تجربة استخدام الذكاء الاصطناعي في المجال التعليمي في اليابان وآليات الاستفادة منها في دول الخليج العربي

The Experience of Using Artificial Intelligence in the Educational Field in Japan and the Mechanisms for Benefiting from it in the Arab Gulf Countries

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الملخص:

إن وجود الذكاء الاصطناعي يعمل كقوة تحويلية في أنظمة التعلم العالمية من خلال إنشاء أساليب تعليمية قابلة للتكيف وتحسين ممارسات الإدارة مع تعزيز فرص الوصول. وتُظهِر اليابان أمثلة جيدة لكيفية تكامل تقنية الذكاء الاصطناعي مع التعلم من خلال وجود برامج تتكيف مع مسار المتعلمين، والتدريب الشخصي القائم على الذكاء الاصطناعي، ونموذج التنبؤ الذكي. وهناك العديد من المزايا لاستخدام الذكاء الاصطناعي في التعليم، مثل تعزيز انتباه الطلاب وتقديم المحتوى بشكل فعال. وتضمن تقنية الذكاء الاصطناعي حل مشكلات خصوصية البيانات، وتقليل التحيزات الخوارزمية، وتعريف الموظفين باستيعاب أنظمة الذكاء الاصطناعي في المؤسسة. وقد اكتسبت الحلول القائمة على الذكاء الاصطناعي اعترافًا من منطقة الخليج العربي والمملكة العربية السعودية والإمارات العربية المتحدة، مما أدى إلى تنفيذ سياسات الذكاء الاصطناعي لتكوين هذه الحلول. وينبغي لمنطقة الخليج أن تتعلم من اليابان من خلال إنشاء استراتيجيات الذكاء الاصطناعي التي تنطوي على الاستثمار في الشبكات الرقمية ومبادرات تدريب المعلمين ومبادئ الذكاء الاصطناعي الأخلاقية وإنشاء برامج مشتركة بين القطاعين الحكومي والخاص. ويخلق الذكاء الاصطناعي حلولاً تعليمية تحل القضايا النظامية مع استيعاب متطلبات الطلاب المختلفة وتحسين الأنظمة الإدارية. ومن خلال التنفيذ المخطط له جيدًا لأنظمة الذكاء الاصطناعي التشغيلية، ستحقق دول الخليج نظامًا تعليميًا قويًا قائمًا على الذكاء الاصطناعي مع أداء مؤسسي ونتائج تعليمية أفضل. ويشكل التحديث التعليمي الناجح في اليابان مثالاً على كيفية دعم أنظمة الذكاء الاصطناعي للتحول التعليمي من أنظمة التعلم التقليدية إلى أنظمة التعلم الحديثة. وتنجح منطقة الخليج في إيجاد الحلول وتوليد إمكانيات تعليمية للابتكار من خلال تنفيذ استراتيجيات قائمة على الذكاء الاصطناعي.

Abstract:

The presence of Artificial Intelligence (AI) serves as a transformative power in worldwide learning systems by creating adaptive educational methods and improving administration practices while enhancing accessibility opportunities. Japan demonstrates good examples of how AI technology can complement learning by having software that adjusts to the learners' course, AI-based personal coaching, and an intelligent forecast model. There are numerous advantages to using AI in instruction, such as enhancing student attention and effectively delivering content. AI

technology ensures that data privacy issues are solved, reduces algorithmic biases, and acquaints employees with assimilating AI systems into an institution. AI-based solutions gained recognition from the Arab Gulf region, Saudi Arabia, and UAE, leading to the implementation of AI policies to configure these solutions. The Gulf region should learn from Japan by creating AI strategies that involve investing in digital networks, educator training initiatives, and ethical AI principles and setting up joint governmental-private sector programs. AI creates educational solutions that resolve systemic issues while accommodating various students' requirements and optimizing administrative systems. Through well-planned implementation of operational AI Systems, gulf countries will achieve a strong AI-based educational system with better institutional performance and learning results. The successful educational modernization of Japan serves as an example of how AI Systems support educational transformation from traditional to modern learning systems. The Gulf Region succeeds in finding solutions and generating educational possibilities for innovation by implementing AI-based strategies.

