

**The impact of artificial intelligence on the
development of interior design deliverables at
Riyadh's universities**



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أثر الذكاء الصناعي على تطوير مخرجات التصميم الداخلي في جامعات الرياض

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ABSTRACT

Artificial intelligence (AI) is making a significant impact on the development of interior design deliverables in Riyadh's universities. AI-driven design tools and software assist students in creating 3D models, suggesting design concepts, and optimizing space planning. Automation and efficiency are key advantages, as AI automates repetitive tasks; allowing students to focus on creativity. AI helps students analyze user preferences, space utilization, and sustainability metrics, enabling data-driven decision-making. It also promotes accessibility and inclusivity in design. Proficiency in AI enhances students' job market readiness. However, traditional design skills should not be replaced by AI, and ethical and privacy considerations should be addressed in its use in interior design education.

الملخص

للذكاء الاصطناعي تأثير كبير على تطوير مخرجات التصميم الداخلي في جامعات الرياض. تساعد أدوات التصميم والبرامج القائمة على الذكاء الاصطناعي الطلاب في إنشاء نماذج ثلاثي الأبعاد، اقتراح مفاهيم التصميم، وتحسين تخطيط المساحة. تعتبر الأتمتة والكفاءة من المزايا الرئيسية، حيث يقوم الذكاء الاصطناعي بأتمتة المهام المتكررة، مما يسمح للطلاب بالتركيز على الإبداع. يساعد الذكاء الاصطناعي الطلاب على تحليل تفضيلات المستخدم واستخدام المساحة ومقاييس الاستدامة، مما يتيح اتخاذ القرارات القائمة على البيانات. كما أنه يعزز إمكانية الوصول والشمولية في التصميم. الكفاءة في الذكاء الاصطناعي تعزز استعداد الطلاب لسوق العمل. ومع ذلك، لا ينبغي استبدال مهارات التصميم التقليدية بالذكاء الاصطناعي، ويجب معالجة الاعتبارات الأخلاقية والخصوصية في استخدامها في تعليم التصميم الداخلي.

KEYWORDS

Artificial Intelligence (AI), Interior Design, Riyadh Universities, 3D Model, Automation, Space Planning, Design Tools, Automation, Personalized Learning.

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OVERVIEW OR BACKGROUND

The integration of artificial intelligence (AI) into various aspects of modern life, including education, is a transformative and rapidly evolving phenomenon. In Riyadh, the capital of Saudi Arabia, AI's influence on education is gaining prominence as the region seeks to harness the potential of AI to enhance the learning experience.

Riyadh's universities, like educational institutions worldwide, are at the forefront of incorporating AI to drive innovation and improvements in the field of education. AI is ushering in a new era of personalized, efficient, and data-driven learning experiences, fundamentally reshaping how students and educators engage with educational content and processes.

This article provides an overview of the impact of AI on education in Riyadh's universities, addressing key implications and trends. It delves into how AI is changing the educational landscape by enabling personalized learning experiences, optimizing administrative tasks, expanding access to education through online and hybrid learning models, and providing valuable data-driven insights. Additionally, AI is enhancing assessments by adapting to students' performance and fostering engagement through interactive platforms. While the benefits of AI in education are significant, this article also highlights the importance of addressing ethical and privacy considerations associated with AI integration. The responsible and ethical use of AI in education is crucial to ensure that the technology serves as a tool for progress without compromising privacy or perpetuating bias

Introduction

The development of digital tools throughout the last century and the emergence of technological advancements such as Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), and digital twins have made significant changes and improvements to the way we work and interact with each other. These advancements have enabled the consumption and analysis of large amounts of data in a shorter time than any human ever would be able to do. Suppose computing technologies and the intellectual skills of technologies, such as AI, progress at a similar rate as we have seen for the past 50 years. In that case, people who live today will see the evolution of such technologies surpassing the logic and information of humankind and likely have a personality that is indistinguishable from humans (Merritt, B. 2016). This can raise questions regarding what place AI will have in the future of our world. People are concerned with being replaced by non-intelligent machines today, you could guess that there would be a greater concern when intelligent machines such as AI start to outperform humans at work in many aspects. It becomes apparent that humans and AI will have to coexist and so the question of who will make decisions for companies will be of great concern. Which decisions will the AI make, which decisions should humans make, and which decisions will be made in collaboration? (Haenlein , M. (2019)) Even if there is a long way until we can experience an AI with characteristics like humans, the AI we have today needs to be addressed in how

