individual needs, thereby empowering teachers to deliver diverse, engaging, and stimulating content. This personalized approach has been shown to promote critical and creative thinking skills from an early age (Su & Yang, 2022) [13].

Despite the potential benefits, there remains a lack of empirical research examining early childhood teachers' attitudes toward using AI applications, their level of competency in employing these technologies, and the adequacy of the supporting infrastructure in educational settings. Addressing this gap, the present study aims to investigate kindergarten teachers' attitudestoward AI integration, assess their digital skills, and evaluate the availability of technological infrastructure that facilitates effective AI-based teaching in the Arab society of Northern Israel's Triangle region.

Moreover, artificial intelligence can contribute to the analysis of educational data generated by children's interactions with digital activities, enabling teachers to monitor individual performance development and adjust instructional plans to better align with each child's actual needs (Su, Davy & Chu, 2023) [11]. This analytical use of data provides greater accuracy in educational decision-making and reduces reliance on subjective estimations, thereby enhancing the overall effectiveness of the learning process.

However, integrating artificial intelligence into early childhood education faces several challenges, including the lack of adequate digital infrastructure in many educational institutions, as well as the urgent need for continuous and specialized training for teachers to use these advanced technologies efficiently and effectively. The absence of these factors may limit the full potential of AI in enhancing children's learning experiences.

Recent studies indicate that the use of artificial intelligence is not limited to content delivery or data analysis alone; it also encompasses the design of interactive learning environments that integrate both cognitive and affective aspects of children's development (Su & Zhong, 2022) [12].

This underscores the importance of understanding teachers' attitudes toward the use of AI applications, as these attitudes serve as a critical indicator of technology acceptance and its potential to positively transform educational practices, particularly in communities with specific cultural and educational characteristics, such as the Arab society in Israel. Accordingly, this study aims to examine the attitudes of early childhood teachers in the Northern Triangle region toward employing AI applications in effective teaching. The research focuses on assessing their skills in using these technologies, analyzing the resulting data, and evaluating the availability of supportive infrastructure for successful integration. The study seeks to provide a clear perspective that can inform the development of technology-based educational policies aimed at enhancing early childhood education.

Section One: General Framework of the Study

Problem of the Study

Advancements in information technology have led to an abundance of knowledge across various fields, thereby narrowing the gap between knowledge, information, and the teacher. This rapid change has compelled educational institutions to undertake new tasks, leveraging technology in teaching processes. Undoubtedly, artificial intelligence (AI) has become an integral and essential component of the educational process, serving as an effective tool for facilitating teaching, enhancing instructional practices, and supporting research in accessing knowledge and information. Numerous previous studies, such as those by Bakari (2023), And Mishaal and Al-Eid (2023) [10], Ali and Al-Juweir (2022), Hasnawi (2022) [6], and have highlighted the importance of employing AI applications to develop teaching strategies, particularly in early childhood education. Given the limited research focusing specifically on this domain, the present study seeks to shed light on kindergarten teachers' attitudes toward using AI applications in effective teaching processes during early childhood, with a particular focus on kindergartens in the Northern Triangle region of Israel.

Research Questions

1. What are the attitudes of early childhood teachers toward using artificial intelligence (AI) applications in effective teaching processes in the Northern Triangle region?
2. What challenges do early childhood teachers face in using AI in effective teaching processes in the Northern Triangle region, from their perspective?
3. Are there statistically significant differences (at $\alpha \leq 0.05$) in the mean attitudes of early childhood teachers toward using AI applications in effective teaching processes in the Northern Triangle region, attributable to their academic qualifications and years of experience?

Study Objectives

To investigate the attitudes of kindergarten teachers in the Arab society of the Northern Triangle region toward employing artificial intelligence (AI) applications in effective early childhood education.

To identify the challenges and difficulties faced by kindergarten teachers when using AI applications in their daily teaching practices.

To examine statistically significant differences in teachers' attitudes toward employing AI in effective teaching, according to the variables of academic qualification and years of experience.

Significance of the Study

Methodology and Procedures

The methodology and procedures of the study represent a central aspect through which the practical component of the research was accomplished, and through which the necessary data were obtained to perform statistical analyses and derive results interpreted in light of the relevant literature.

Research Method

The study adopted a descriptive survey approach to address the research questions, given its suitability for the nature and objectives of this study.