Chapter 1: Introduction

1.1 Overview of Artificial Intelligence (AI) in Education

The personal learning environment, test optimization, AI technologies for enhanced data insights, and real-time information management systems may be available. It is an emerging concept that equally influences study courses, educational processes, and school management systems (Chen et al., 2020). Riiid and Arteria all apply adaptive learning software that adapts the content delivered in a classroom to the ability level of learners, hence increasing the level of learning in students (Ingavélez-Guerra et al., 2022). Implementing chatbots and automated testing helps instructors reduce administrative tasks, so they can focus on mentoring tasks and providing excellent teaching practices.

The Japanese educational system has begun integrating AI technology to address academic issues that arise in learning institutions. Notably, the education system in the Gulf Region faces significant challenges, including shortages of instructors, resources, and motivation of students to cover educational inequities (Cobianchi et al., 2022). AI is integrated across levels of schooling, from school levels to institutions of higher learning, where AI is employed to complement students' assessments, administration processes, and customized learning plans (Ulnicane, 2022). AI also bridges educational inequities by offering accessibility software such as programs that translate speech into writing, real-time translators, and AI-based tutoring to non-lingua speakers and students with disabilities (Tanveer et al., 2020).

Despite its advantages, AI use within Japan's educational sector is confronted by data confidentiality, algorithmic bias, and differences in technological infrastructure (Cioffi et al., 2020). Although technologically advanced institutions have adapted to AI, most underfunded institutions have been confronted by adapting to these technological advancements (Laux et al., 2024). Japan has prioritized developing strict ethics guidelines and investing in nation-level digital educational programs that educate instructors on AI use to guarantee its AI's full benefits have been utilized (Cobianchi et al., 2022).

1.2 Research Questions:

- What are the primary applications of AI in Japan's education system, and how do they impact learning and teaching processes?
- What are the ethical, technical, and logistical challenges associated with integrating AI into education?
- How can these challenges be addressed to facilitate AI adoption in different regions?

- How does AI influence student engagement, learning outcomes, and educational accessibility?
- What strategies and policy frameworks can be developed to enhance AI's effectiveness in the Arab Gulf's educational systems?

1.3 Research Objectives:

- To analyze the primary applications of AI in Japan's education system, and how they impact learning and teaching processes.
- To assess the ethical, technical, and logistical challenges associated with integrating AI into education.
- To explore how these challenges can be addressed to facilitate AI adoption in different regions.
- To identify how AI influences student engagement, learning outcomes, and educational accessibility.
- To analyze the strategies and policy frameworks that can be developed to enhance AI's effectiveness in the Arab Gulf's educational systems.

1.4 Research Gaps:

The study aimed to contribute to a better understanding of AI's role in educational contexts and how lessons can be learned by the Arab Gulf region on how to improve its educational system through Japan's AI strategies by addressing these gaps.

According to Takanori, Ishida, and Tanaka (2021), although AI tools have been integrated into Japanese classrooms, there have been no longitudinal studies to determine the long-term impact of these AI tools. It is unknown how AI applications develop over time and whether they affect teaching practices and student outcomes in the long run. In the future,

research may look into the long-term effects of AI and how it has helped evolve the strategies practiced in the education field.

Manca and Masiello (2021) review that there are some ethical and technical challenges to adopting AI in education, such as data privacy and algorithmic bias. Unfortunately, little is known about the practices that address these challenges, especially when implementing equitable AI. Future research should include how ethical issues come against technical constraints when educational institutions use AI in their systems.

According to Lee, Choi, and Kim (2020), with the adoption of AI, it is crucial to develop region-specific strategies to overcome the barriers to AI integration. We still lack a research gap on how various regions, such as those in developing countries, will address such challenges as digital literacy and infrastructure limitations. Future studies should look into culturally relevant solutions and explore policies in a particular regional context.

Lai, Chen, and Chou (2020), have researched how AI impacts student engagement and educational outcomes. However, there is still a shortage of information on how AI can be utilized for the diverse requirements of learners like persons with disabilities. Additional research is needed to determine how AI can be created to be suitable for all student populations and enhance access in a manner that is useful for all student populations.

