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Assessing the prerequisites for integrating artificial intelligence in secondary education: Perspectives of teachers in Saudi Arabia

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ABSTRACT

This study investigates the essential prerequisites for the effective integration of artificial intelligence (AI) into secondary education in the Kingdom of Saudi Arabia, assessing the perceptions of both male and female educators. Employing a descriptive survey methodology, the primary data collection tool consists of questionnaires administered to 427 secondary school teachers in Riyadh. The findings reveal a notable average agreement level (mean score of 4.43) among participants concerning the identified prerequisites for implementing AI. Notably, students' requirements scored the highest (average of 4.51), followed closely by those for teachers (average of 4.48), the educational environment (average of 4.46), and educational content (average of 4.25). Each category demonstrates consistently high importance. Gender-based analysis indicates no statistically significant difference in determining prerequisites, except for those expected from teachers and the educational environment, which garnered preference from female educators. Similarly, no statistically significant variance emerged in the identification of prerequisites based on major. Regarding teaching experience, no statistically significant difference was found in determining prerequisites, except for requirements related to the educational environment, where educators with 10-15 years of experience exhibited a preference. The study concludes that qualification does not significantly impact the determination of prerequisites for AI in secondary education. This study offers useful insights into the perspectives and requirements of educators, providing detailed knowledge of the integration of artificial intelligence (AI) into secondary education in Saudi Arabia. It highlights important factors that need to be considered for the effective deployment of AI in education.

Contribution/ Originality: This study uniquely investigates AI integration in Saudi Arabian secondary education, analyzing perceptions of both male and female educators with a substantial sample size. It provides nuanced insights into prerequisites and preferences, filling a gap in understanding AI implementation in diverse educational contexts.

1. INTRODUCTION

The contemporary era is defined by remarkable scientific and technological progress, with technology playing vital roles in the daily lives of people worldwide. This progress encompasses various aspects, including electronic devices, communication networks, and advanced software utilizing diverse systems, such as artificial intelligence.

Artificial intelligence, an outcome of the Fourth Industrial Revolution, has captured considerable interest from organizations and nations alike. Numerous entities have embraced it as a pivotal strategy to augment their performance, and one of its promising applications lies within the domain of education. According to Cooper [1] artificial intelligence has already penetrated the educational landscape, witnessing the emergence of intelligent education systems [2, 3]. The ongoing development and implementation of these systems underscore a transformative trend in education, showcasing the potential for AI to revolutionize learning methodologies and outcomes.

The systematic integration of AI into education holds the potential to address pressing challenges, drive innovation in teaching and learning, and advance the Sustainable Development Goal. UNESCO [4] underscores the importance of AI deployment, aiming to augment human capabilities, safeguard human rights, and foster effective collaboration between humans and machines in life, learning, work, and development [5].

A significant positive impact of employing artificial intelligence applications in the educational process, as Khalida [6] suggests, is the streamlining of school administration tasks, the promotion of self-directed learning among students, and the reduction of teachers' burdens both inside and outside the classroom. Al-Saidi, et al. [7] predict that artificial intelligence technology will serve as an alternative to many of the efforts traditionally undertaken by teachers in the current educational landscape [8].

Anticipations are high for the education sector, with projections of approximately 48% growth in the artificial intelligence market in the near future. Artificial intelligence technology holds immense potential in education, offering enhanced learning opportunities and improved methods and strategies to achieve learning outcomes. Its application areas in education encompass optics, virtual reality, robotics, expert systems, and intelligent content [9].

Moreover, the significance of artificial intelligence was underscored at the European Union Summit held in Gothenburg, Sweden, in 2017. The summit was significant as it introduced the second digital education strategy, emphasizing the expected profound influence of artificial intelligence on teaching and learning processes in the future [10-12]. The event emphasized a forward-looking perspective, recognizing the transformative potential of artificial intelligence in shaping the landscape of education.

1.1. Study Problem

In recent years, the increasing impact of artificial intelligence on various aspects of life has prompted a call to leverage its potential in the realm of education. Recognizing the transformative successes of artificial intelligence in diverse fields, UNESCO [4] emphasizes that its application in education poses significant questions. These include considerations about what and how to teach, the evolving roles of educators, and the profound social and ethical implications of integrating artificial intelligence.

Johar, et al. [13] highlights the pervasive influence of the technological boom in education, necessitating a thoughtful approach. The Arab Foundation for Education, Science, and Arts (AFESA) conference in September 2022 advocated for heightened awareness among institutions about the positive impacts of artificial intelligence in teaching.

Alfaraj, et al. [14] underscore how artificial intelligence addresses computer-related challenges faced by learners. The study by Al-Talhi and Al-Amiri [15] recommends the Saudi Ministry of Education adopt artificial intelligence applications, though it acknowledges potential obstacles, as noted in the Amal and Tahrir [16] study, citing weak infrastructure.

Wardat, et al. [17] advocate for utilizing artificial intelligence to solve educational problems and expanding its applications to enhance student skills. Al-Kahlot and Al-Muqayd [18] study, focusing on smart learning in Palestinian universities, prioritizes curriculum elements and teacher involvement.

The importance of curricula in addressing artificial intelligence is stressed in Al-Bagzi [19] who recommends a reevaluation of school curricula to include relevant information technology. Al-Saidi, et al. [7] propose the development of electronic content covering artificial intelligence concepts and applications.

Emphasizing the pivotal role of teachers, AlAli, et al. [20] advocate for workshops to train teachers in employing artificial intelligence applications and building evaluation tools utilizing these technologies. Critical factors for successful implementation include providing a sufficient number of technical experts and individuals with strong computer skills, along with financial and moral incentives [21].

Addressing the practicalities, Al-Faqih and Al-Farni [22] stress the need for an adequate budget, equipment, and capabilities for employing artificial intelligence applications, coupled with awareness workshops on their importance in education.

In light of these insights, it is evident that artificial intelligence holds great potential for overcoming educational challenges and introducing innovative teaching practices. To fully capitalize on this, education systems must equip all stakeholders with the fundamental competencies and skills necessary for effective use. Prior to implementing artificial intelligence techniques in teaching, careful consideration of prerequisites is essential to overcome potential obstacles. This study aims to identify the specific requirements for integrating artificial intelligence in teaching at the secondary stage in the Kingdom of Saudi Arabia.

1.2. Study Questions

1. What are the prerequisites for incorporating artificial intelligence into teaching at the secondary stage in the Kingdom of Saudi Arabia, as perceived by teachers?
2. Do statistically significant differences exist in the identification of prerequisites for the integration of artificial intelligence into teaching at the secondary stage, based on variables such as gender, major, experience, and qualification?

1.3. Study Objectives

1. To ascertain the necessary conditions for integrating artificial intelligence into teaching at the secondary stage in the Kingdom of Saudi Arabia, as perceived by teachers.
2. To explore variations in the identification of these conditions based on the study's variables, including gender, major, experience, and qualification.

1.4. Importance of the Study

1. Alignment with Vision 2030: The study holds significance in aligning with the goals of Vision 2030 for the Kingdom, aiming to incorporate modern technologies into various aspects of life. By exploring the requirements for integrating artificial intelligence into secondary education, the research contributes to the realization of the Kingdom's vision for technological advancement.
2. Harnessing Artificial Intelligence: Recognizing the pivotal role of artificial intelligence as a leading modern technological trend, the study acknowledges its potential to serve societies. By understanding the prerequisites for utilizing artificial intelligence in education, the research addresses the imperative of leveraging cutting-edge technology for societal progress.
3. Secondary Stage Preparation: The study holds importance in the context of the secondary stage, emphasizing its role in preparing male and female students for university studies and entry into the labor market. This is consistent with the goals of the new secondary stage system, particularly the path system, emphasizing the importance of the study in influencing educational results and achieving wider societal objectives.

2. THEORETICAL FRAMEWORK

2.1. The Concept of Artificial Intelligence

According to the Saudi Data and Artificial Intelligence Authority (SDAIA) [23] artificial intelligence encompasses systems utilizing advanced technologies capable of gathering data and utilizing it to predict, recommend, or make decisions, exhibiting varying degrees of self-control. These systems are designed to choose optimal actions to achieve specific goals.