Study Population and Sample

The study population consisted of all early childhood education teachers in the Northern Triangle area of the Haifa District in the Palestinian interior for the academic year 2024/2025, totaling 486 teachers. A purposive sample of 70 teachers was selected from this population, as shown in the following table:

Table 1: Distribution of study sample

Variables	Categories	Repetition	Percentage
Experience	Less than 5 years	18	26
	From 5-10 years	22	31
	10 years and more	30	43
Qualification	Bachelor	52	74
	Master and above	18	26
Total		70	100.0

Research Instruments

The study questionnaire was developed to collect data by referring to the theoretical literature and previous studies related to the research problem, such as the studies by Al-Muaamari (2024), Mishaal and Al-Eid (2023) [10], Tawfiq and Al-Obaid (2023) [14], Ali and Al-Juweir (2022), and Al-Badawi and Al-Qahtani (2022) [3]. An exploratory study was also conducted to identify the key dimensions that should be included in the questionnaire. The questionnaire consisted of 22 items designed to measure early childhood teachers' attitudes toward the use of artificial intelligence (AI) applications in the Northern Triangle region of the Palestinian interior. These items were distributed across three main dimensions:

First Dimension: AI Strategy (7 items)
Second Dimension: AI Data (8 items)
Third Dimension: AI Infrastructure (7 items)

A closed-ended questionnaire was adopted in preparing the survey, which defines the possible responses for each question. The responses were classified into five equally ranged categories using the following formula to determine the criterion for judging the scores:

Category length = (Highest value on the scale – Lowest value) ÷ Number of options on the scale (5)

Category length = (5 - 1) ÷ 5 = 0.8

Category	Range of averages	Degree of approval
The first	4.21 - 5.00	Very high
The second	3.41 – 4.20	High
The third	2.61 – 3.40	Medium
The fourth	1.81 – 2.60	Low
Fifth	1.00 – 1.80	Very low

Section Two: Artificial Intelligence

Artificial intelligence (AI) is considered one of the most prominent examples of digital transformation in education, as it is applied across various fields of life and employed in educational processes to enhance quality and effectively develop the necessary professional skills. AI focuses on creating highly advanced systems capable of strategic thinking similar to humans. In this way, AI complements computer science by developing efficient programs that support the creation of virtual systems with capabilities for reasoning, problem-solving, and learning (Malik, Tayal, & Vij, 2019).

1. Concept of Artificial Intelligence

Artificial intelligence (AI) is intelligence that resembles human intelligence and is performed by a computer, robot, or any other device. It refers to the ability of machines to simulate human cognitive abilities, learn from examples and experiences, recognize objects, understand and process languages, make decisions, solve problems, and integrate various capabilities to perform functions that humans can carry out. AI represents a comprehensive technological field that mimics human actions and can encompass anything from an expert system—an application designed to solve problems based on complex rules—to entities resembling fictional characters, which are devices that develop intelligence and willpower (Abu Ayadah, 2022).

AI is also considered the science of intelligent machine engineering and computer programs, as it involves creating software and computational devices capable of thinking in ways similar to the human brain and mimicking human behaviors. This field is based on mathematical rules, hardware, and software that are assembled in computer systems, which in turn perform a variety of tasks and operations that humans can execute to improve institutional performance. These systems are distinguished by their speed and accuracy in solving complex problems (Al-Desouki, 2020).

Farani (2020) describes AI as a simulation of human thought and behavior, but notes a certain discrepancy, as AI and human action are not precisely defined. Furthermore, humans establish the standards of intelligence and, with technological advancements, have created digital entities with varying degrees of intelligence. Additionally, humans have been interacting with and surrounded by smart technologies for a considerable period; these technologies influence our present and future in a balanced manner, yet, ultimately, they remain distinct from human thinking.

AlSaud (2016) describes AI as a branch of computer science through which computer programs can be created and designed to simulate human intelligence. This enables computers to perform certain tasks on behalf of humans, tasks that require thinking, understanding, listening, speaking, and moving in a logical and organized manner.

2. Importance of Artificial Intelligence

Artificial intelligence represents a qualitative leap across various fields of life, as it contributes to improving efficiency and productivity through process automation and data analysis that is faster and more accurate than human capabilities. It can also support data-driven decision-making, helping institutions predict future trends and adapt to them quickly. Furthermore, AI opens new horizons for innovation in areas such as medicine, education, and industry, thereby enhancing quality of life and addressing complex challenges more effectively (Al-Anzi, 2022) [2].

Artificial intelligence plays a vital role in enhancing education by providing personalized learning experiences for

each student. Through AI technologies, individual student performance can be analyzed to identify strengths and weaknesses, guiding them toward educational paths that meet their specific needs. AI also contributes to the development of innovative educational tools, such as interactive learning applications and online platforms, making learning more effective and engaging. Additionally, AI can support teachers by automating administrative tasks and analyzing large datasets, allowing them to focus on delivering a higher-quality educational experience (Ali & Al-Juweir, 2022).

The importance of artificial intelligence can be summarized as follows (Mishaal & Al-Eid, 2023) [10]:

Personalized Learning: AI can design customized learning experiences for each student based on their individual needs and abilities.

Performance Assessment and Data Analysis: AI helps track children's progress and continuously analyze their performance, enabling timely and appropriate support.

Enhancing Interactive Learning: AI provides interactive tools, such as educational games and smart applications, making learning more engaging and enjoyable for children.