In her paper, Al-Khalifa (2021) mentions the possibility of improving the educational systems in the Arab Gulf through the adoption of AI, but with a lack of specific policy frameworks tailored to their needs, which become the rule of thumb in the pursuit of this process. The research gap remains in determining how educational policies may be formulated to facilitate AI integration in response to the region's specific socio-cultural

and economic challenges, including language and variability of technological readiness.

Chapter 2: Literature Review

Extensive research on mechanical Intelligence in the 20^{th} century has built today's Artificial Intelligence (AI) fundamentals. AI is constituted by its variegated subfields, i.e., machine learning, natural language processing, robotics, and computer vision, which are critical to educational use (Samoili et al., 2020). Machine learning enables decision-making using data, while natural language processing enables AI to understand and convey using human language, making AI-based chatbots and virtual assistants' part of today's educational framework. AI is increasingly being implemented within learning institutions to enhance learning, make administration effective, and personalize educational experiences (Cioffi et al., 2020). AI is reported to steer instructors to process large amounts of data, identify learning trends, and adjust teaching accordingly (Ilić et al., 2021). AI adaptive learning software such as Riiid and Arteria provide students with adaptive content that is adjusted to students' performance, offering students adaptive instruction that maximizes engagement and retention (Song & Wang, 2020). It is reported that AI adaptive learning software students retain learned content better and perform better than non-technological teaching resources (Cioffi et al., 2020).

AI also assists in automating tasks such as planning, marking, and allocating resources, offloading part of the educator's burden and increasing productivity beyond classroom instruction (Cioffi et al., 2020). Computer-based marking software scans students' answers, provides instant feedback, and maintains marking consistency, finally allowing instructors to focus on interactive teaching and critical-thinking-based instruction (Shiohira, 2021). AI-based decision programs also assist institutions' planning by forecasting enrollment trends and allocating

resources accordingly (Pham & Sampson, 2022). AI has also led to innovation regarding accessibility and inclusivity of learning. AI-driven software, such as speech-to-text software and real-time translators, make learning inclusive by supporting students with disability and non-English speakers (Ingavélez-Guerra et al., 2022). The software bridges the language and cognitive barriers, ensuring every learner gets equal learning opportunities.

AI-driven adaptive tutorial programs also make students learn through adaptive feedback and practice activities suited to their individual learning needs (Tanveer et al., 2020). Despite its numerous benefits, AI integration within education is also beset by challenges of an ethical and logistical kind. Data privacy is of great concern, considering that AI programs gather and process copious amounts of students' data, triggering safety issues, consent, and appropriate use (Cobianchi et al., 2022). The algorithmic bias of AI programs can also reinforce inequality, mainly where AI is used to automate marking or admissions processes, making educational inequities wider (Ulnicane, 2022). This calls for strong ethical guidelines and regulations to ensure the appropriate use of AI (Chen et al., 2020). Another challenge is that the region embraces AI variably regarding technological and economic infrastructure (Tanveer et al., 2020). More prosperous economies like Japan have progressed significantly in AI takeup while developing regions have weak AI-enabled resources and facilities to tap into. The challenge can only be bridged through investments targeting infrastructure, educator upskilling, and affordable AI-enabled options to make AI-enabled learning universal (Laux et al., 2024). AI-enabled educational technology investments have been reported to significantly narrow educational inequities and improve sustained learning outcomes (Ilić et al., 2021).

Notably, AI systems are a crucial element that should be implemented to manage education programs efficiently. The absence of AI

decision-making has limited educators and policymakers in making practical and applicable decisions and policies in the management of education (Alzubaidi et al., 2023). Features such as AI's "black box" make determining how AI systems make decisions challenging, hence bringing doubt regarding its reliability. More transparency and AI literacy programs can make policymakers and educators better understand and employ AI in teaching (Chen et al., 2020). AI programs have the potential to alter teaching by enhancing the learning experience, clerical automation, and making teaching more inclusive. In addition, supervision and relevant annual examination of the deployments of AI systems in education also helps to provide responsibility, correctness, and fairness to the use of AI in education (Song & Wang, 2020).