A broader perspective is offered by Nashwa [24] who defines artificial intelligence as the science concerned with creating electronic systems possessing intelligence akin to human cognitive abilities. This enables these systems to engage in critical thinking, decision-making, and subsequent actions aligned with the tasks assigned to them by Alneyadi and Wardat [25].

Nath and Manna [26] provide another definition, characterizing artificial intelligence as a branch of computer science that emphasizes the capacity of computers and robots to emulate human-like thinking, learning, and reasoning. It is a field that employs algorithms and other technologies to empower machines to analyze extensive data sets, identify patterns, and make informed decisions.

2.2. Artificial Intelligence Techniques

As outlined by the Saudi Data and Artificial Intelligence Authority (SDAIA) [23] artificial intelligence encompasses various technologies, with notable ones being:

1. Machine Learning:
- Supervised Learning: Establishing the relationship between inputs and outputs using user-labeled datasets.
- Unsupervised Learning: Extracting patterns from unlabeled datasets.
- Reinforcement Learning: Interacting with the environment through trial and error to achieve optimal results.
- Deep Learning: Employing neural networks with multiple layers to process data, whether directed, undirected, or to enhance human capabilities in task completion.

2. Natural Language Processing:
- Text Generation: Creating useful texts meeting specific requirements.
- Answering Questions: Automatically responding to user queries.
- Machine Translation: Translating texts into different languages.

3. Computer Vision:
- Object Recognition: Identifying objects in images or videos.
- People Recognition: Recognizing individuals through images, audio, or video.

4. Speech Processing:
- Speech-to-Text: Recognizing sounds and converting them to text.
- Text-to-Speech: Recognizing texts and converting them to sounds.

5. Robots:
- Industrial Robot: Used in industrial fields to automate processes.
- Service Robot: Employed in commercial or personal areas to complete specific tasks or services.

2.3. Components of Artificial Intelligence

- Knowledge Base: A self-service electronic library containing information necessary for system tasks, including (Frequently Asked Questions) FAQs, manuals, and troubleshooting guides, enabling the system to interact and respond to user input.
- Programmed Procedures: Involving deduction, induction, and deduction processes to simulate human intelligence and perform required tasks.

- User Interface: Facilitating interaction with the system [24].

Applications of Artificial Intelligence in Education: Nath and Manna [26] highlight diverse applications of artificial intelligence in education, including:

- Personalized Learning: Tailoring the learning experience for each student by analyzing strengths, weaknesses, and reactions to content.
- Intelligent Teaching Systems: Creating interactive and adaptive lesson systems to facilitate personalized learning at individual paces.
- Educational Games: Developing games that adapt to players' skill levels, enhancing engagement and effectiveness.
- Content Creation: Generating new educational content, such as quizzes and articles, to diversify and dynamically enhance educational materials.
- Automated Assessment: Automatically grading student work, allowing teachers more time for other tasks, and providing timely feedback.
- Predictive Analytics: Analyzing student data to make predictions about performance, aiding teachers in identifying and intervening with at-risk students before they fall behind.

2.4. Areas of Artificial Intelligence in Education

1. Artificial Intelligence for Education Management and Delivery:

- It involves leveraging AI to enhance the overall administration and delivery of education. This encompasses the management of schools, automation of basic tasks, monitoring of energy services, internet, and water connections, and facilitating better decision-making for educators and officials through the analysis of data based on machine learning principles.

2. Artificial Intelligence to Empower Teaching and Teachers:

- Focuses on using AI to support teachers by automating tasks such as grading tests, checking and analyzing homework, and organizing research. AI systems also aid in the development of educational procedures, upkeep of reports, production of presentations, and management of administrative chores in educational institutions, including schools, universities, and virtual classrooms..

3. Artificial Intelligence for Learning and Teaching Assessment:

- Encompasses the application of AI in assessing both learning and teaching. This involves utilizing algorithms to check and analyze assignments, grade tests, and organize research, thereby streamlining assessment processes and ensuring accuracy and efficiency.

4. Developing Values and Skills for the AI Age:

- Aims to equip students with the values and skills necessary to navigate life and work in the age of artificial intelligence. This could involve integrating AI-based learning tools and experiences into curricula to foster a deeper understanding of AI concepts and applications.

5. Artificial Intelligence to Provide Lifelong Learning Opportunities:

- Involves the use of AI to create opportunities for continuous learning throughout one's life. This could include personalized learning experiences, adaptive educational platforms, and AI-driven tools that cater to individual learning needs and preferences.

According to Iftikhar, et al. [27] these areas are further defined as follows:

- Managing Entire Schools and Automating Basic Tasks:
- It involves the use of technology and AI algorithms to monitor and manage various aspects of schools, such as energy services and internet connections. Additionally, AI supports teachers and education officials by analyzing data based on machine learning principles, enabling better-informed decision-making, efficient scheduling, and faster, more accurate organization of study programs.

- Occupation of AI Software Systems in Educational Tasks:
- AI software systems play a significant role in schools, universities, and virtual classrooms. They automate tasks such as creating educational processes, checking and analyzing homework, grading tests, organizing research, generating reports, creating presentations, and handling administrative duties. This integration aims to create a more quality and productive learning environment.

2.5. Bridging Students' Knowledge Gaps and Enhancing Learning

Utilizing smart programs, applications, and machine learning technologies addresses individual student needs by assessing their current skill levels, analyzing learning history, and identifying weaknesses. This adaptive learning process automates and guides the learning experience, tailoring it to the needs of individual students. It enhances teaching methods, sparks commitment to improvement, and fosters innovation. Intelligent content creation facilitates visual study environments, including 2D and 3D visualizations, providing a more comprehensive and faster comprehension of information.

2.6. Eliminating Language Barriers and Enhancing Communication

The integration of chatbots has proven effective, especially after the Covid-19 pandemic. Chatbots enhance classroom efficiency, facilitate communication between teachers and parents, and aid foreign students by providing translation services. Students may enhance their abilities and fix their deficiencies outside of the typical classroom environment by using the individualized learning experiences and interactive formats that online educational platforms provide. In the age of digital learning, AI-powered chatbots provide efficient communication and assistance.

2.7. Reducing Student Dropout and Controlling Cheating

Smart technologies play a role in monitoring student behavior, identifying patterns such as frequent absences, poor grades, and avoidance of extracurricular activities. This data's cognitive analysis supports measures aimed at preventing student dropout. AI is also employed in tests and interviews to detect suspicious behavior, monitoring students through webcams, microphones, and web browsers. This reduces cheating attempts and ensures test integrity.

2.8. Advantages of Using Artificial Intelligence in Education

1. Improving the Learning Experience:
- Adaptive learning enhances the experience by creating personalized educational content, offering guidance based on performance, and providing immediate assessment and feedback to teachers.
2. Analysis of Educational Data:
- AI analyzes educational data to track student progress, understand learning difficulties, and offer tailored educational recommendations.
3. Quality of Learning Improvement:
- AI improves the quality of learning by analyzing student performance, identifying errors, and providing recommendations and exercises for improvement.
4. Student Behavior Analysis:
- AI predicts academic success and failure through behavior analysis, offering appropriate support and educational advice to students.
5. Providing Linguistic Support:
- AI translates educational content into students' native languages, aiding understanding and comprehension.
6. Curriculum Development:

- AI analyzes data to determine effective curricula, identify factors affecting learning outcomes, and improve academic performance.

7. Self-Monitoring:

- Virtual agents provided by AI help learners analyze and rectify errors in their performance.

8. Developing Teaching Techniques:

- AI contributes to the development of smart teaching systems, presenting educational content in interactive and engaging ways.

9. Distance Education:

- AI facilitates effective communication between students and teachers, manages interactions, and analyzes relevant data.

10. Improving Educational Administration:

- AI enhances educational administration by analyzing data and providing recommendations to improve academic performance and develop educational programs.

11. Solutions for Special Cases:

- AI offers tailored solutions for students with learning difficulties or disabilities, significantly improving their educational experiences [24, 28].