Supporting Teachers: AI assists teachers in automating routine tasks, such as grading assignments and preparing reports, allowing them to focus on interacting with students and developing effective instructional plans.

3. Characteristics of Artificial Intelligence

Artificial intelligence possesses a set of characteristics that determine its effectiveness and consensus among specialists, as follows (Al-Anzi, 2022) [2]:

- **Problem Solving:** The ability to use intelligence to address challenges and solve problems.
- **Thinking and Perception:** The ability to think logically and understand the surrounding environment.
- **Knowledge Acquisition and Application:** The ability to gather and analyze information and apply the results effectively.
- **Learning from Experience:** The ability to benefit from past experiences and lessons for learning and development.
- **Utilizing Past Expertise:** The ability to apply previous experiences in new contexts.
- **Trial and Error:** The ability to use trial-and-error methods to explore and improve performance.
- **Rapid Response:** The ability to react quickly to new situations and conditions.
- **Handling Complex Situations:** The ability to manage difficult and complex scenarios effectively.
- **Dealing with Ambiguity:** The ability to navigate situations with insufficient information.
- **Distinguishing Relative Importance:** The ability to assess and prioritize the relative importance of different elements in presented cases.
- **Visualization and Creativity:** The ability to think creatively and envision matters in novel ways.
- **Supporting Administrative Decisions:** The ability to analyze information and present it in a manner that aids informed decision-making.

Dimensions of Artificial Intelligence:

Artificial intelligence is considered a transformative technology characterized by complexity, multidimensionality, and rapid development. For its application, it is necessary to closely integrate and operate several organizational functions in order to assess the readiness of existing AI technologies within the institution through the availability of a number of dimensions, as outlined by (Al-Badawi & Al-Qahtani, 2022; Hassan, 2020; Al-Hujaili, 2020) [3, 7, 5].

- **Strategy:** It is a planning process aimed at achieving alignment between artificial intelligence and the organization's objectives, including data goals, use cases, and measurable key performance indicators. The strategy involves developing a detailed action plan that outlines a roadmap across all levels, enabling the organization to integrate data-driven thinking into its structure. This strategy also contributes to fostering harmony between top management and employees, while enhancing the benefits of the transformative impact across every function.
- **People:** This dimension refers to the mindset, roles, and skills required to develop, deploy, and deliver AI-supported initiatives, whether inside or outside the organization. Even the most innovative artificial intelligence in the world will not be effective unless people are properly prepared to use it. Accordingly, educational institutions must ensure alignment between leadership, organizational culture, and change management, in order to guarantee individuals' readiness, willingness, and ability to adopt AI. This requires technical-level training, continuous functional support, and purposeful engagement in the strategy.
- **Infrastructure:** There are numerous applications of artificial intelligence in education, including the creation of digital content with the same level of sophistication as that produced by human counterparts, profiling learners and predicting their performance, conducting assessments and evaluations with high levels of accuracy and efficiency, and monitoring their academic engagement. It also encompasses learning environments, instructional design, the use of academic data to track and guide students, knowledge representation, and the integration of artificial intelligence with virtual reality.
- **Data:** Smart learning data aim to shift learning environments from a focus on educational content to a focus on the learner, through the use of artificial intelligence technologies. This transformation significantly contributes to enhancing the quality of education. Numerous educational software and applications have been developed to facilitate the learning process, including adaptive learning programs, educational games, and robots, as well as software that responds to students' needs. These tools also emphasize identifying subjects in which students face difficulties, while promoting the acquisition of 21st-century skills such as critical and creative thinking, problem-solving, and programming skills.

5. Advantages of Artificial Intelligence in Education

Based on a review of several studies on artificial intelligence in the field of education, the following advantages have been identified (Mohammed, 2020; Ismail, 2017) [9]:

Personalization and Individualization: Enables the provision of personalized learning experiences that adapt to the needs of each student individually, thereby enhancing students' understanding of content and increasing learning

effectiveness.
Self-Paced Learning: Allows students to learn at their own pace through AI-powered educational platforms that provide training content tailored to their level of progress.
Real-Time Analytics: Offers instant assessments and continuous performance analysis for students, enabling them to track their progress and identify weaknesses more quickly.
Teacher Support: Helps reduce teachers' workload by automating routine tasks such as grading exams and managing attendance, giving them more time to focus on teaching.
Interactive and Engaging Learning: Provides interactive tools such as educational games and smart applications that make learning more engaging and enjoyable for students, especially in virtual classrooms.
Easy Accessibility: Ensures access to educational resources anytime and anywhere, making education more accessible to students who may not have the opportunity to attend traditional classrooms.
Fostering Creativity and Innovation: Encourages students to explore and utilize new technologies, thereby enhancing their creativity as well as their critical and innovative thinking skills.
Adaptation to Different Learning Styles: AI can deliver educational content tailored to various learning styles, whether visual, auditory, or kinesthetic.
Inclusive Education: Contributes to integrating students with special needs by providing educational tools that adapt to their requirements and support effective learning.
Enhanced Access to Education: Offers opportunities for distance learning, making education accessible to a wider range of students around the world, regardless of their geographical location.