it will be developed for the future as it can be expected to have a great impact on our society. In the meantime, we can look at how the implementation of AI affects human traits such as creativity, which this paper will explore from an architectural viewpoint. With creativity being a very complex human trait with many factors at play, that plays a big role in design thinking, the effects AI has on this trait become interesting. Digital platforms and tools have since their introduction in the early 60s been seen as supporting design thinking with simulation, and modelling of design options. They are also viewed as enablers to enhance cognitive strategies and skills, such as creativity (Lee, J.H.(2020). As the development of drawing tools has gotten more and more advanced since the introduction of digital tools like CAD and CAAD in the early 1960s, there is a need for exploration into how future technologies such as AI will affect the creative design process. Not only because it is a relatively new technology, but also because the technology itself challenges the more complex human traits such as creativity. Unfortunately, the advancements in technology have not had the expected effect on the architecture, engineering, and construction (AEC) industry as one might have wished. Despite the technological advancements, the AEC industry has, in many ways, failed to efficiently adopt and implement digital tools and take advantage of their potential to streamline the workflow and processes of the industry as it continues to lag other sectors (Chowdhury, Adafin and Wilkinson, 2019). The complexity of the industry can explain this but also by its old age and reluctance to change the way it works. The many disciplines involved in the industry choose different ways to approach digitization, and disciplines have made progress at different paces, leading to difficulties in integrating processes between them (Fioravanti, Novembri and Rossini, 2018). This is clearly shown in a recent study by Bosch-Sijtsema

et al. (2021) of the Swedish AEC industry, where the various disciplines, which are client, lead design engineer/architect and contractor, priorities different technologies. The study shows that Building Information Modelling (BIM) is the most prioritized among the disciplines, and it's pretty equally distributed. Still, for the lead design engineer/architect, AI/ML is the most prioritized, and they outmatch every other discipline in that area. The development of new-generation information technology is mainly reflected in big data, the Internet of Things and artificial intelligence, especially artificial intelligence as the leading. Western countries have put forward a new national development strategy which focuses on the development of artificial intelligence. This reflects their emphasis on the manufacturing industry, which is mainly artificial intelligence. The advanced manufacturing in the United States, 4.0 in Germany and the robot revolution in Japan all reflect the ambition of these countries to promote the development of the manufacturing industry by science and technology. Since the 1950s, artificial intelligence has been developed from the beginning to high speed and has penetrated all walks of life from the research field. In China, the environmental art specialty belongs to the design art under the first level of art. Environmental art plays a great role in the process of economic development in China, whether in landscape architecture or the construction of indoor and outdoor projects. However, the concept of environmental art is still controversial. In the current discipline, western countries (such as the United States) have not separated the environmental design majors separately, but they are scattered among the major teaching contents of environmental art, such as landscape architecture, the interior design of art academies and urban public art.

Technological development has become an area of strategic importance and a key driver of economic development . According to the results of the global employer's survey, provided by the World Economic Forum (2018; 2020), technological advances, including artificial intelligence, are set to dominate the period of 2018–2025 as drivers positively affecting business growth. Recent theoretical developments have revealed that artificial intelligence (AI) influences business by creating competitive advantage, and new opportunities, expanding the range of customers, and connecting devices that provide a constant flow of data on functionality, usage, production, and customer needs. These options can provide companies with a competitive advantage by creating results that people can quickly interpret, predict, and use . This is a mature field that is now being spun out into commercial applications. AI today has been integrated into a variety of economic sectors, such as finance, national security, health care, transportation, and smart environment technologies. The design industry is no exception: AI is being increasingly applied in the development of design products and services. However, there is another side to the coin. The latest World Economic Forum (2020) data show that “by 2025, 85 million jobs may be displaced by a shift in the division of labour between humans and machines, while 97 million new roles may emerge that are more adapted to the new division of labour between humans, machines, and algorithms”. This is more widely used at the time of the COVID-19 pandemic. “Automation, in tandem with the COVID-19 recession, is creating a ‘double-disruption’ scenario for workers” (World Economic Forum (2020). Not all designers today use AI-based programs, which allows them to generate design solutions saving time. However, potential customers of designers have increasing opportunities to directly, without live contact, obtain them on AI-based sites. This raises the question: how

are these changes affecting and will continue to affect designers' work in the future. What skill sets will be needed for designers to begin or continue working in the industry?