2.9. Challenges of Artificial Intelligence in Education

1. Digitization of Educational Curricula and Distance Education:

- *Challenge:* Many education systems face difficulties in fully digitizing their curricula and implementing effective distance education.
- *Solution:* Develop strategies to enhance digitization efforts, invest in technological infrastructure, and provide training for educators to adapt to online teaching methodologies.

2. Weaknesses of Educational Systems and Policies:

- *Challenge:* The existing weaknesses in educational systems and policies pose obstacles to the seamless integration of artificial intelligence.
- *Solution:* Address systemic issues through comprehensive reforms, ensuring policies align with the evolving needs of technologically driven education.

3. Dominance of In-Person Education:

- *Challenge:* The prevailing dominance of traditional, in-person education hinders the widespread adoption of AI-driven educational solutions.
- *Solution:* Promote awareness and advocacy for the benefits of AI in education, encouraging institutions to embrace innovative approaches.

4. High Costs:

- *Challenge:* The implementation of artificial intelligence in education often requires significant financial investment.
- *Solution:* Explore cost-effective AI solutions, encourage collaborations, and seek funding sources to make these technologies more accessible.

5. Job Displacement and Increased Unemployment:

- *Challenge:* Integrating AI may automate tasks, potentially displacing jobs and increasing unemployment.
- *Solution:* Implement retraining programs to equip individuals with skills for the evolving job market and enact policies supporting a smooth transition.

6. Lack of Creativity in AI:

- *Challenge:* Artificial intelligence lacks the ability to think creatively or outside the predefined parameters.

- *Solution:* Add human creativity to AI applications, highlighting the cooperative role of AI in boosting rather than displacing creative thought.

7. Potential Laziness and Reduced Cognitive Engagement:

- *Challenge:* There is concern that overreliance on AI may lead to human complacency, reducing cognitive engagement and reliance on critical thinking skills.
- *Solution:* Promote a balanced approach to AI integration, emphasizing its role as a tool to enhance learning rather than replace human cognitive functions.

8. Limited Adaptability of Machines and Robots:

- *Challenge:* Machines and robots excel at tasks they are programmed for but struggle with tasks beyond their programming.
- *Solution:* Develop AI systems with enhanced adaptability and problem-solving capabilities, emphasizing versatility in learning and application.

9. Inability to Replace Human Connections:

- *Challenge:* Artificial intelligence (AI) cannot take the place of the social and emotional ties that underpin human civilization, no matter how far technology has progressed.
- *Solution:* Emphasize the importance of human interaction in education, utilizing AI as a complementary tool to enhance, not replace, interpersonal relationships.

In addressing these challenges, a comprehensive and collaborative approach is crucial to ensuring the responsible and effective integration of artificial intelligence in education [29].

This study was designed to investigate four aspects of the prerequisites essential for effectively incorporating artificial intelligence in the Kingdom of Saudi Arabia's secondary education, gauging perceptions from both male and female educators. These four aspects were as follows: Dimension 1: Requirements that must be met in educational content to use artificial intelligence. Dimension 2: Requirements that must be met by a teacher to use artificial intelligence. Dimension 3: Requirements that must be met by the learner to use artificial intelligence. Dimension 4: Requirements that must be met in the educational environment to use artificial intelligence. The aspects of the four dimensions are presented in the conceptual framework in Figure 1.

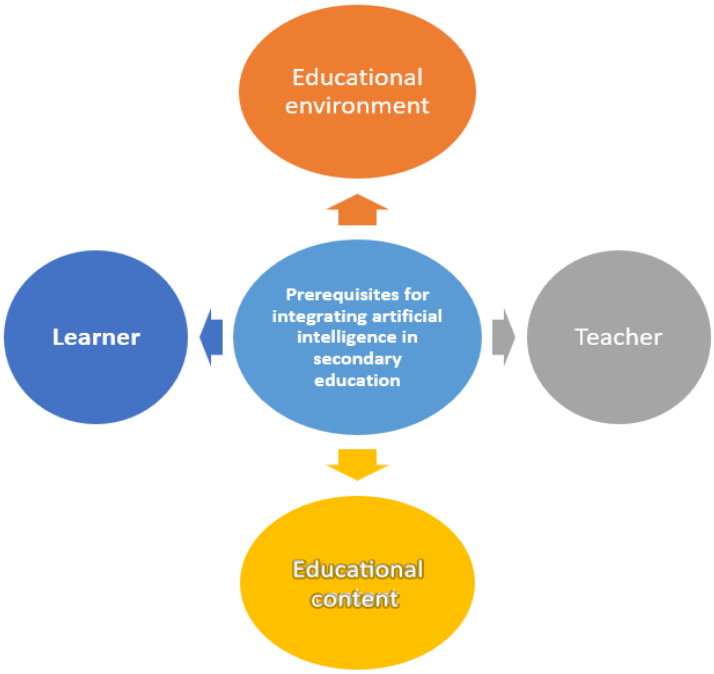

Figure 1. Conceptual framework of the investigation of four aspects of the prerequisites essential for effectively incorporating artificial intelligence in Kingdom of Saudi Arabia's secondary education.

3. LITERATURE REVIEW

UNESCO [30] aimed to illustrate the incorporation of artificial intelligence (AI) into global education, particularly focusing on developing countries and their role in achieving sustainable development goals. AI's potential contributions to personalized learning, better educational outcomes, increased access to education, collaborative learning environments, and the adoption of smart teaching systems were highlighted in the study's key findings, which were obtained through the use of an inductive, descriptive approach and content analysis based on the United Nations report for 2019 and discussions during Learning Week. The study recommended the widespread adoption of AI across all education levels.

In a similar vein, Naidoo, et al. [31] explored the impact of integrating a theoretical framework for AI in urban South African secondary schools. The research integrated the interactive communication model with the technology acceptance model to create a comprehensive theoretical framework. The results underscored the significance of information and communication technology in teaching, particularly when coupled with extensive teacher training. The study concluded that the integrated framework facilitates interactive blended learning, striking a balance between dynamism and equilibrium in the classroom. It further emphasized that any delay in AI implementation may impede meeting the daily and educational needs of digital learners.

Ryoo and Winkelmann [32] explored opportunities and challenges in using an innovative educational platform in Georgia. Examining a group of students, the study found that the platform enhanced teaching quality, self-learning, and student engagement. Students perceived virtual classrooms as comprehensive and time-efficient, with the platform saving teachers time and effort.

Chen et al.'s comprehensive review Chen, et al. [33] analyzed AI in education, highlighting a scarcity of research on deep learning techniques and their interaction with educational theories. Traditional AI techniques, especially natural language processing, were more commonly used. The study urged researchers to explore AI applications in real classrooms and understand detailed relationships between learners' responses and the required understanding within smart teaching systems.

Chiu and Chai [34] surveyed teachers' views on AI, focusing on curriculum planning in Hong Kong secondary schools. In order to efficiently organize and plan students' educational experiences, the study used four curriculum planning techniques and stressed the significance of combining these approaches with instructors' own motivations and attitudes.

Alonso [35] engaged secondary school students in Spain in interactive workshops using AI and the Scratch program. The study demonstrated the effectiveness of teaching through AI, highlighting students' problem-solving skills. The study concluded by proposing an organized circle between teachers and curriculum officials, encompassing preparation, content design, educational process design, development design, and reinforcement.

The study by Yoshida and Kiyuna [36] aimed to identify the requirements for implementing artificial intelligence applications in teaching at Saudi universities and to explore challenges perceived by experts. The study, which used a descriptive methodology and an electronic questionnaire to poll specialists, brought attention to the necessity of developing a thorough set of specifications for using artificial intelligence in education. The identified requirements fell into two dimensions: organizational, human, and financial aspects. The participants in the research strongly supported these requirements, with an average agreement of 4.58 out of 5.00. The research also discussed the difficulties Saudi universities have in implementing AI in the classroom, and the respondents (averaging 4.38 out of 5.00) firmly agreed with these difficulties. The study recommended the development of the educational environment in Saudi universities to facilitate the integration of artificial intelligence in the teaching process.