6. Applications of Artificial Intelligence in Early Childhood Education

Kindergarten teachers must be aware of the emerging technological advancements in the field of artificial intelligence and the rapid technological developments that are increasingly permeating all areas of life, particularly the educational field. Within their capacities and abilities, they should strive to integrate these technologies in ways that align with professional requirements. Hassnawi (2022) emphasizes that the use of electronic learning materials and environments represents one of the key quality standards in the educational process, encompassing all elements of the learning environment due to its vital role in improving, developing, and facilitating learning. Furthermore, the integration of technology in educational institutions has a positive impact on both teachers' and students' performance, enriches curricula, enhances interaction between students and the learning environment, and supports collaborative learning.
There are several models of artificial intelligence applications that can be utilized in early childhood learning, as reported by Bakari (2022) [4] and Worghy (2022):

1. Thinkster Math
Adaptive Learning: Adjusts to each learner's abilities and presents suitable problems, providing a personalized learning experience.
Performance Analysis: Analyzes how students solve problems and identifies errors accurately, allowing learning improvement based on actual performance.

2. Brainly
Virtual Social Interaction: Enables students to collaborate and share knowledge through a social network dedicated to academic tasks, enhancing cooperative learning.
Self-Paced Learning: Offers a platform where students can ask questions and receive answers tailored to their level of understanding.

3. Netex Learning:
Adaptive Learning: Allows teachers to design customized lessons with interactive elements suited to students' needs.
Instant Feedback: Integrates self-assessment and interactive evaluation within lesson content, providing rapid feedback to students.

4. Reinforcement Learning:
Trial and Error: Uses learning-from-experience algorithms to improve performance and adapt to changing conditions.
Continuous Learning: Continuously strives to enhance behavior based on feedback and past experiences.

5. Educational Robotics:
Natural Interaction: Interacts with students through responses to sounds and movements, enriching the interactive learning experience.
Interactive Learning: Provides an interactive learning environment through motion, sensing, and environmental interaction.

6. Data Analysis
Curriculum descriptors feed into content technology engines that analyze data to generate personalized educational materials.

Each of these applications contributes to enhancing the learning experience in different ways, using artificial intelligence to promote personalization, interaction, and performance analysis in the educational process.

Section Three: Study Results and Discussion
First: Discussion of the results of the first question, which states: "What are the attitudes of early childhood teachers towards the use of artificial intelligence applications in effective teaching processes in the Northern Triangle region?"
arithmetic means and standard deviations of the study sample responses were used, as shown in Table (2).

Table 2: Arithmetic Means and Standard Deviations of Early Childhood Teachers' Estimates Regarding Their Attitudes Toward Using Artificial Intelligence Applications in Effective Teaching Processes in the Northern Triangle Region

No.	Item	Arithmetic	Standard Deviation	Rank	Degree
1	Difficulties in Using Digital Teaching Skills by the Teacher	3.63	1.11	1	High
2	Skills for Integrating Computers into the Digital Learning Process	3.54	1.07	2	High
3	Skills for Designing Digital Learning Software	2.99	1.12	3	Medium

It is evident from Table (2) that the attitudes of early childhood teachers toward the use of artificial intelligence applications in effective teaching processes in the Northern Triangle region varied, with arithmetic means ranging from (2.96) to (3.60). The Strategy dimension received the highest mean score (3.60) with a standard deviation of (0.86) and a rating of "High," indicating a positive orientation and advanced intellectual awareness among teachers regarding the importance of AI strategies in enhancing teaching effectiveness and improving learning outcomes. This reflects their mental readiness and openness to adopting AI tools, despite the challenges.

As for the Data dimension, it ranked second with a mean score of (3.18), a standard deviation of (0.96), and a rating of "Medium," indicating a moderate level of utilization of AI data to guide the educational process. However, there is a need to further develop teachers' analytical skills and to enhance a digital educational culture that relies on data analysis for informed decision-making.

As for the Infrastructure dimension, it ranked last with a mean score of (2.96), a standard deviation of (0.95), and also received a "Medium" rating. This indicates that the technical and equipment-related aspects still pose a barrier to the effective use of artificial intelligence applications, which is often linked to limited resources available in kindergartens and insufficient institutional support for providing a fully integrated digital environment.

Overall, the results indicate that teachers have relatively positive attitudes toward the use of artificial intelligence, particularly at the level of thinking and planning. However, the actual implementation is still affected by factors related to infrastructure and data utilization, necessitating developmental and training interventions to activate these attitudes and translate them into practical classroom practices.