PROBLEM STATEMENT

While the integration of artificial intelligence (AI) into education in Riyadh's universities holds great promise, it also presents several challenges and issues that need to be addressed to maximize the benefits and ensure ethical and responsible use. The problem statement for this context can be summarized as follows: Riyadh's universities are increasingly incorporating AI technologies into their educational systems, aiming to enhance learning experiences, improve administrative efficiency, and expand access to education. However, the rapid adoption of AI in education raises concerns related to data privacy, equity, ethical usage, and the need for adequate training and infrastructure. The challenge lies in effectively harnessing AI's potential while safeguarding privacy, ensuring fairness, and promoting responsible AI practices in educational settings".

This problem statement outlines the need to strike a balance between the potential advantages of AI in education and the ethical and practical considerations that must be addressed to mitigate potential risks and challenges.

GOAL AND OBJECTIVES

The primary goal of this research is to develop a comprehensive framework for the ethical and responsible integration of artificial intelligence (AI) into education in Riyadh's universities. This framework will aim to address the ethical and privacy concerns

associated with AI adoption in educational settings and promote fair, transparent, and accountable AI practices.

Research Objectives: To achieve the research goal, the following specific objectives will be pursued:

- Assess Current AI Integration: Evaluate the current state of AI integration in education within Riyadh's universities, identifying the types of AI applications in use and their potential ethical and privacy implications.
- Identify Ethical and Privacy Concerns: Investigate and document the ethical and privacy concerns related to AI use in education, focusing on issues such as data privacy, algorithmic bias, and the implications for student rights.
- Review Ethical Guidelines and Regulations: Examine existing ethical guidelines, regulations, and best practices related to AI in education, both at the national and international levels.
- Develop an Ethical Framework: Create a comprehensive ethical framework that outlines principles and guidelines for the responsible use of AI in education, addressing data privacy, fairness, transparency, and accountability.
- Implement Pilot Programs: Collaborate with selected universities in Riyadh to implement pilot programs based on the developed ethical framework, observing the practical implications of the framework's application.
- Evaluate Framework Efficacy: Assess the effectiveness of the ethical framework in addressing ethical and privacy concerns and enhancing AI integration in education.
- Recommend Policy and Practice Changes: Provide recommendations for policy changes and best practices that promote responsible AI adoption in Riyadh's universities and potentially serve as a model for the broader region.
- Disseminate Findings: Share research findings, the developed framework, and best practices through publications, presentations, and knowledge sharing within educational institutions and relevant authorities.

The research objectives aim to bridge the gap in ethical

considerations and privacy protection in AI integration in education, ultimately ensuring that AI technologies are leveraged for educational enhancement in an ethical, transparent, and responsible manner.

Theoretical Framework

What is artificial intelligence?

Artificial intelligence is a branch of computer science, and it is the science that makes machines think like humans, i.e. a computer that has a mind. It is also defined as behavior and certain characteristics that characterize computer programs and make them mimic human mental abilities and work patterns, and among the most important of these characteristics is the ability to learn, deduce, and respond. Acting on situations for which machines were not programmed. They are systems or devices that mimic human intelligence to perform tasks and that can improve themselves based on the information they collect.

The automation system differs from artificial intelligence (AI), as automation is a system that depends on the rules determined by programming, where the machine follows pre-determined logical sequences, which means that symbol A leads logically to symbol B, and so on. As for artificial intelligence, it is like teaching a machine to make conclusions on its own and understand what it should do and what it should not do. The encryption or coding here is not explicit, as it allows the machine a certain amount of maneuvering. (Barto et al, 2006)

The science of artificial intelligence aims to develop systems that achieve a level of intelligence similar to or better than human intelligence, and its applications are designed to imitate the actions of the human mind. The goal is to place human knowledge inside the computer within what is known as knowledge bases, and then the computer can, through software tools, search these rules, and compare and analyze, in order to extract and conclude the best answers and solutions to various problems, and this is similar to what a person does when he tries to solve new problems. He encounters him in his daily life based on his previous experiences and experiences, through his expectations of possible outcomes, and through his skills in deduction and comparison between the best available solutions. (Alex, 2019)

Artificial intelligence is a term given to one of the latest computer sciences, and it aims for the computer to simulate the intelligence processes that take place within the human mind, so that the computer has the ability to solve problems and make decisions in a logical and organized manner in the same way as the human mind thinks.