Malik, et al. [37] delved into the role of artificial intelligence in teaching, learning, and classrooms, exploring the expectations it holds for the future of education and the evolving roles of teachers. Utilizing a descriptive approach, the study concluded that artificial intelligence technology enhances education by providing a higher

degree of flexibility and customization previously unavailable. It envisions a revolution in schools and classrooms, streamlining various teacher tasks. The study predicts considerable changes in teacher duties, in line with the expected prominence of artificial intelligence technologies in the learning environment, while still recognizing the critical and analytical roles that instructors play.

In Salam and Muhammad [38] the focus was on understanding the applications, fields, and requirements of artificial intelligence in education, along with the ethical risks associated. Employing a descriptive approach and distributing questionnaires to faculty members in Egyptian universities, the study revealed a consensus on the necessity of leveraging artificial intelligence in education. It outlined detailed requirements for implementation, curriculum development, competency qualification, and risk mitigation. The study proposed recommendations, including the establishment of an Artificial Intelligence Ethics Center tasked with enacting legislation and controls for responsible and ethical use of artificial intelligence in education.

The study conducted by Al-Shibl [39] aimed to assess mathematics teachers' perceptions of the artificial intelligence (AI) approach in teaching and learning mathematics, along with identifying their views on the requirements for teaching mathematics through the AI approach. The researcher utilized a questionnaire consisting of two dimensions. The first dimension focused on teachers' perceptions towards teaching mathematics using AI, while the second dimension explored their views on the requirements for AI-based mathematics teaching. This included supporting the educational environment with AI components and employing the AI approach in lesson planning and implementation.

The study revealed that mathematics teachers' perceptions of teaching mathematics using the AI approach were moderate overall. However, their perceptions regarding the direction of using the AI approach were reported as high. On the other hand, their perceptions of the request to "support the school with AI and robotics devices and tools as educational resources to enrich learners" were found to be weak.

Statistically significant differences were observed at the 0.05 significance level between the perceptions of mathematics teachers in different general education stages. Middle school educators, those with a decade or more of experience, and those who had completed over fifteen training courses all expressed positive opinions. Both the overall questionnaire score and the attitude towards applying AI to mathematics instruction and learning made these disparities clear.

Interestingly, there were no statistically significant differences between teachers' perceptions of the requirements for teaching mathematics according to the AI approach. The study concluded with recommendations, including the implementation of AI-based techniques in teaching mathematics, which aligns with the strategic goals of the Kingdom's Vision 2030.

The study conducted by Ibrahim's [40] aimed to assess the extent to which artificial intelligence applications and ethics are incorporated into physics curricula for the secondary stage, focusing on physics books as the population for the study. The researcher employed the descriptive analytical method based on the content analysis approach. Content analysis was used as a unit of analysis to determine how extensively physics courses include applications of artificial intelligence and its ethics, ensuring stability and validity.

The results of the study highlighted weaknesses and shortcomings in the inclusion of applications of artificial intelligence and its ethics in physics courses at the secondary level. As a result, the researcher suggested that courses, especially those in physics, require the presentation of a vision for the integration of applications of artificial intelligence and its ethics.

Similarly, the study conducted by Ahmad, et al. [41] aimed to identify the degree to which concepts and applications of artificial intelligence are integrated into the content of computer and information technology curricula for middle and secondary levels in the Kingdom of Saudi Arabia. The descriptive approach, employing content analysis, was utilized for the study. A content analysis card was prepared, including five dimensions and 35

indicators, with a high reliability coefficient of 0.86. Computer and information technology books for middle and high school levels were analyzed accordingly.

The results indicated varying overall percentages of inclusion of concepts and applications of artificial intelligence in middle school books. For instance, the inclusion rates in the content of first-grade intermediate books reached 3.46%, 6.7% for the second intermediate grade, and 10% for the third intermediate grade. In the realm of computer books, the inclusion rates were 10% for information technology in the secondary stage and reached 18% in the content of computer books 1 and 3, while they reached 15% in the content of computer books 2.

The study recommended a reconsideration of the content of computer and information technology books for middle and secondary levels, emphasizing an increased focus on the inclusion of concepts and applications of artificial intelligence alongside Information and Communication Technology (ICT).

The study conducted by Al-Tuwaijri and Al-Nouh [42] aimed to identify the requirements for supporting administrative decision-making using artificial intelligence in the Ministry of Education in the Kingdom of Saudi Arabia. The study adopted a descriptive survey approach, utilizing interviews as a tool. Seventeen experts, including leaders in the Ministry of Education, university professors, and specialists in computer science and artificial intelligence, participated in the interviews. In order to determine the requirements for applying artificial intelligence across four aspects of the management decision-making process—defining the problem, obtaining data and analysis, identifying and choosing alternatives, and implementing and monitoring—the interview questions were created.

The study yielded several prominent results, highlighting the highest requirements in each dimension of the decision-making process. After identifying the problem, the highest requirements included raising the quality of available data and processing it, unifying the data and information center in the Ministry of Education, rebuilding the digital system and data center to ensure compatibility with artificial intelligence techniques, and employing specialized human expertise in building artificial intelligence systems.

After data was gathered and analyzed, the most stringent requirements included integrating the ministry's digital systems, turning on machines and sensors to gather data, connecting data and sharing it with pertinent government and private sector entities, and placing a strong emphasis on professional development to stay abreast of technological advancements.

In the dimension of identifying and selecting alternatives, the highest requirements involved re-engineering processes to align with artificial intelligence algorithms, transferring human experience to rule knowledge, and committing to the principles of ethics of artificial intelligence in the Kingdom of Saudi Arabia.

After decisions were put into action and followed up on, the study found that the most important things were to set up ways to test and measure how well artificial intelligence works, let intelligence programmes access data sources and the Ministry of Education's information centre, and make sure that data entry and follow-up were supervised.

In light of these results, the study proposed several recommendations to aid officials in the Ministry of Education in applying artificial intelligence techniques to support decision-making processes.

3.1. Comment on Previous Studies

The current study aligns with previous research in recognizing the significance of artificial intelligence in education. Like the majority of previous studies, it employs a descriptive approach, underscoring the importance of understanding and describing the phenomena related to the integration of artificial intelligence in educational settings. It is noteworthy that the studies by Alonso [35] deviate from the descriptive approach, utilizing an experimental method. This variation in methodology might contribute additional insights and perspectives to the existing body of knowledge.

A common focus among the studies is the interest in artificial intelligence within the general education stage, particularly at the secondary level. This commonality provides a comprehensive understanding of the implications and challenges associated with integrating artificial intelligence into educational practices. However, it's worth noting that the study by Ryoo and Winkelmann [32] deviates from this pattern by emphasizing higher education. This divergence in focus allows for a broader exploration of the applicability and impact of artificial intelligence across different educational levels.

While the current study shares common ground with previous research, it stands out in terms of its unique contributions. The definition of the study problem, the construction of the research tool, and the interpretation of results represent distinctive aspects where the current study diverges from its predecessors. These differences could offer fresh perspectives and novel insights, enriching the overall understanding of artificial intelligence in education. The uniqueness of these elements emphasizes the importance of considering the context and specific research objectives when conducting studies in this dynamic and evolving field.

4. METHODOLOGY

Study Population: The study population consisted of all secondary school teachers at the General Administration of Education in the city of Riyadh, numbering 17478 male and female teachers.

Study Sample: The researchers distributed the study tool to all members of the population via online links. The completed responses amounted to 427, which is a sufficient number according to the Morgan equation, determining the sample to be no less than 377 male and female teachers.

The characteristics of the study sample members can be explained according to their variables as follows:

- Gender: It is clear from Table 1 that 89% of the sample members were female, and 11% were male.

Table 1. Distribution of secondary school teachers by gender.

Gender	Frequency	Percent
Male	47	11
Female	380	89
Total	427	100

- Major: It is evident from Table 2 that 70.3% of the sample members majored in academic subjects, while 29.7% majored in general subjects.

Table 2. Distribution of secondary school teachers according to major.

Major	Frequency	Percent
Academic	300	70.3
General	127	29.7
Total	427	100

- Experience: It is clear from Table 3 that 86% of Teachers have more than (10) years of experience, 9.6% of them have less than (5) years of experience, and 4.4% of them have (5) - (10) years of experience.

Table 3. Distribution of secondary school teacher's experience.