Chapter 3: Methodology

3.1. Research Design and Methodology: Secondary Data Analysis:

This research, therefore, adopts a secondary research method to establish how AI is being adopted in learning institutions in Japan and the Arab Gulf States. The research study made extensive and comprehensive to get references and collect secondary data used in the published literature, government, and reports, along with case studies, were included (Snyder et al., 2021). This makes secondary data even more helpful as it involves using published works that are readily available to explain AI use in learning settings in the said areas (Creswell & Poth, 2018). Secondary data assist in discussing regional differences because they allow for cost and time savings compared to gathering primary data (Flick, 2018). In the qualitative research, thematic analysis was used because it helps identify trends, patterns, and findings related to the use of AI in education. This approach was essential for analyzing qualitative data, as it provides a detailed evaluation of the use of AI applications, ethical concerns, and challenges (Braun & Clarke, 2006).

3.2. Data Collection Process:

The publishing articles were used to address the applicability of AI in the Japanese and Gulf Arab education systems in carrying out this research. While the reports and government documents were used to get additional information. The databases Scopus, Jstor, and Google Scholar were also used by typing the following keywords: 'Artificial intelligence in education within the Japan;' 'AI in education systems in the gulf region;' and 'Adaptive learning system.' (Kumar & Gupta, 2020). They also assisted us to select sources that inform about such tendencies in the given area.

Inclusion Criteria:

- Studies published within the range of 2018–2023.
- Peer-reviewed articles and reports of governments.
- Focus on AI use in Japanese and Arab Gulf Education.

Exclusion Criteria:

- Articles published before 2018 (excluding groundbreaking).
- Non-scholarly or indirectly applicable sources on AI in education (Snyder et al., 2021).

3.3. Data Retrieval and Organization:

The research obtained and organized its sources by selecting Mendeley as a key reference management software. The research used thematic topics such as "AI use in Japan" and "AI use in the Gulf" after data extraction. The systematic organization allowed for a straightforward data analysis which ensured cross-trend comparison of Japan and the Arab Gulf countries, which is central to the aim of the study (Mendeley, 2020).

3.4. Data Synthesis: Synthesis of Themes:

Thematic analysis was employed to synthesize the data that had been collected. It is most appropriate to establish overarching trends and themes within diverse sources of data (Braun & Clarke, 2006). The data synthesis approach permitted a broader view of how AI is utilized within educational institutions and the challenges encountered within each region. The process followed in the following process;

- Familiarization: The process began by thoroughly reviewing the data to make one well-informed on key trends regarding AI in education (Nowell et al., 2017).
- Coding: The content was also coded to identify unique topics such as “AI in classrooms” and “Ethical challenges of AI integration” (Fereday & Muir-Cochrane, 2006).
- Theme Identification: Following coding, corresponding codes were combined into broader-ranging themes, e.g., educational benefits of AI and bias issues as an ethical concern (Braun & Clarke, 2006).
- Integration and Interpretation: Integrating identified themes within the comparative AI adoption of Japan and the Gulf region provided insight into universal challenges and regional differences (Patton, 2015).

3.5. Rationale Behind Methodology:

Secondary data is an appropriate tool for this study as it takes advantage of the ample literature that is readily available on AI applications in Japanese and Gulf education. With existing data, this study can provide valuable insight into trends in AI use and regional differences without gathering primary data (Braun & Clarke, 2006). The thematic analysis also facilitates the identification of matters to do with the use of AI as it brings ethical aspects in technology and shows how the use of

ford; AI enhances student performance (Flick, 2018). In addition, the qualitative approach also enables comprehensive description of integration of AI into the education sector and achievement of the intended objectives. The study can establish the technological issues associated with integrating AI in the respective fields besides the cultural, ethical, and policy-making issues in the respective fields (Braun and Clarke, 2006).

3.6. Ethical Issues:

The research study ensures that ethical considerations are still intact despite secondhand data being employed and all the data was collected on ethical basis. For instance, proper research references were made to reduce plagiarism cases (Booth et al., 2016). The data were also collected from reliable sources, so there was no bias in the gathered data (Wiles, 2013). The study also adhered to good research practices regarding how all available bias was detected within the sources of information and provided an objective report on the findings (Denzithat et al., 2017).