It is also the branch of computer science through which it is possible to create and design computer programs that mimic the style of human intelligence so that the computer can perform some tasks instead of humans, which require thinking, understanding, hearing, speaking, and moving in a logical and organized manner. (Wolfgang, 2018)

The evolutionary history of artificial intelligence:

The birth of true artificial intelligence began with the Foundation Research Conference in 1956 at Dartmouth College, by John McCarthy, Marvin Maine Ski, Allen Noel, Arthur Samuel, and Herbet Sayun, who were able to solve problems in algebra and prove logical

and English-speaking theorems. The history of artificial intelligence at the international level can be reviewed as follows:

- In 1921, the term robot was used for the first time in the Czech Play Universal Cartoon Robots.
- In 1854, George Boole invented the theory of algebraic logic based on the values of zero and one.
- In 1940, attempts appeared to invent simple electronic networks that mimic nerve cells in a primitive way.
- In 1948, the scientist Alan Turing came up with the intellectual method that made it clear that machines have the ability to think like humans.
- In 1958, scientist John McCarthy invented the programming language for artificial intelligence.
- In the 1980s, artificial intelligence research saw a resurgence of commercial success in the field of expert systems that mimic human experts.
- In 1985, artificial intelligence profits reached more than a billion dollars, and governments began to fund this research.
- 1987 Artificial intelligence achieved greater successes in the field of logistics, data mining, and medical diagnosis. (Partic, 2018)

The period from 1980 to 1987 was called the Renaissance, as these eight years witnessed the rise in the levels of influence of expert systems and deep learning, and the stage of material harvest and the fifth generation project began, and the process of communicative life began. It should be noted that the science of artificial intelligence is the product of two sciences (behavioral and neurological sciences) and computer science, or as it is recently

called informatics science. In the years extending from (1987-1993) these five years began the phase of removing obstacles and providing the fertile environment that embraced this type of science. It was the beginning of the emergence of its programs and projects, and it was the first time that the importance of departments and bodies organizing the work of artificial intelligence emerged, in which opinions and goals were unified and led to the remaining ones merging in order to strive to form unified steps. (Osondo, 2021)

With the emergence of the financial problems that the industrial sector was suffering from, it was necessary to exploit modern technology to treat these problems. The employment of artificial intelligence appeared and the robot was produced in its simplified form, but this progress was not sufficient to satisfy the aspirations of the twentieth century, which led them to reduce the amount of funding allocated. In this field, then researchers were able in the mid-eighties of the twentieth century to develop computers capable of making some decisions based on solutions to pre-programmed problems, but the developers exploited this invention in practical applications. For all of the above, an important question is raised: Do machines think? With the technological explosion taking place, artificial intelligence has gained a greater status than before. Computers appeared capable of learning and solving problems independently, and in 1977 a computer beat a human for the first time in the game of chess. Then came a succession of inventions and improvements that pushed artificial intelligence to become an urgent need today. It is an essential, effective and indispensable method. (OCED, 2019)

- Application of artificial intelligence in design

The term "design" has several various connotations depending on the context. As a product, it can be a drawing, a model of a building, a clay slab of a sculpture, a garden building that

has been realized or constructed, or other works of art; as a process, it can be a stage of product production, or a presentation means in the process of product formation. The design process and product are isolated from the computer-aided design program. The difference in the meaning of "design" also demonstrates that computer-based drawing tools should be involved in the design process, from representing design information to products, from appearance modelling to form visualization, and from comprehensive design solutions to performance evaluation. CAD currently has two meanings: one as a drafting and modelling tool, and the other as a design medium. This is simply a method for designers to obtain assistance in the design process. Computer tools have played a significant role in the current environmental design business as a drawing tool and visual means, but they cannot ultimately influence designers' decision-making processes. On the one hand, the designer's design reasoning is informed by his knowledge reserve and rational and perceptual knowledge of the object, and different types of knowledge reserve determine the designer's decision-making level; on the other hand, computer-aided means continue to rely on massive data sources and a support system built from various types of information. The general approach to realizing artificial intelligence is to create an operating model for the design goal. The model is constructed in two steps. First, cognitive modelling is utilized to build customization and a reasonable spatial arrangement, which is the concept learning stage driven by data. Environmental art design, like its "fellow brothers" architectural design, has built its theory based on mathematics, geometry, material utilization, and engineering design approach since its inception. For thousands of years, human architects have achieved significant advances in these specialized domains of design. With the introduction of computers. The engineering techniques and design approaches made