Experience	Frequency	Percent
Less than (5) years	41	9.6
(5) - (10) years	19	4.4
More than (10) years	367	86
Total	427	100

- Qualification: It is clear from Table 4 that 72.8% of Teachers have bachelor's degrees, and 27.2% of them have postgraduate qualifications.

Table 4. Distribution of secondary school teachers' qualifications.

Qualifications	Frequency	Percent
Bachelor's	311	72.8
Graduate	116	27.2
Total	427	100

Study approach: Researchers devised a questionnaire targeting secondary school teachers to ascertain the prerequisites for integrating artificial intelligence into teaching at the secondary level in Saudi Arabia. Drawing from previous studies, theoretical frameworks, and their own expertise, they employed a five-point Likert scale for responses.

Validity of study tools: The questionnaire, in its initial form, consisted of the initial data of the respondents and included: (gender - major - experience - qualification). The questionnaire also included (42) items, divided into four areas: 1. Educational content: It consists of (11) paragraphs. 2. The teacher: It consists of (12) paragraphs. 3. Learner: It consists of (10) paragraphs. 4. The educational environment: It consists of (9) paragraphs. To ensure the validity of the tool, it was presented to a group of arbitrators specialized in curricula, teaching methods, and to evaluate educational techniques and ensure their suitability, the researchers assessed paragraphs based on arbitrators' feedback. Two phrases were removed, and wording in seven paragraphs was adjusted. To distribute study sample responses based on Likert scale arithmetic means, researchers calculated the scale's range (5-1 = 4) and determined category lengths by dividing the range by the number of categories (4/5 = 0.80). Subsequently, the following distribution was applied:

Table 5 presents the distribution of responses from secondary school teachers participating in the study based on the Likert scale arithmetic mean.

Table 5. Distribution of study secondary school teachers responses based on likert scale arithmetic mean.

Agreement degree	Average
Very high	4.20 – 5
High	3.40 – 4.19
Medium	2.60 – 3.39
Low	1.80 – 2.59
Very low	1 – 1.79

4.1. Internal Consistency Validity

To ascertain the internal consistency and validity of the tool, ensuring coherence between the Items within each questionnaire and its overall score, correlation coefficients between each Item and the total score of the questionnaire were calculated. The results are as follows:

Table 6. Correlation coefficients between each dimension item and the total score of its respective dimension.

No.	Correlation coefficients			
	Dimension 1	Dimension 2	Dimension 3	Dimension 4
1.	**0.766	**0.763	**0.824	**0.912
2.	**0.850	**0.787	**0.844	**0.937
3.	**0.833	**0.874	**0.837	**0.937
4.	**0.898	**0.895	**0.849	**0.917
5.	**0.915	**0.857	**0.884	**0.901
6.	**0.870	**0.906	**0.858	**0.899
7.	**0.874	**0.881	**0.944	**0.934
8.	**0.931	**0.902	**0.918	**0.904

No.	Correlation coefficients			
	Dimension 1	Dimension 2	Dimension 3	Dimension 4
9.	**0.875	**0.857	**0.944	**0.897
10.	**0.849	**0.818	**0.916	
11.		**0.779		

Note: (**) significant at 0.01.

It is clear from Table 6 that all correlation coefficients are statistically significant at the level of (0.01), which indicates internal consistency between the dimension items and the total score of the dimension.

Reliability of the study tool: The Reliability of the tool was calculated using the Cronbach alpha equation, and Table 7 shows the value of the reliability coefficient for each part of the questionnaire.

Table 7. Displays the reliability coefficient values for each dimension.

Dimensions	Reliability coefficient
Requirements that must be met in educational content to use artificial intelligence	0.962
Conditions that a teacher must meet in order to use artificial intelligence	0.960
Requirements that the learner must meet in order to use artificial intelligence	0.968
Requirements that must be met in the educational environment to use artificial intelligence	0.975
Over all dimensions	0.987

It is clear from Table 7 that the values of reliability coefficients are high, which indicates that the questionnaire has a high degree of reliability.

4.2. Data Analysis

The data were coded and analyzed using the statistical program SPSS. Various statistical methods were employed, including:

1. Calculating Cronbach's alpha coefficient to assess the instrument's reliability.
2. Determining the internal consistency of the study tool using the Pearson correlation coefficient.
3. Describing study individuals using frequencies and percentages.
4. Analyzing trends in sample responses using the arithmetic mean and standard deviation,
5. T-test to determine the statistical differences between two independent samples. 6. Kruskal-Wallis test to determine statistical differences. 7. Mann-Whitney test to determine the source of statistical differences.

5. RESULTS

The First Question: What are the requirements for using artificial intelligence in teaching the secondary stage in the Kingdom of Saudi Arabia from the point of view of teachers?

To answer this question, frequencies, percentages, arithmetic mean, standard deviation, and ranking were calculated for each item of the questionnaire and for each dimension separately. The results are clear in the following tables.

From Table 8, it is clear that the arithmetic mean of the first dimension Items reached (4.25), indicating a very high degree of agreement among the study sample members on the requirements that must be met in the educational content for using artificial intelligence. The items of highest agreement among the sample members are:

- The educational content provides the rules and ethics of dealing with artificial intelligence, with an arithmetic mean of (4.49), indicating a very high degree of approval.
- The educational content provides feedback to the learner, with an arithmetic mean of (4.34), indicating a very high degree of agreement.
- The content should be compatible with various artificial intelligence applications, with an arithmetic average of (4.33), indicating a very high degree of agreement.

Table 8. Teachers perceptions about the requirements that must be met in the educational content for using artificial intelligence.

No.	Items		Agreement degree					Mean	SD	Ranking
			Very high	High	Medium	Low	Very low			
1.	Provides digital educational content continuously to the learner.	F	201	148	39	26	13	4.16	1.02	8
		%	47.1	34.7	9.1	6.1	3			
2.	Flexibility of educational content.	F	206	124	27	20	20	4.11	1.10	10
		%	48.2	29	13.3	4.7	4.7			
3.	The educational content allows the learner to interact with it.	F	204	126	64	26	7	4.15	0.998	9
		%	47.8	29.5	15	6.1	1.6			
4.	The educational content should be designed to suit artificial intelligence.	F	244	92	59	25	7	4.26	1.01	5
		%	57.1	21.5	13.8	5.9	1.6			
5.	The presence of interactive instructions that enable the learner to deal with the educational content.	F	235	121	39	25	7	4.29	0.969	4
		%	55	28.3	9.1	5.9	1.6			
6.	The content must be compatible with various artificial intelligence applications.	F	265	84	46	19	13	4.33	1.03	3
		%	62.1	19.7	10.8	4.4	3			
7.	The educational content should be linked to multiple websites related to artificial intelligence.	F	240	90	58	26	13	4.21	1.08	6
		%	56.2	21.1	13.6	6.1	3			
8.	The existence of evaluation methods that are compatible with artificial intelligence.	F	233	115	28	38	13	4.21	1.09	7
		%	54.6	26.9	6.6	8.9	3			
9.	The educational content provides feedback to the learner.	F	251	104	46	19	7	4.34	0.952	2
		%	58.8	24.4	10.8	4.4	1.6			
10.	The educational content provides the rules and ethics of dealing with artificial intelligence.	F	285	83	46	13	0	4.49	0.806	1
		%	66.7	19.4	10.8	3	0			
Overall arithmetic mean = 4.25, overall standard deviation = 0.873										

5.1. While the Least Agreed-Upon Items from Sample Members Were

- Continuous provision of digital educational content for the learner, with an arithmetic mean of (4.16), indicating a high degree of agreement.
- The educational content allows the learner to interact with it, with an arithmetic mean of (4.15), indicating a high degree of agreement.
- Flexibility of educational content, with an arithmetic mean of (4.11), indicating a high degree of agreement.

Second: The requirements that must be met by the teacher to use artificial intelligence are:

Table 9. Teachers' perceptions on the requirements for utilizing artificial intelligence in teaching.