3.7. Limitations:

The research highlights some limitations associated with the secondary data used. Some of the limitations included the risk of having bias on the existing information regarding the application of AI and the lack of adequate primary research data from practicing AI individuals (Denzin, 2017). The limitations can reduce the amount of information provided by the students and instructors concerning their difficulties through data triangulation, where multiple data sources were used to check for consistency and enhance the reliability of the data (Johnson et al., 2019).

Chapter 4: Data Analysis

This analytic study examines the use of AI in education in the Arab Gulf region and Japan by applying thematic coding in it. Among the key themes, protocols proposed for using AI to increase student engagement include adaptive learning technologies that personalize content to enhance student performance (Cioffi, et al., 2020; Song & Wang, 2020). Another aspect of the study showed how AI helped to improve accessibility, specifically with regard to tools for students with disabilities or struggles with language, such as speech-to-text software or speech-to-speech translation (Tanveer et al., 2020). This is further explored by analyzing the ethical and technical problems of both regions by comparing concerns regarding data privacy and algorithm bias, creating the potential for increased inequalities within education (Cobianchi et al., 2022; Ulnicane, 2022). However, data privacy and the issue of bias are significant challenges related to using AI-based tools in Japan as they are elsewhere in the world (Cioffi et al., 2020). AI has significant potential to help reduce educational inequities in the Gulf region if challenges such as the lack of infrastructure and limited region-specific policies that inhibit the use of AI in education are addressed (Tanveer et al., 2020). The analysis highlights the necessity for the development of custom strategies to overcome these barriers in the areas of ethical consideration, infrastructure investment, and framework policies in the integration of AI in order to effectively integrate AI into the educational systems in both regions.

Chapter 5: Results

From the analysis of AI adoption in Arab Gulf states and Japan, the following findings have been realized concerning the use, challenges, and opportunities of artificial intelligence. The chapter gives a concrete indication of such a conclusion, thus with special attention to the

experience of Japan in using Artificial Intelligence in education, on mechanisms that can be addressed to Arab Gulf states, and on the kind of challenges and prospects that have been identified both in these two areas of the world.

5.1 AI Applications in the Japanese Education System:

Japan is considered one of the countries that effectively integrate AI technologies into education and educational management at the high end. Rid and Arteria have adopted AI use for their platforms, and they have effectively contributed to the cause of personalized learning in Japan, as stated by Ingavélez et al. (2022). These systems can alter content for individual teachings and learning and engage students and knowledge by incorporating real-time student performance as adaptable tools. From the studies carried out, it has been established that learners using AI systems have better results than learners using conventional approaches (Ingavélez-Guerez et al., 2022). Also, some AI applications have been used in office tasks, such as grading systems and resource allocation. Technological advancements, for example, can enable an automatic grading system where instant grading can be done; together with feedback provision, teachers can be relieved of most of the work and can teach more. In particular, AI tools and administrative processes and assertions enable efficient management and increase the efficiency of the use of funds and materials (Shiohira, 2021). This becomes paramount, especially given the aging society in Japan and the measures that are being taken in endeavors to counter the scarcity of teachers through the application of Artificial Intelligence for what may be arduous human tasks. AI utilization in Japan has shown considerable progress in moving beyond the mere provisions of jobs for people with disabilities in administration and teaching. As to technology, today, students with disabilities may use such software to help them with their tasks in class as text-to-speech packages, real-time interpretation using AI, or even personalized

coaching, which has proved practical when it comes to giving equal opportunities and the same achievements to disabled students. These technologies range in the needs that enhance the ability to study and embrace diversity in schooling, which is the essence of education in Japan.

5.2 Challenges Facing Japan in Integrating Artificial Intelligence:

However, using AI has also brought some problems and challenges to the education sector in Japan. According to the research findings, data security and privacy have been identified as some of the factors. As the student data is collected to enhance the learning experience input from the students, there has been a debate on using student data from an ethical angle. Currently, there are no clear guidelines for utilized student data protection in institutions, leading to concerns about the ownership of data, the consent of students, and the possibility of explaining with outputs recommended by an AI system (Cobianchi et al., 2022). The lack of regulation can pull down confidence in using such technologies.