available by computers represent a significant shift in modern environmental art, particularly architectural design. The use of CAD and CAE replaces the fundamental role of mathematics in environmental design. Second, an intelligent system can be used to optimize design and fine-tune the newly developed solution. Scientists will use various scientific calculations to use intelligent computing in the field of architecture and interior design during the specific implementation procedure. Artificial intelligence is more intriguing to experiment with in the development of design style. For example, the styles of various types of furniture are contrasted and researched. The approach is implemented utilizing large data from the literature and is based on a geometric feature vector. The chosen objects are projected into a shared k-dimensional space. The application with similar styles is obtained by calculation. Architectural design, landscape design, interior design, and soft decoration layout can currently give some automatic manual services. The service content should comprise not only personalized information for designers but also professional advice services for beginners. As a result, in line with other domains, the development of artificial intelligence focuses on these elements as well.

1) Massive amounts of data. Big data is used by AI to calculate and learn.

The more data it has, the better its learning capacity and level will be.

2) The creation of software and hardware. The technical foundation for the realization of local artificial intelligence is software that can process large amounts of data, as well as the hardware and hardware technology that supports the software's operation.

- With the realization of artificial intelligence, the pursuit of constructing intelligent computers that mimic human behaviour has quickened. Many definitions and explanations

of what constitutes AI systems have developed because of recent advances in computer science. For example, "the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings" (Remian, D. (2019) has been characterized. This definition emphasizes the mimicking of human behaviour and consciousness. Furthermore, artificial intelligence (AI) is "the combination of cognitive automation, machine learning, reasoning, hypothesis generation and analysis, natural language processing, and intentional algorithm mutation producing insights and analytics at or above human capability". This definition combines the various subfields of AI and emphasizes their utility while approaching or exceeding human capacity.

Combining these categories, artificial intelligence can be defined as the technology that creates systems that can think and act like humans and achieve goals. AI is most commonly associated with various applications and advanced computer programmes such as recommender systems (e.g., YouTube, Netflix), personal assistants (e.g., Apple's Siri), facial recognition systems (e.g., Facebook's face detection in images), and learning apps (e.g., Duolingo) (Iman, M.,(2021). To build on these programmes, several sub-fields of AI have been applied in a wide range of applications. Machine learning and evolutionary algorithms are the most relevant to schooling.

Algorithms

Algorithms are the foundation of AI. The creation of sophisticated and evolving algorithms is important to the history of AI. An algorithm is a set of rules or instructions that computers must follow in problem-solving activities in order to attain a specific end goal. Algorithms are at the heart of all computer programmes. They involve thousands of lines of code that convey mathematical instructions that the computer follows to solve the intended issues

(for example, doing numerical calculations, processing an image, and verifying grammar in an article). Speech and facial recognition, visual perception, learning, and decision-making and learning are just a few of the disciplines where AI algorithms are being used. Algorithms can thus offer instructions for nearly every AI system and application that we can imagine (Henderson, P.,(2018).

Machine learning

Machine learning is derived from statistical learning methods and employs data and algorithms to execute jobs that humans normally perform (Naqvi, A. (2020). Machine learning is the process of teaching computers to act or perform without providing them with explicit instructions (Holmes, W.,(2023) . The exposure of the learning model to large volumes of high-quality data is the machine learning working mechanism. Machine-learning algorithms analyze data to identify patterns and then use these patterns to predict future values. To put it another way, machine learning is a three-step process. It first analyses and collects data, then constructs an excel model for various activities, and then executes the action and successfully generates the intended outcomes without human interaction . The working principles of machine learning have enabled widely known AI applications such as recommender systems and facial recognition systems.

Interior Design:

Although the field of interior design is very old, archaeological evidence in the civilization of Iraq and the civilization of ancient Egypt indicates the existence of interior design for ancient facilities, especially residential ones, in different periods, Sumerian, Akkadian, Babylonian, Assyrian, Pharaonic, and through cylinder seals, clay tablets, stone, and finds.

Archaeological works, and all these evidences confirm that there was a certain arrangement on the basis of which these facilities were designed (however, today he practices a new profession that is completely different in its concept from what he used to work in in the past, as he had a main relationship with the surface forms of house decoration, and years ago he used the term Decoration was replaced by a more comprehensive and descriptive term, Interior Decoration, which is Interior Design. In some European countries where the specialty was well established, it is known today as Interior Architecture. (massey, 2012)

As the University of Brighton guide indicates, it is an important path that represents the link between pictorial ideas in private design and every method towards real material. It is a description of how current places change and focus to become more useful to humans, as materials and elements represent their form and content, as they are the backbone of this specialization. It is an indication of the type of continuity and integration between interior design and architectural design, where the work of the architect and the interior designer is side by side.