These results can be attributed to several interrelated factors, most notably the increasing theoretical awareness among early childhood teachers regarding the importance of AI strategies in improving the quality of education, which explains the high rating of the Strategy dimension. In contrast, the medium levels observed in the Data and Infrastructure dimensions are attributed to the limited practical training in educational data analysis, the insufficient technical resources available in educational institutions, and the lack of consistent institutional support for the effective implementation of AI tools. These limitations negatively affect actual classroom practice despite the positive attitudes observed.

Dimension One: Artificial Intelligence Strategy

Table 3: Arithmetic Means and Standard Deviations of the Study Sample's Estimates Regarding the Use of Artificial Intelligence Application

No.	Item	Mean	Standard Deviation	Rank	Level
1	I use AI tools to analyze children's educational needs and plan learning activities	4.00	0.41	1	High
2	I use AI applications to provide personalized educational content according to each child's level	3.89	0.75	2	High
3	I use AI strategies to deliver interactive and stimulating activities for children	3.77	0.98	3	High
4	I believe that AI contributes to improving the quality of early childhood education	3.74	1.00	4	High
5	I have the ability to select the appropriate AI strategy based on the nature of the content	3.40	0.73	5	Medium
6	I ensure the use of AI strategies that enhance children's thinking and problem-solving skills	3.34	1.01	6	Medium
7	I participate in trainings or workshops that help me integrate AI strategies into my teaching	3.06	1.11	7	Medium
Total		3.60	0.86		High

It is evident from Table (3) that the arithmetic means for the level of using artificial intelligence strategies among early childhood teachers in the Northern Triangle region of the Palestinian Interior ranged between (3.06 – 4.00), with all items falling under the "High" and "Medium" rating categories. The first four items received a "High" rating, topped by Item No. (4), which states: "I use AI tools to analyze children's educational needs and plan learning activities" with a mean of (4.00). In contrast, Item No. (7), which states: "I participate in trainings or workshops that help me integrate AI strategies into my teaching," ranked last with a mean of (3.06) and a "Medium" rating.

As a whole, the dimension received a mean score of (3.60), corresponding to a "High" rating. The researchers attribute this variation to the fact that teachers generally possess a good awareness of the importance of employing AI strategies, particularly in tasks related to analysis and planning. However, a relative weakness is observed in participation in practical trainings and workshops, indicating that teachers need more hands-on training opportunities and technical support to enhance the effective integration of AI within the classroom.

Dimension Two: Artificial Intelligence Data

Table 4: Arithmetic Means and Standard Deviations of the Study Sample's Estimates Regarding the Use of Artificial Intelligence Application

No.	Item	Mean	Standard Deviation	Rank	Level
9	I use data generated from children's interaction with digital activities to adjust educational plans	3.39	0.92	1	Medium
11	I use AI data to track the individual performance progress of each child	3.30	1.02	2	Medium
15	I consider AI data an important tool to support educational planning and evaluation	3.25	0.98	3	Medium
12	I benefit from AI analytics in identifying learning gaps among children	3.21	0.96	4	Medium
10	I refer to data reports provided by AI tools to support my educational decisions	3.19	1.01	5	Medium
13	I ensure the analysis of digital data related to children's participation and interaction during learning	3.15	1.10	6	Medium
14	I follow daily or weekly data provided by AI applications regarding children's activities	3.00	0.88	7	Medium
8	I use data to determine each child's level and suggest activities suitable to their performance	2.95	0.79	8	Medium
Total		3.18	0.96		High

It is evident from Table (4) that the arithmetic means for the level of using artificial intelligence data among early childhood teachers in the Northern Triangle region of the Palestinian Interior ranged between (2.95 – 3.39), with all items falling under the "Medium" rating category. This indicates a moderate use of AI applications in educational data analysis and decision-making based on such data.

Item No. (9), which states: *"I use data generated from children's interaction with digital activities to adjust educational plans,"* ranked first with a mean of (3.39) and a standard deviation of (0.92), reflecting a relative awareness among teachers of the importance of linking data analysis to the development of educational plans. In contrast, Item No. (8), which states: *"I use data to determine each child's level and suggest activities suitable to their performance,"* ranked last with a mean of (2.95) and a standard deviation of (0.79), possibly indicating difficulties in customizing learning activities based on data or a lack of supporting tools.

As a whole, the dimension received a mean score of (3.18) and a standard deviation of (0.96), corresponding to a "Medium" rating. This suggests an initial awareness of the importance of AI data, yet practical use remains moderate and requires further development. This level is attributed to limited hands-on training, weak digital infrastructure, and insufficient technical guidance in effectively employing AI tools, highlighting the need to provide more structured training opportunities for teachers, in addition to preparing a school environment equipped to support the use of AI in teaching and assessment processes within classrooms.