No.	Items		Agreement degree					Mean	SD	Ranking
			Very high	High	Medium	Low	Very low			
1.	Possessing advanced skills for utilizing technology in education.	F	209	146	66	6	0	4.30	0.779	11
		%	48.9	34.2	15.5	1.4	0			
2.	Considering the ethical aspects of employing artificial intelligence.	F	285	109	27	6	0	4.57	0.675	2
		%	66.7	25.5	6.3	1.4	0			
3.	Having suitable electronic devices for utilizing artificial intelligence.	F	266	95	39	20	7	4.38	0.948	10
		%	62.3	22.2	9.1	4.7	1.6			
4.	Conducting workshops to elucidate systems for integrating artificial intelligence into teaching.	F	297	76	28	19	7	4.49	0.920	5
		%	69.6	17.8	6.6	4.4	1.6			

No.	Items		Agreement degree					Mean	SD	Ranking
			Very high	High	Medium	Low	Very low			
5.	Training teachers in the utilization of artificial intelligence for teaching.	F	295	85	21	12	14	4.48	0.955	6
		%	69.1	19.9	4.9	2.8	3.3			
6.	Proficiency in handling applications of artificial intelligence.	F	276	92	39	13	7	4.44	0.900	8
		%	64.6	21.5	9.1	3	1.6			
7.	Ability to authenticate the reliability of electronic information.	F	274	98	42	6	7	4.46	0.853	7
		%	64.2	23	9.8	1.4	1.6			
8.	Understanding the concept of artificial intelligence.	F	310	70	41	6	0	4.60	0.719	1
		%	72.6	16.4	9.6	1.4	0			
9.	Familiarity with the roles of both teachers and learners in the utilization of artificial intelligence.	F	270	91	47	19	0	4.43	0.857	9
		%	63.2	21.3	11	4.4	0			
10.	Establishing material and moral incentives for exceptional teachers employing artificial intelligence.	**F**	303	71	40	13	0	4.55	0.786	3
		%	71	16.6	9.4	3	0			
11.	Providing feedback to learners.	**F**	278	110	33	6	0	4.54	0.698	4
		%	65.1	25.8	7.7	1.4	0			
Overall arithmetic mean = 4.48, overall standard deviation = 0.703										

From Table 9, it is evident that the arithmetic mean of the first dimension Items reached (4.48), indicating a very high degree of agreement among the study sample members on the requirements that must be met by the teacher to use artificial intelligence. The sample members have the highest agreement on the following items:

Knowledge of the concept of artificial intelligence, where the arithmetic mean reached (4.60), indicating a very high degree of agreement.

- Taking into account the ethics of using artificial intelligence, an arithmetic mean of (4.57), indicates a very high degree of approval.
- Establishing material and moral incentives for distinguished teachers in employing artificial intelligence in teaching, with an arithmetic average of (4.55), indicates a very high degree of approval.

While the least agreed-upon Items from sample members were:

- Understanding the roles of the teacher and the learner in utilizing artificial intelligence has an arithmetic mean of (4.43), reflecting a very high level of agreement.
- Having electronic devices suitable for implementing artificial intelligence, has an arithmetic mean of (4.38), indicating a very high level of approval.
- Possessing advanced skills to utilize technology in education, with an arithmetic mean of (4.30), indicates a very high level of approval.

Third: The conditions that the learner must fulfill in order to use artificial intelligence:

Table 10. Teachers perceptions on the requirements that learners must fulfill to use artificial intelligence.

No.	Items		Agreement degree					Mean	SD	Ranking
			Very high	High	Medium	Low	Very low			
1.	Ability to verify the reliability of electronic information.	F	256	118	33	20	0	4.29	0.825	10
		%	60	27.6	7.7	4.7	0			
2.	Consideration of ethical aspects in using artificial intelligence.	F	317	83	14	13	0	4.64	0.690	1
		%	74.2	19.4	3.3	3	0			
3.	Effective time management skills.	F	269	112	33	13	0	4.49	0.767	5
		%	63	26.2	7.7	3	0			
4.	Providing students with training on interacting with artificial intelligence applications.	F	301	85	28	13	0	4.57	0.747	2
		%	70.5	19.9	6.6	3	0			
5.	Possession of a suitable device for interacting with artificial intelligence.	F	304	83	20	20	0	4.57	0.788	3
		%	71.2	19.4	4.7	4.7	0			
6.	Efficient handling of devices used in the educational process.	F	276	98	27	26	0	4.46	0.861	8
		%	64.6	23	6.3	6.1	0			
7.	Expertise in dealing with artificial intelligence applications.	F	288	79	33	27	0	4.47	0.886	7
		%	67.4	18.5	7.7	6.3	0			
8.	Understanding the concept of artificial intelligence.	F	303	77	14	33	0	4.52	0.883	4
		%	71	18	3.3	7.7	0			
9.	Understanding the roles of both the teacher and the learner in the context of artificial intelligence.	F	284	90	33	20	0	4.49	0.829	6
		%	66.5	21.1	7.7	4.7	0			
10.	Capability to communicate electronically with teachers and colleagues.	F	283	78	39	27	0	4.44	0.900	9
		%	66.3	18.3	9.1	6.3	0			
Overall arithmetic mean = 4.51, overall standard deviation = 0.723										

From Table 10, it is clear to us that the arithmetic mean of the first dimension Items reached (4.51), meaning the study sample members showed a very high level of agreement on the requirements for learners to use artificial intelligence. The items with the highest agreement among the sample members include:

- Considering the ethics of using artificial intelligence, an arithmetic mean of (4.64), indicating very high approval.
- Providing training to students on how to interact with artificial intelligence applications, has an arithmetic mean of (4.57), indicates very high approval.
- Having a suitable device for interacting with artificial intelligence has an arithmetic mean of (4.57), indicating very high approval.

On the other hand, the items with the least agreement among sample members were:

- The ability to efficiently handle the devices used has an arithmetic mean of (4.46), indicating a slightly lower degree of agreement.

The agreement is very high. • The ability to communicate electronically with the teacher and colleagues, where the arithmetic mean was (4.44), meaning that the degree of agreement is very high. • The ability to verify the reliability of electronic information, as the arithmetic average reached (4.29), meaning that the degree of agreement is very high.

Fourth: The requirements that must be met in the educational environment to use artificial intelligence:

From Table 11, it is evident that the arithmetic mean of the Items in the first dimension was (4.46), indicating a very high degree of agreement among the study sample members on the requirements that must be met in the educational environment for the use of artificial intelligence. The items of highest agreement among the sample members are:

- The presence of a wireless network in schools is available to the teacher and learner, with an arithmetic mean of (4.63), indicating a very high degree of agreement.
- Developing learning management systems specifically for artificial intelligence has an arithmetic average of (4.58), indicating a very high degree of approval.
- Providing suitable and sufficient equipment for teachers and learners, with an arithmetic mean of (4.56), indicating a very high degree of agreement.

Table 11. Teachers' perceptions about the requirements that must be met in the educational environment to use artificial intelligence.

No.	Items		Agreement degree					Mean	SD	Ranking
			Very high	High	Medium	Low	Very low			
1.	The presence of a wireless network in schools makes it available to both teachers and learners.	F	347	46	7	13	14	4.63	0.917	1
		%	81.3	10.8	1.6	3	3.3			
2.	Providing appropriate and sufficient devices for both teachers and learners.	F	336	50	0	27	14	4.56	1.01	3
		%	78.7	11.7	0	6.3	3.3			
3.	Developing learning management systems tailored for artificial intelligence.	F	329	51	27	6	14	4.58	0.921	2
		%	77	11.9	6.3	1.4	3.3			
4.	Designing specialized educational applications.	F	257	97	39	20	14	4.31	1.03	8
		%	60.2	22.7	9.1	4.7	3.3			
5.	The availability of an electronic library.	F	250	90	60	6	21	4.26	1.07	9
		%	58.5	21.1	14.1	1.4	4.9			
6.	Providing a technical support team around the clock.	F	289	84	27	13	14	4.45	0.976	6
		%	67.7	19.7	6.3	3	3.3			
7.	Encouragement and support from officials for the use of artificial intelligence.	F	276	90	34	6	21	4.39	1.03	7
		%	64.6	21.1	8	1.4	4.9			
8.	Financial support for integrating artificial intelligence into teaching.	F	304	76	14	19	14	4.49	0.989	5
		%	71.2	17.8	3.3	4.4	3.3			
9.	Establishing regulations and guidelines for the use of artificial intelligence.	F	317	63	14	19	14	4.52	0.988	4
		%	74.2	14.8	3.3	4.4	3.3			
		%	347	46	7	13	14			
Overall arithmetic mean = 4.46, overall standard deviation = 0.910										

5.2. While the Least Agreed-Upon Items from Sample Members Were

- Designing special educational applications has an arithmetic mean of (4.31), indicating a very high degree of approval.
- Designing special educational applications has an arithmetic mean of (4.26), indicating a very high degree of approval.