Interior design indicates that it falls within a larger comprehensive field, which is Environmental Design, and that this environmental system contains two basic parts, as indicated by the Environmental Design Research Society, which are: (Abercrombie, 2018)

- Physical Environment: which can be described and measured in terms of visual, thermal, aural and other physical characteristics.
- Spatial Environment: which can be described and measured through the measurement terms size, number, form, type, and connections between spaces.

Through these two trends, we find that interior design is directly concerned with studying the elements that constitute the space in the building, such as ceilings, walls, floors,

openings, furniture, etc. It also studies the physical composition of the material from which the elements are composed, its quality and its visible sensory impact, such as color, texture, and shape, and determines the relationship of these elements to each other as well. About other qualities.

From the above, interior design can be defined as preparing the interior space to perform functions with minimal effort. This includes floors, walls, ceilings, and equipment.

It is also defined as (the art of treating space or space and all its dimensions in a way that exploits all design elements in an aesthetic way that helps work inside the building).

Finally, it can be said that interior design is the broad and unlimited awareness of all architectural matters and their details, especially the interior ones, the materials, what they are, and how to use them. It is the pure knowledge of furniture, its measurements, its distribution in interior spaces according to its purposes, how to use it, choose it, and place it in the appropriate place, as well as knowledge of other necessary coordination matters, such as lighting and its distribution. And coordinate it and the various other accessories needed for the space according to its function.

Interior design evolution

Specialists in the field of interior design matured at the end of the twentieth century and the beginning of the twenty-first century. New trends in design and interior design due to the changes taking place in public life. It seems that the change in the social structure and the disappearance of some of its old methods has played a major role in this, as interior design has a clear connection. With the forms of social, economic, religious and intellectual life, and the so-called style that characterizes any of the different historical stages. It is

nothing but a direct product of the economic and social factors, intellectual trends, and religious beliefs that govern any of these stages. It can be said that interior design is an art that can reach wide ranges in conveying aesthetic and spiritual ideas and values, even at the level of individual buildings.

The development of interior design and furnishing was, and still is, dependent on the process of development of human thought in various aspects of life. The design and interior design process went through many stages within historical eras, each of which was given a specific name that expressed it. Many factors led to the distinction and crystallization of each stage. Among these factors: (Gibbs, 2005)

- Intellectual and cultural factors such as artistic and architectural movements (styles and currents).
- Technological factors (scientific and industrial), as modern developments in manufacturing affect all components of the interior space, such as materials, colors, furniture, service systems, etc.
- Social factors and all the variables that occur in human thought and the way people understand life at every period of time
- Economic factors and their direct effects on technological development.
- The designer and architect, especially the international architectural pioneers, had and still have a wide and clear impact on the development of global artistic thought and the development of the furniture industry and the design of interior spaces, as many of them are considered pioneers or leaders in establishing art schools, designing and manufacturing furniture, and directing the global industry and manufacturing process in the modern era.

- International and local artistic, architectural and industrial exhibitions play a major role in highlighting and spreading artistic movements, architectural styles and modern industrial methods that express each period of time. (brooker, 2010)

From this, we conclude that the great development that the world has witnessed in all technological fields, the availability of materials and technologies, as well as specialized studies and research, and the multiplicity of technical schools, have had significant effects on the interaction or increased interest in studying the field of interior design and its development.

The impact of artificial intelligence on the development of interior design deliverables at Riyadh's universities:

Artificial intelligence in interior design relies on search algorithms that determine consumers' tastes through their browsing data. Artificial intelligence also allows computers to activate the filtering feature based on their tastes, thus enabling companies to implement any type of design style based on customer preferences (www.fihm.ai). There are many applications of artificial intelligence to help in the field of interior design, which are characterized by sophistication. Continuous is one of the most important of these applications:

- Computer vision: Computer vision in the field of interior design helps the designer access data and visual discovery during the research process. The designer can take pictures of the design elements to be furnished and then search and compare visually to choose the most suitable and best from within different companies with ease and speed, an example

of which is the company (Cadeera), which works with artificial intelligence technology by applying a flexible search approach in interior design.

- Natural language processing: Or natural language processing, which is concerned with developing programs and systems that have the ability to understand or generate human language, meaning that the user of these programs enters data naturally and the computer understands it and extracts from it.