Dimension Three: Artificial Intelligence Infrastructure

Table 5: Arithmetic Means and Standard Deviations of the Study Sample's Estimates Regarding the Use of Artificial Intelligence Application

No.	Item	Mean	Standard Deviation	Rank	Level
18	There is a stable and fast internet connection in the kindergarten that facilitates the operation of artificial intelligence applications.	3.40	0.85	1	Medium
19	A display screen or smart board is available in the kindergarten and is used in artificial intelligence applications	3.32	0.91	2	Medium
22	A safe digital learning environment is available to protect children's data when using artificial intelligence.	3.23	0.88	3	Medium
16	Modern digital devices are available in the kindergarten that allow the use of artificial intelligence applications.	3.18	0.95	4	Medium
20	The kindergarten provides educational software and applications based on artificial intelligence	2.59	1.02	5	Low
21	The software and applications used in the kindergarten are continuously updated to keep up with developments.	2.55	1.05	6	Low
17	There are classrooms equipped with the necessary technological infrastructure to use artificial intelligence tools	2.48	0.99	7	Low
Total		2.96	0.95		Medium

It is evident from Table (5) that the arithmetic means of early childhood teachers' estimates regarding the availability of the necessary infrastructure for using artificial intelligence applications in kindergartens ranged between (2.48 – 3.40). This indicates a variation in the extent to which infrastructure components are available, as only three items received a "moderate" degree, while four items were rated "low".

Item (18): "There is a stable and fast internet connection in the kindergarten that facilitates the operation of artificial intelligence applications" ranked first with a mean of (3.40) and a standard deviation of (0.85), reflecting a relative availability of network-related infrastructure, which is a pivotal element in the use of intelligent applications.

In contrast, Item (17): "There are classrooms equipped with

the necessary technological infrastructure for the use of artificial intelligence tools" ranked last with a mean of (2.48) and a standard deviation of (0.99). It was the only item that clearly fell within the "low" category, highlighting the weakness of classroom readiness in keeping pace with the requirements of artificial intelligence.

Overall, the total score for this dimension recorded a mean of (2.96) and a standard deviation of (0.95), placing it within the "moderate" level of estimation, yet leaning toward its lower bound. This serves as an indicator of deficiencies in the digital infrastructure of early childhood institutions, which weakens the prospects for the actual implementation of artificial intelligence technologies within classrooms.

These results can be attributed to a set of factors, most notably the limited funding allocated to educational technology in early childhood education, the absence of a clear digital strategic vision in some educational institutions, and the restricted availability of smart devices and networks in certain kindergartens, particularly in peripheral areas.

Furthermore, the lack of technical training and continuous support contributes to weakening teachers' ability to benefit from the available resources, which keeps the use of artificial intelligence at a moderate level tending toward decline, reflecting an urgent need for the comprehensive and effective development of digital infrastructure.

Secondly: Discussion of the results of the second question, which states: "What are the challenges faced by early childhood teachers in using artificial intelligence for effective teaching processes in the Northern Triangle area from their perspective?"

To answer this question, the arithmetic means and standard deviations of the statements of the second dimension were extracted. The criterion of judgment in the classification table of arithmetic mean levels (according to the five-point Likert scale) was adopted to assess the results of the second question, and the following table presents the findings.

Table 6: Arithmetic Means and Standard Deviations of the Study Sample's Estimates Regarding the Use of Artificial Intelligence Application

No.	Item	Mean	Standard Deviation	Rank	Level
8	It is difficult for me to keep up with the developments of artificial intelligence in the educational field	4.20	0.66	1	High
2	I have not received sufficient training on using artificial intelligence in the kindergarten environment	4.18	0.75	2	High
1	I lack adequate knowledge about artificial intelligence applications suitable for children	4.15	1.00	3	High
5	I find it difficult to identify safe and appropriate artificial intelligence applications for children	4.07	0.97	4	High
4	I do not have enough time to use artificial intelligence tools within my daily work routine	4.03	0.88	5	High
3	We do not have the proper digital infrastructure to implement artificial intelligence technologies	4.00	1.01	6	High
9	The available applications do not take into account the Arabic children's language and cultural context	3.98	1.03	7	High
6	Internet connectivity in the kindergarten is weak and unstable	3.95	1.11	8	High
7	I fear that artificial intelligence may weaken human interaction with children	3.92	0.76	9	High
Total		4.05	0.90		High

It is evident from the results of the table that all nine items received a "high" rating, with mean scores ranging between (3.92 – 4.20). This indicates a relative consensus among the sample participants regarding the significant challenges faced by the teachers in this context.

The highest-ranked challenge was item (8): "It is difficult for me to keep up with the developments of artificial intelligence in the educational field", with a mean score of (4.20) and a standard deviation of (0.66). This reflects a strong sense of inability to cope with the rapid advancements in the field and highlights the need for continuous and up-to-date professional development programs.