Another major challenge is algorithmic bias, which can exacerbate inequality in academic examinations. Grading and admission systems can inadvertently foster bias towards specific student populations, reinforcing prejudices present in the educational setting (Ulnicane, 2022). In heavily AI-saturated Japan, such bias must be addressed to maintain equity and inclusivity. Moreover, while many urban or wealthier schools have already embraced AI technology, many underfunded or rural schools are still unable to adopt it. However, the opportunity for the novel to be read by a broad audience remains a challenge since there is a digital gap in the provision of infrastructure and technologies in Japan. The lack of capacity and training in schools and necessary IT infrastructure is preventing the adoption of AI solutions in education and thus has been partly contributing to the increase in inequalities in schooling.

5.3 AI Applications in Arab Gulf Countries:

The Arab Gulf nations like the Kingdom of Saudi Arabia and the United Arab Emirates are rapidly adopting AI technologies in their education systems. For instance, the UAE has presented several initiatives about using AI in its education system, such as the 2031 National Artificial Intelligence Strategy. These have included a continued push toward the creation of digital facilities as well as AI curricula in academic institutions and fostering partnerships between government and private entities for school implementation of AI solutions. In Saudi Arabia, improvements have been made regarding adopting AI under Vision 2030 to change the nation's schooling system. Some of the measures taken under this initiative include using intelligent platforms for learning and using artificial intelligence in administration, such as calendars, grading, and management of resources, among others, as suggested by Tanveer et al., 2020. The Gulf states fund AI solutions as they believe it will augment students' performance, lessen the burden on the teachers, and strengthen the school systems. Also, the Gulf countries learned about the role of AI in accessibility in education. Personalization of learners' courses or extra-need learners has also been incorporated into artificial intelligence devices. The systems guarantee that every learner of any ability level and origin attains quality education, which is more in line with the region's goals on the education policy for all.

5.4 Challenges of Adopting Artificial Intelligence in Arab Gulf Countries:

However, several challenges still may prevent the integration of AI in education at a large scale in the Gulf region. The final question is also addressed: the digital divide, the last of the significant challenges; this becomes even more apparent in poorer areas. While developed countries like the UAE and Qatar have invested in ways to incorporate AI into

education, the rest of the poorly-trained, rural, and less-funded counterparts do not have the necessary infrastructure and access to such technologies. In closing this gap, there needs to be more infrastructure investments in teacher training and efforts towards making access and cost of AI solutions cheaper. Another critical set of issues for the Gulf countries is ethical issues relating to data and algorithms. AI also sparks issues regarding student data privacy, students' consent, and the transparency of algorithms when incorporated into education as it is in Japan. For such problems, Gulf nations have to enhance the validity and reliability of data protection legislation and ethical guidelines regarding the application of AI for learning. The table below depicts the key opportunities and challenges of incorporating AI into education for the Arab Gulf states and Japan:

Challenges	Japan	Arab Gulf Countries
Data Privacy and Security	Lack of robust data protection frameworks	Need for clear data protection regulations
Algorithmic Bias	Potential for biases in AI assessments	Risk of reinforcing inequalities with AI-driven systems
Digital Divide	Unequal access to AI in rural areas	Struggles in less affluent regions to adopt AI
Teacher Training	Need for continuous professional development	Demand for extensive training programs for educators
Ethical Guidelines	Insufficient ethical frameworks	Need for clear ethical guidelines for AI use in education

5.5 Opportunities for the Arab Gulf Countries:

However, the challenges discussed above are still present; the Gulf nations could still harness AI in education in the following ways. From the Japanese case, the Gulf nations are positioned to invest in infrastructure

regarding the new age, train teachers for AI, and develop ethics concerning AI. It will be necessary for governments, schools, and private companies to work hand in hand for AI solutions to be fashioned appropriately for the region. However, the Gulf states can further explain the opportunity of how AI can enhance the knowledge divide even further in society and benefit underprivileged groups of the population, such as disabled people, second language learners, and poor students. Nevertheless, by implementing a learning and accessibility system through AI in education, the Gulf state can transform the performance of every learner. Also, the institutions of the Gulf can use AI analysis to identify students who are academically troubled and come to the rescue of these students, thus boosting their student outcomes and retention.