- Augmented Reality 3D Display: Augmented Reality technology allows the development of artificial intelligence capabilities in the field of interior design, as it enables the designer to combine digital information with information derived from the surrounding environment, to display them together in a composite image that resembles realism, which helps in displaying furniture pieces in 3D. By creating a virtual home, and through this technology, users can check whether the furniture is suitable for the place and meets their needs or whether they need something else. An example of this is LexSet.ai, which combines artificial intelligence and augmented reality technologies to serve its customers. (Brooker, 2010)

- design programs enhanced with artificial intelligence technology:

- DALL-E: The program's technology produces images based on the text data entered into it and a description entered into it, The user (OpenAI) designed Dall-e to facilitate user design and artistic expression by creating images based on textual descriptions. (www.tremplin-numerique.org)

- Planner 5D: It is a three-dimensional program that is easy to use to create a professional design plan. This artificial intelligence tool is available for Windows and Mac

systems, as well as applications on phones, and through this application, a 2D diagram can be converted into 3D with ease. The tool is effective in creating customized interior settings for homes, apartments, or offices. Thanks to its 3D graphics, the interior design looks very realistic. The program also allows you to change the position of furniture and various other decorative elements. Electronic devices such as televisions, refrigerators, indoor plants, etc. can also be added” (www.fihm.ai).

- Havenly: is an application that works with artificial intelligence. It relies on collecting the user’s ideas for interior design, and choosing what suits him to add reality to his imagination. To complete this, the user must be subjected to a simple test to identify his taste, after which the algorithm selects the appropriate design for him. (pilem 2005)
- IKEA Place: is an application launched by IKEA, a furniture marketing company, where an interior design platform supported by artificial intelligence has been designed. The application, which uses virtual reality, makes the company's products available in the private space of consumers, by scanning the products with the help of mobile phone cameras, recommending the best matching options and also providing the actual measurements of the furniture to suit their space, and then users choose what suits them (www.fihm.ai)
- DecoraMatters is a smart application that relies on the use of augmented reality technology to help the user in interior design try out different pieces of furniture according to the nature of their interior spaces, and in a way that suits their special desires and needs. It is noteworthy that AR visualization enables almost the entire design technology in their real homes. This feature ensures that users choose the ideal furniture and decor pieces before making the purchase process, as it operates their artificial intelligence algorithm on

www.decormatters.com (www.decormatters.com). Through the huge amount of stored data, they have, which enables users to choose what suits their desires and tastes.) Ching, 2018)

From the above, artificial intelligence techniques and tools have provided valuable innovative solutions in most fields and have effectively contributed in the field of interior design to solving problems between consumer requests and the practical application of various solutions, as they have enabled the user to visualize the place to be designed with ease and view the various design solutions. Choosing the appropriate pieces of furniture for the interior spaces, and making modifications based on desires, which helped the interior designer and users avoid many mistakes, material losses, and save time.

- A learning space is the physical environment in which learning takes place (Todhunter, B. J. (2015), and it can also include the interface between a student's environment and learning (Kolb, A. Y.,(2005) New scientific research reveals that the function of the learning environment is strongly dependent on the quality of students' academic outputs for effective academic processes in schools (Mahat, M.,(2019). Learning techniques are now shifting from teacher-centred to student-centered, so research is being conducted on how to promote interactive teaching that will increase cooperation by modifying the perspectives of the learning spaces . Some learning spaces are specifically designed to promote constructivist pedagogy at the same time as allowing the teacher to transition from the role of a "sage on the stage" to being a "guide on the side" (Misra, P. K. (2020) or can be a "peer at the rear" where the instructor is involved in leading a classroom community. According to a study conducted by Ref. (Sadera, W. A.,(2009), learners learn more when they believe they are close to their teacher. The importance of the classroom learning

environment in defining how teaching and learning are carried out has been emphasized in recent decades (Wasnock, D. P. (2010) . Classroom learning space is defined as a material reality made up of an anthropogenic environment that interacts with societal behaviour models, and humanitarian ideals, and actively and dynamically manages the function of the classroom . It is now well acknowledged that the landscape of teaching and learning in schools is rapidly changing (Serrano, D. R.,(2019). Educators have recently been obliged to use creative strategies that will allow them to adjust to the digital age to ensure the participation of secondary school pupils in the twenty-first century while meeting their learning demands. Evidence can be seen in the educational sector's paradigm shift over the previous few decades from didactic teacher-led instruction to student-centred instruction. Modifications to school learning spaces have begun on a global scale, resulting in the creation of unique learning settings that promote more intense teaching and learning (Cleveland, B.,(2014). According to Ref. (Cleveland, B. (2016), when learning environments are successfully built, constructivist pedagogy is facilitated, which increases learner engagement. The arrangement of classroom space and the aesthetic character of the classroom can influence students' grades, and this varies with age and gender . Some of the demographic variables associated with student learning include age, gender, parents' educational level, rural/urban background, and so on, as well as students' metacognitive variables such as self-efficacy, motivation, confidence, interest, emotional states, and stress (Graetz, K. A. (2006). The modern classroom is technologically advanced, with different areas for instructors. They are similar to U-shape student sitting, in which flexible chairs and flexible cabinetry have replaced the old classroom setup, which consisted of rows of desks with only one point for the instructor . Changes in the virtual realm have resulted in