This was followed by item (2): "I have not received sufficient training on using artificial intelligence in the kindergarten environment", with a mean score of (4.18). This finding indicates a clear shortage in professional preparation and practical training on integrating artificial intelligence tools into early childhood education.

Item (1): "I lack adequate knowledge about artificial intelligence applications suitable for children" received a mean score of (4.15). This result emphasizes the teachers' insufficient cognitive awareness regarding the nature of these applications, which in turn hinders their effective utilization.

In contrast, item (7): "I fear that artificial intelligence may weaken human interaction with children" ranked last, with a mean score of (3.92). Despite still falling within the "high" category, this result indicates the presence of pedagogical and humanistic concerns among the teachers; however, these concerns appear to be less intense compared to the skill-related, knowledge-based, and structural challenges.

The overall mean score for the domain reached (4.05) with a standard deviation of (0.90), reflecting the presence of clear structural, cognitive, technical, and cultural challenges faced by the teachers when attempting to integrate artificial intelligence into kindergartens.

These results can be attributed to a set of interrelated factors, most notably: a lack of professional qualification and specialized training in the field of artificial intelligence, alongside weak technical infrastructure within kindergarten institutions, which hinders the effective use of these applications. The findings also revealed difficulties in keeping up with rapid technological developments, in addition to educational and cultural concerns related to the limited suitability of applications for the local language and culture, as well as worries about the potential decline of human interaction in the educational process. Moreover, work pressures and limited time emerged as obstacles that restrict teachers' opportunities to adopt AI technologies.

These challenges reflect the need for a comprehensive educational vision that integrates infrastructure development, ongoing professional training, and the adaptation of technology to the local cultural context to ensure the effective and safe integration of artificial intelligence applications in early childhood education

Third: Discussion of the Results of Question Three

Question three states: "Are there statistically significant differences at the significance level ($\alpha \leq 0.05$) between the means of early childhood teachers' attitudes toward using artificial intelligence applications in effective teaching processes in the Northern Triangle area, attributable to the variables of educational qualification and years of experience?"

1. Years of experience

No.	Questionnaire Domains	Years of experience	Sample Size	Mean	Standard Deviation	f-value	Significance Level
1	Strategic Dimension	Less than 5 years From 5-10 years 10 years and more	18 22 30	3.45 3.62 3.74	0.52 0.49 0.46	2.841	0.066
2	Data Dimension	Less than 5 years From 5-10 years 10 years and more	18 22 30	3.05 3.25 3.55	0.56 0.53 0.55	4.129	0.020
3	Infrastructure Dimension	Less than 5 years From 5-10 years 10 years and more	18 22 30	2.89 3.02 3.15	0.47 0.45 0.41	1.906	0.156

The results of the (ANOVA) test for differences between the means of early childhood teachers according to the variable of years of experience (less than 5 years, from 5 to 10 years, 10 years or more) across the three questionnaire dimensions showed that there were statistically significant differences only in the Data Dimension, where the calculated F-value was (4.129) at a significance level of (0.020), which is less than 0.05. This indicates a statistically significant difference in favor of teachers with 10 years or more of experience, whose mean score was (3.55) compared to (3.25) and (3.05) for teachers with 5–10 years and less than 5 years of experience, respectively. As for the Strategic and Infrastructure Dimensions, the F-values were (2.841) and (1.906) at significance levels of (0.066) and (0.156), respectively, which are higher than 0.05, indicating no statistically significant differences between the groups in these two dimensions.

These results can be attributed to the fact that teachers with greater experience often possess cumulative skills and deeper practices in the field of data analysis and its educational applications, making them more capable of handling data in the context of digital education. This group may have gained extensive professional and practical experience over the years, which enhances their abilities in organizing and analyzing educational data, reflected in their higher mean scores in the Data Dimension.

On the other hand, the absence of statistically significant differences in the Strategic and Infrastructure Dimensions may be attributed to the fact that these aspects rely more heavily on the institutional and technological resources available in the educational environment, or on general training programs received by all teachers regardless of their years of experience. This limits the impact of practical experience in these dimensions and results in similar levels of practice across the different groups.

This result can be explained by the fact that the Strategic and Infrastructure Dimensions do not mainly depend on the teachers' personal or professional experience, but are more affected by external factors in the work environment, such as:

- **Availability of technical resources:** The presence of suitable devices, software, and internet networks within the educational institution, which directly influences teachers' ability to implement digital strategies and make use of the available infrastructure.
- **Institutional and organizational support:** Policies of the school or educational center, the existence of clear official plans and strategies supporting digital education, as well as continuous technical support.
- **Standardized training programs:** Most teachers receive similar training sessions or professional workshops regardless of their years of experience, which equalizes the level of practice in these two dimensions.

Consequently, this interplay of factors reduces the apparent effect of individual years of experience, leading to similar performance levels across the different groups in these dimensions.