Chapter 6: Discussion and Recommendations

AI integration within the education process has been one of Japan's most significant innovations, including individualization, improvement of efficiency, and inclusion. The application of adopted AI in the country's education system increases the capacity of technology to alter teaching processes by using adaptive learning systems, computer grading systems, and artificial intelligent tutoring systems. However, simultaneously, there are crucial issues concerning Japan, such as data privacy, algorithm bias, and urban/rural differences. These present the need for strict ethical frameworks and equitable access to AI capacities across regions. On the other hand, the current AI implementation is less advanced in the Arab Gulf states, mainly because there have been recent infrastructure and training plan enhancements. For example, the UAE Artificial Intelligence Strategy 2031 and Saudi Vision 2030 have been developed to enhance the adoption of artificial intelligence in industries, including education. Nevertheless, the nations are not without challenges; for example, there

are few infrastructures, most are in rural areas, and there are no or few qualified teachers and data privacy.

Policy Recommendations:

- Physical Development: The Arab Gulf states require enhanced investment in physical development, focusing on rural areas, to gain equal opportunity for related AI training.
- Teacher Training: Teacher training programs must be developed to equip teachers with the necessary knowledge to use tools such as AI in their line of duty. In the process, they can see why AI must be adopted to improve student performance. Collection of Ethical Principles for Applying AI and the Regulations for them: The Gulf nations and Japan must have well-rounded regulations on using artificial intelligence; thus, data privacy, fairness, and explainability of the AI must not be violated and must be biased.
- Fostering Collaboration: Governments, academic institutions, and technology companies can facilitate collaboration, sharing their skills, innovations, and resources towards achieving the adoption of AI.

Chapter 7: Conclusion

Integrating Artificial Intelligence (AI) into education has revolutionized global teaching methods and learning environments. The experience of Japan with Artificial Intelligence has been of invaluable worth in affirming the revolutionary potential of adaptive learning systems, computer-graded systems, and artificial intelligence-guided tutoring solutions, whose impacts on student interaction, administrative task performance, and accessibility for differently-abled learners have been significant. However, data privacy, algorithmic bias, and infrastructure disparities between urban and rural districts still pose significant issues whose solution needs to be

realized for the complete capacity of Artificial Intelligence to be unleashed. Saudi Arabia and UAE, as well as other Arab Gulf states, are among the countries gradually implementing AI in schooling systems. The countries have developed national plans for the infrastructure and teaching practices for AI development. Despite the benefits of AI, there are challenges, such as the digital divide, the requirements for training teachers for technology solutions, and data privacy.

The Gulf states, however, can learn from Japan and apply their plans best to suit their needs in the region. Thus, this study also suggests investing more in developing the digital education environment and preparing related modules for teachers to ensure equal access to teaching resources based on artificial intelligence, especially for students in developing regions. Besides, creating clear ethical codes for norms in teaching AI will also prove critical in eradicating unfair bias in algorithms as well as the privacy of data. To properly implement and achieve optimal pedagogical effectiveness using AI, the proper approach involves synchronizing the Gulf and Japanese governments, establishing institutions of learning and education, and the technology firms in the teaching and learning process involving the Application of Intelligence. The lessons of the adversary experience of what has been achieved in Japan and today's problems can be utilized to build a firm strategy for AI to improve the quality of schooling and increase the efficiency of education for Arab Gulf countries. The importance of applying AI in the K–12 context increases only when it is done responsibly and when funding for teachers and learners is sustained with assets in this constantly evolving technological environment.