Table 12. Dimensions ranking.

No.	Dimensions	Mean	SD	Ranking
1.	Requirements that must be met in educational content to use artificial intelligence.	4.25	0.873	4
2.	Requirements that must be met by a teacher to use artificial intelligence.	4.48	0.703	2
3.	Requirements that must be met by the learner to use artificial intelligence.	4.51	0.723	1
4.	There are requirements that must be met in the educational environment to use artificial intelligence.	4.46	0.910	3
Dimensions mean = 4.43, Dimensions SD= 0.742				

5.3. Arrangement of Questionnaire Dimensions

From Table 12, it is evident that the questionnaire axes among the sample members are arranged in the following order:

1. The requirements that must be met by the learner to use artificial intelligence have an arithmetic average of (4.51), indicating a very high level of agreement.
2. The requirements that must be met by the teacher to use artificial intelligence, where the arithmetic mean is (4.48), suggest a very high level of agreement.
3. The requirements that must be met in the educational environment to use artificial intelligence have an arithmetic mean of (4.46), indicating a very high level of agreement.
4. The requirements that must be met in the educational content for using artificial intelligence have an arithmetic average of (4.25), indicating a very high level of agreement.

The overall arithmetic mean of (4.43) shows a very high level of agreement among the study sample members with the questionnaire Items.

6. DISCUSSION

6.1. Discussion and Interpretation of Results for the First Question

The examination of the participants' answers to the different aspects of the questionnaire reveals a notably strong consensus regarding the necessary conditions for integrating artificial intelligence into educational content, teacher responsibilities, learner involvement, and the educational setting. This alignment with the findings of previous studies, including Salam and Muhammad [38] and Al-Tuwaijri and Al-Nouh [42] underscores a consensus among target groups regarding the necessary requirements for integrating artificial intelligence into education.

This collective agreement aligns with the global trend observed in the Kingdom of Saudi Arabia and Vision 2030, emphasizing the optimization of artificial intelligence in education and learning and the enhancement of human capital. It is also consistent with the recommendations of UNESCO [30] which stressed the imperative of harnessing artificial intelligence applications in education and fulfilling the associated requirements. The result reflects the palpable advancements in educational technologies grounded in artificial intelligence. The Ministry of Education in the Kingdom of Saudi Arabia's proactive efforts to develop curricula and infuse them with artificial intelligence technologies showcase a commitment to keeping pace with the profound technical advancements and innovations characterizing the Fourth Industrial Revolution [43].

The demonstrated consensus on these requirements underscores their critical importance in contemporary education, particularly considering the transformative impact of the Fourth Industrial Revolution on global education systems.

Table 13. T-test to identify differences in teachers' perceptions based on gender.

Dimensions	Gender	Mean	SD	Freedom	T	Sig.
Requirements that must be met in educational content to use artificial intelligence.	Male	4.20	0.923	425	- 0.424	0.672
	Female	4.26	0.868			
Requirements that must be met by a teacher to use artificial intelligence.	Male	4.22	0.952	425	- 2.65	*0.008
	Female	4.51	0.660			
Requirements that must be met by the learner to use artificial intelligence.	Male	4.43	0.847	425	- 0.754	0.451
	Female	4.52	0.707			
There are requirements that must be met in the educational environment to use artificial intelligence.	Male	4.22	1.30	425	- 1.40	0.049
	Female	4.50	0.846			

Note: (*) significant at 0.05.

The examination of Table 13 yields the following insights:

Educational Content Requirements:

- No statistically significant differences were found in the responses of the sample members regarding the requirements for educational content when using artificial intelligence. The T coefficient of (-0.424) at a degree of freedom of 425 and a significance level of 0.672 is greater than 0.05.

Teacher Requirements:

- Statistically significant differences exist in the responses of the sample members regarding the requirements for teachers to use artificial intelligence, particularly favoring females. The T coefficient of (-2.65) at a degree of freedom of 425 and a significance level of 0.008 is smaller than 0.05.

Learner Requirements:

- There are no statistically significant differences in the responses of the sample members regarding the requirements for learners to use artificial intelligence. The T coefficient of (-0.754) at a degree of freedom of 425 and a significance level of 0.451 is greater than 0.05.

Educational Environment Requirements:

- Statistically significant differences are observed in the responses of the sample members concerning the requirements for the educational environment to use artificial intelligence, particularly benefiting females. The T coefficient of (-1.40) at a degree of freedom of (425) and a significance level of (0.049) is smaller than (0.05).

These statistical results tell us a lot about the complicated opinions of the sample members. They show us exactly where people have very different ideas, especially when it comes to teacher and school environment requirements that favour female teachers. These findings contribute to a deeper understanding of the gender dynamics in the perception of artificial intelligence integration in education.

- T-test to determine the statistical differences of the dimensions with respect to the major variable:

Table 14. T-test differences between the responses of secondary school teachers based on the major variable.

Dimensions	Major	Mean	SD	Freedom	T	Sig.
Requirements that must be met in educational content to use artificial intelligence.	Academic	4.22	0.917	425	-1.24	0.215
	General	4.34	0.755			
Requirements that must be met by a teacher to use artificial intelligence.	Academic	4.46	0.759	425	- 0.63	0.528
	General	4.51	0.549			
Requirements that must be met by the learner to use artificial intelligence.	Academic	4.51	0.787	425	- 0.054	0.957
	General	4.51	0.544			
There are requirements that must be met in the educational environment to use artificial intelligence.	Academic	4.43	1.02	425	- 1.17	0.239
	General	4.54	0.534			

Note: (*) significant at 0.05.

6.2. T-test Analysis for Experience Variable

Upon conducting a T-test to determine statistical differences in the responses based on the experience variable, the results are outlined below (referencing Table 14):

Educational Content Requirements:

- No statistically significant differences are observed in the responses of the sample members concerning the requirements for educational content when using artificial intelligence. The T-coefficient reached (-1.24) at a degree of freedom (425) and a significance level (0.215), which is greater than (0.05).

Teacher Requirements:

- Similarly, there are no statistically significant differences in the responses related to the requirements for teachers to use artificial intelligence. The T-coefficient reached (-0.632) at a degree of freedom of (425) and a significance level (0.528), which is greater than (0.05).

Learner Requirements:

- No statistically significant differences are noted in the responses of the sample members regarding the requirements for learners to use artificial intelligence. The T-coefficient reached (-0.054) at a degree of freedom of (425) and a significance level (0.957), which is greater than (0.05).

Educational Environment Requirements:

- The analysis indicates no statistically significant differences in the responses regarding the requirements for the educational environment to use artificial intelligence. The T-coefficient reached (-1.17) at a degree of freedom of (425) and a significance level (0.239), which is greater than (0.05).

These outcomes suggest a consistent perception of the requirements for incorporating artificial intelligence in education among participants, irrespective of their experience levels.

- Kruskal-Walli's test to determine statistical differences regarding the experience variable:

Table 15. Kruskal-Wallis test statistical differences in responses among secondary school teachers based on experience variable.

Dimensions	Experience	N	Ranking average	Qi square	Freedom	Sig.
Requirements that must be met in educational content to use artificial intelligence.	Less than (5) years	41	226.95	0.626	2	0.731
	(5) - (10) years	19	221.76			
	More than (10) years	367	212.15			
conditions that a teacher must meet in order to use artificial intelligence	Less than (5) years	41	215.15	1.29	2	0.522
	(5) - (10) years	19	244.82			
	More than (10) years	367	212.28			
Requirements that must be met by the learner to use artificial intelligence.	Less than (5) years	41	193.22	2.26	2	0.322
	(5) - (10) years	19	240.71			
	More than (10) years	367	214.94			
There are requirements that must be met in the educational environment to use artificial intelligence.	Less than (5) years	41	199.77	7.66	2	*0.022
	(5) - (10) years	19	284.26			
	More than (10) years	367	211.95			

Note: (*) significant at 0.05.