2. Academic Qualification

No.	Questionnaire Domains	Academic Qualification	Sample Size	Mean	Standard Deviation	t-value	Significance Level
1	Strategic Dimension	Bachelor's Master's or higher	52 18	3.55 3.65	0.50 0.48	0.754	0.453
2	Data Dimension	Bachelor's Master's or higher	52 18	3.01 3.35	0.56 0.52	2.343	0.022
3	Infrastructure Dimension	Bachelor's Master's or higher	52 18	2.91 3.01	0.41 0.44	0.845	0.401

The results of the (t) test for differences between the means of early childhood teachers according to the variable of educational qualification (Bachelor's, Master's or higher) across the three questionnaire dimensions showed that there were statistically significant differences only in the Data Dimension, where the calculated t-value was (2.343) at a significance level of (0.022), which is less than 0.05. This indicates a statistically significant difference in favor of teachers holding a Master's degree or higher, whose mean score was (3.35) compared to (3.01) for those with a Bachelor's degree.

As for the Strategic and Infrastructure Dimensions, the t-values were (0.754) and (0.845) at significance levels of (0.453) and (0.401), respectively, which are greater than 0.05, indicating no statistically significant differences between the two groups in these dimensions.

These results can be attributed to the fact that teachers holding a Master's degree or higher often possess a deeper academic background and more advanced training in data analysis and its educational applications, making them more aware of the importance of educational data and more capable of handling it in the context of digital education. This group may have been exposed during their postgraduate studies to advanced courses or research and organizational experiences that emphasize the use of data in planning, decision-making, and improving educational performance, which is reflected in their higher mean scores in the Data Dimension.

On the other hand, the absence of statistically significant differences in the Strategic and Infrastructure Dimensions may be attributed to the fact that these aspects rely more heavily on the institutional and technological resources available in the educational environment, or on the general training that most teachers receive regardless of their academic qualification, which reduces the impact of the qualification in these dimensions.

This may be because these dimensions do not necessarily depend on academic qualifications, but are more influenced by the availability of technical resources in educational institutions and by general training programs accessible to all teachers, regardless of their qualification, resulting in relatively similar opportunities for practice between the two groups.

Conclusion

The study concluded that kindergarten teachers in the Arab community of the Northern Triangle in Israel demonstrate positive attitudes toward employing artificial intelligence applications for effective teaching in early childhood education. This trend reflects a growing awareness of the importance of leveraging these technologies to enhance the quality of the educational process and improve teaching effectiveness, particularly in terms of strategic planning and the implementation of digital learning activities.

The results also indicated that teachers' skills in analyzing and utilizing data for digital education are significantly influenced by their academic qualifications and years of experience. Teachers holding a master's degree or higher, and those with ten or more years of experience, outperformed their colleagues with a bachelor's degree or less experience in their ability to analyze educational data and make informed instructional decisions. This highlights the crucial role that academic and professional experience plays in enhancing teachers' competence in effectively employing artificial intelligence tools.

Conversely, the study found no statistically significant differences in the strategic and infrastructure dimensions, indicating that these aspects rely more heavily on institutional factors and the available educational environment, as well as the standardized training programs received by all teachers, regardless of their qualifications or practical experience. This underscores the importance of ongoing institutional support and the provision of adequate infrastructure to ensure the stability and effectiveness of digital educational integration.

Furthermore, the study emphasized the urgent need to enhance digital infrastructure in early childhood education institutions, alongside the development of specialized training programs designed to improve teachers' abilities in utilizing artificial intelligence technologies. This is particularly crucial in the areas of data analysis and its application in planning and instructional decision-making. Developing these skills is a key factor in maximizing the impact of artificial intelligence on educational outcomes and achieving effective and safe integration of these applications in classrooms, ultimately improving learning quality and enriching the educational experience for children in early childhood.

Recommendations

1. Enhance Digital Infrastructure: Early childhood education institutions should prioritize the development of robust digital infrastructure to support the effective integration of artificial intelligence applications in teaching and learning processes.
2. Specialized Teacher Training: Implement continuous and specialized training programs for kindergarten teachers, focusing on the practical use of artificial intelligence tools, data analysis, and data-driven decision-making to improve instructional outcomes.
3. Promote Data-Driven Practices: Encourage teachers to utilize educational data from AI applications to inform lesson planning, monitor individual student progress, and tailor activities to meet learners' needs, thereby strengthening the link between technology and pedagogical effectiveness.
4. Institutional Support: Establish ongoing institutional and technical support, including access to appropriate software, devices, and guidance, to ensure that all teachers, regardless of experience or academic

qualification, can effectively apply AI in the classroom.
5. Integration of AI in Curriculum Planning: Incorporate AI-related strategies and tools into curriculum design and assessment practices, ensuring that both strategic and operational aspects of teaching benefit from technological advancements.

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