References:

- Al-Fanar Media. (2024). As AI transforms Arab higher education, universities navigate benefits and challenges. https://www.al-

fanarmedia.org/2024/11/as-ai-transforms-arab-higher-education-universities-navigate-benefits-and-challenges/

- AGBI. (2023). AI education in the UAE. https://www.agbi.com/tech/2023/11/ai-education-in-the-uae/
- AI Expert Network. (2025). Case study: AI integration in Japan's education sector. https://aiexpert.network/ai-integration-in-japans-education-sector/
- Al-Khalifa, H. (2021). Policy frameworks for integrating AI into education in the Gulf region: Challenges and solutions. *Education and Information Technologies, 26* (2), 1581-1598. https://doi.org/10.1007/s10639-020-10480-1
- Arab News. (2024). Preparing for an AI-driven education system: Global contexts and insights for Saudi Arabia. https://www.arabnews.com/node/2372411/preparing-ai-driven-education-system-global-contexts-and-insights-saudi-arabia
- Arab News Japan. (2025). How AI and remote learning platforms are transforming education in the Middle East. https://www.arabnews.jp/en/middle-east/article_91764/
- Booth, W. C., Colomb, G. G., & Williams, J. M. (2016). *The craft of research* (4th ed.). University of Chicago Press.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3* (2), 77-101. https://doi.org/10.1191/1478088706qp063oa
- Chen, X., Zou, D., Xie, H., & Cheng, G. (2020). Fifty years of research on AI in education: Insights from a bibliometric analysis. *Educational Technology & Society, 23* (1), 26-40.

- Cioffi, R., Travaglioni, M., Piscitelli, G., Petrillo, A., & De Felice, F. (2020). Artificial intelligence and machine learning applications in smart production: Progress, trends, and directions. *Sustainability, 12* (2), 492. https://doi.org/10.3390/su12020492
- Cobianchi, S., Pugliese, L., Peloso, A., Dal Mas, F., & Angelos, P. (2022). Artificial intelligence in healthcare and education: Ethical considerations and practical applications. *AI & Society, 37* (3), 1–13. https://doi.org/10.1007/s00146-022-01386-w
- Cobianchi, L., et al. (2022). Ethical concerns in AI-driven educational systems. *Journal of Educational Technology*.
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research* design*: Choosing among five approaches* (4th ed.). SAGE Publications.
- Denzin, N. K. (2017). *The research act: A theoretical introduction to sociological* methods. Routledge.
- EU-Japan Centre for Industrial Cooperation. (2025). Report: Artificial intelligence in the Japanese educational sector. https://www.eu-japan.eu/eubusinessinjapan/library/publication/report-artificial-intelligence-japanese-educational-sector
- Lai, K., Chen, S., & Chou, C. (2020). The impact of AI on student engagement and learning outcomes: A review of personalized learning systems. *Journal of Educational Computing Research, 58* (3), 447-469. https://doi.org/10.1177/0735633120919564
- Lee, J., Choi, K., & Kim, S. (2020). Adoption of AI in education: Overcoming challenges in developing countries. *Educational Technology Research and Development, 68* (3), 1097-1112. https://doi.org/10.1007/s11423-020-09773-2

- Manca, S., & Masiello, G. (2021). Exploring ethical challenges of AI in education: Data privacy and bias considerations. *Computers and Education, 173*, 104282. https://doi.org/10.1016/j.compedu.2021.104282
- Song, Y., & Wang, J. (2020). Adaptive learning technologies and AI applications in education: A systematic review. *Computers & Education, 156*, 103940. https://doi.org/10.1016/j.compedu.2020.103940
- Takanori, M., Ishida, Y., & Tanaka, H. (2021). The application of artificial intelligence in Japanese education: Opportunities and challenges. *International Journal of Educational Technology in Higher Education, 18* (1), 34–49. https://doi.org/10.1186/s41239-021-00239-7
- Tanveer, M. I., Majeed, M. K., & Al-Samarraie, H. (2020). AI-powered assistive technologies for students with disabilities: A review. *Education and Information Technologies, 25* (6), 4905–4922. https://doi.org/10.1007/s10639-020-10224-9
- Ulnicane, I. (2022). Artificial intelligence and the future of education: Ethical and policy implications. *AI & Ethics, 2* (1), 25–40. https://doi.org/10.1007/s43681-021-00052-4