The results from Table 15 indicate the following:

Educational Content Requirements:

- There are no statistically significant differences in the responses of the sample members regarding the requirements for educational content when using artificial intelligence. The chi-square coefficient reached (0.626) at a degree of freedom of (2) and a significance level of (0.731), which is greater than (0.05).

Teacher Requirements:

- Similarly, there are no statistically significant differences in the responses of the sample members regarding the requirements for teachers to use artificial intelligence. The chi-square coefficient reached (1.29) at a degree of freedom of (2) and a significance level of (0.522), which is greater than (0.05).

Learner Requirements:

- No statistically significant differences are noted in the responses of the sample members regarding the requirements for learners to use artificial intelligence. The chi-square coefficient reached (2.26) at a degree of freedom of (2) and a significance level of (0.322), which is greater than (0.05).

Educational Environment Requirements:

- There are statistically significant differences in the responses of the sample members regarding the requirements for the educational environment to use artificial intelligence. The chi-square coefficient reached (7.66) at a degree of freedom of (2) and a significance level of (0.022), which is smaller than (0.05).

To delve deeper into the source of these differences, the Mann-Whitney test was conducted. The analysis revealed statistically significant differences between those with less than (5) years of experience and those with (5) - (10) years of experience, in favor of the latter. Moreover, statistically significant differences were observed between those with (5) - (10) years of experience and those with more than (10) years of experience, again favoring the (5) - (10) years of experience group, as illustrated in Table 16.

Table 16. The Mann-Whitney test, indicating the differences in responses among secondary school teachers based on the experience variable.

Dimension	Experience	Mean	Ranking total	Mann-Whitney	Sig.
Requirements that must be met in the educational environment to use artificial intelligence.	Less than (5) years	41	27.10	*0.015	*0.015
	(5) - (10) years	19	37.84		
	(5) - (10) years	19	256.42	*0.007	*0.007
	More than (10) years	367	190.24		

Note: (*) significant at 0.05.

- T-test to determine the statistical differences of the dimensions with respect to the qualification variable:

Table 17. T-test of differences between the responses of secondary school teachers based on the qualification variable.

Dimensions	Qualifications	Mean	SD	Freedom	T	Sig.
Requirements that must be met in educational content to use artificial intelligence.	Bachelor's	4.22	0.910	425	-1.3	0.183
	Postgraduate	4.35	0.761			
Requirements that must be met by a teacher to use artificial intelligence.	Bachelor's	4.44	0.733	425	-1.62	0.104
	Postgraduate	4.57	0.610			
Requirements that must be met by the learner to use artificial intelligence.	Bachelor's	4.52	0.769	425	0.843	0.400
	Postgraduate	4.46	0.580			
There are requirements that must be met in the educational environment to use artificial intelligence.	Bachelor's	4.49	0.901	425	0.984	0.326
	Postgraduate	4.39	0.935			

The outcomes from Table 17 reveal the following:

Educational Content Requirements:

- No statistically significant differences exist in the responses of the sample members regarding the requirements for educational content when using artificial intelligence. The T-coefficient reached (-1.33) at a degree of freedom of (425) and a significance level (0.183), which is greater than (0.05).

Teacher Requirements:

- Similarly, there are no statistically significant differences in the responses of the sample members regarding the requirements for teachers to use artificial intelligence. The T-coefficient reached (-1.62) at a degree of freedom of (425) and a significance level (0.104), which is greater than (0.05).

Learner Requirements:

- No statistically significant differences are noted in the responses of the sample members regarding the requirements for learners to use artificial intelligence. The T-coefficient reached (0.843) at a degree of freedom of (425) and a significance level of (0.400), which is greater than (0.05).

Educational Environment Requirements:

- Similarly, there are no statistically significant differences in the responses of the sample members regarding the requirements for the educational environment to use artificial intelligence. The T-coefficient reached (0.984) at a degree of freedom of (425) and a significance level (0.326), which is greater than (0.05).

These results suggest that the varying levels of teaching experience do not significantly impact the perceived requirements for utilizing artificial intelligence in teaching.

6.3. Discussion and Interpretation of Results for the Second Question

The findings from the second question analysis reveal several noteworthy observations.

1. Gender-Based Differences:

- The statistical analysis indicates no significant differences in responses related to gender concerning the requirements in educational content and for the learner when utilizing artificial intelligence. However, there are significant variations in responses regarding the prerequisites for teachers and the educational environment, favoring females. This discrepancy might be attributed to the heightened demand for these prerequisites, particularly among female teachers. The prevalence of females in the teaching profession at the secondary level in Riyadh, coupled with a higher concentration of female-only secondary schools, may potentially lead to a heightened need for these particular qualifications.

2. Major Variable:

- The results highlight no statistically significant differences in responses among sample members concerning the requirements in educational content, the learner, the teacher, and the educational environment based on the major variable. This suggests a consistent acknowledgment of the necessity to integrate artificial intelligence across various majors for teaching the secondary stage.

3. Experience Variable:

- No statistically significant differences were observed in responses related to the requirements in educational content, the learner, and the teacher based on the experience variable. However, there are significant differences in responses regarding the requirements for the educational environment. Participants with (5) - (10) years of experience favored certain prerequisites over those with less than (5) years of experience. Notably, individuals with (5) - (10) years of experience demonstrated a higher preference compared to those with more than (10) years of experience. This could be attributed to the extensive exposure of the former group to the educational environment, allowing them to witness developments in curricula, particularly in response to the integration of artificial intelligence.

4. Qualification Variable:

- Results indicate no statistically significant differences in responses concerning the requirements for educational content, the learner, the teacher, and the educational environment based on the qualification

variable. This uniformity may stem from the early stages of artificial intelligence adoption in the field of education, where technical innovation is still in its initial phases.

7. LIMITATIONS

1. Objective Limitations:

- The study focuses on the requirements for using artificial intelligence in teaching the secondary stage, specifically in the areas of educational content, teachers, learners, and the educational environment.

2. Spatial Boundaries:

- The research is confined to secondary schools within the General Administration of Education in the city of Riyadh, establishing specific spatial boundaries for the study.

3. Time Limits:

- The study is limited to the academic year 2023/2024, providing a specific timeframe within which the research is conducted.

7.1. Terminology of the Study

Requirements for Using Artificial Intelligence:

- The term is operationally defined as the essential components necessary for the effective utilization of artificial intelligence in teaching the secondary stage. These components are deemed crucial in shaping the educational content, guiding the teacher-student dynamic, and fostering an optimal educational environment. The study's focus encompasses the procedural definition of these requirements across various dimensions of the educational process.

8. RECOMMENDATIONS

In light of the study's findings, the researchers propose the following recommendations:

1. Provide Necessary Programs for Teacher Qualification:

- Implement programs aimed at qualifying and training teachers to enhance their skills and augment their experience and knowledge in applying artificial intelligence to teaching.

2. Develop a System of Incentives:

- Establish a system of material and moral incentives to boost teachers' engagement with artificial intelligence techniques in teaching.

3. Enhance Curricular Content:

- Develop and enhance the content of secondary-level curricula to better support the integration of artificial intelligence in learning.

4. Cultivate Awareness and Ethics:

- Disseminate a culture of using artificial intelligence ethically in education among various stakeholders, including parents, school administrators, teachers, students, and school counselors.

5. Allocate Adequate Budget for Educational Environment:

- Set aside enough money to build an educational setting that is compatible with contemporary software, which is necessary for integrating artificial intelligence into the teaching process. This should include provisions for periodic maintenance of devices and Internet communication networks.

9. SUGGESTIONS

The researchers also suggest exploring further studies in the field, such as:

1. Requirements for the using Artificial Intelligence in Primary Education.
2. The Level of Artificial Intelligence Usage among Secondary School Teachers.

3. The Effectiveness of Artificial Intelligence Applications in Teaching Specific Courses at the Secondary Level.

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