a paradigm shift in the educational sector, with collaborative and viable learning techniques of schooling know-how replacing lecture-based instruction (Bernstein, B. (2000). There have been few studies on the impact of learning environments and materials on classroom education. Bernstein's theory proposed three interconnected principles in the teacher-student relationship: i) superior rules, ii) sequencing rules, and pace . With the standards in place, kids are well aware of the appropriate forms of verbal utterances, social interactions, or school roles . The typical features of historical school buildings are characterized by the fixed and unchangeable arrangement of desks into rows, and even modern-day classrooms are designed in such a way that parallel rows and columns of pupils face the board as well as the teacher's desk. The teacher's desk is near to the board in this style of classroom setup. It provides students and teachers with a fixed sitting position in the classroom. The concept of self-efficacy derives from social learning theory . Self-efficacy is accountable for the observed disparities in how people feel, think, and motivate themselves. A lack of efficacy impedes cognitive advancement and achievement in a variety of circumstances, including how well or poorly resolutions are formed and academic performance (Ahmadi, S. (2020). The goal of this study was to provide a full understanding of how students' academic grades, collaboration, and interest results are connected with characteristics capable of changing classroom-learning spaces. The study includes a plethora of mediators.

- Role of AI in Education

Education is critical to the advancement of human civilization. Since ancient times, the technique of learning has been constantly expanding and changing because of new technologies. We are all familiar with traditional methods of learning in which instruction

is taught to a group of pupils within the confines of classrooms. With the help of the internet and digital technologies, the online platform is gradually but steadily taking the role of classrooms (Mureşan, M. (2023)) . Thus, the modern education system has eliminated the space limitation of a classroom by encouraging more students from all over the world to participate. The current education system has been able to attract a diverse range of students and teachers to participate in technology-based learning by giving knowledge through online platforms or websites. Online learning is growing in popularity since it is not limited by time, place, or the number of pupils. Online learning, which is still evolving to ensure the quality of education has various advantages, including flexibility, lower costs, and a diverse selection of content. Artificial Intelligence (AI) has become more prevalent in our lives in recent decades, having a substantial impact on a variety of disciplines, including education. Education has changed dramatically, and the effect of artificial intelligence brings with it the possibility to reform and adapt the teaching/learning process. There is a need to investigate the impact of artificial intelligence on education, as we know it, as well as how we might use this knowledge to better the lives of students and teachers (Mureşan, M. (2023)) . As a result, we begin this investigation with the definition and characteristics of artificial intelligence. Thus, artificial intelligence refers to the creation of systems and technologies capable of simulating intelligent human behavior such as learning, thinking, and problem solving. It entails the use of algorithms and complicated mathematical models to enable machines to learn and improve their performance independently, and the primary goal of AI is to enable computers to exhibit human cognitive qualities. The ability to learn is a critical component of Artificial Intelligence. Intelligent systems are intended to learn from data and experiences, discover patterns and trends, and continuously improve their

performance. This is accomplished by employing machine learning algorithms and artificial neural networks, which enable machines to process data, find patterns, and make predictions or judgments based on them. Another important feature of Artificial Intelligence is reasoning. Intelligent systems can make logical decisions and solve complicated issues by utilizing available knowledge (Vimal, D. (2022) . They can analyze data, extract pertinent information, and develop desired outcomes or solutions using rules and algorithms. Problem solving is a fundamental talent of artificial intelligence that employs intelligent systems to approach and solve a wide range of challenges, whether mathematical, logical, or information-processing-related. They can employ specialized algorithms and approaches to arrive at optimal solutions or make decisions based on the objectives and limitations at hand. It is important to note that Artificial Intelligence is divided into two categories: weak artificial intelligence, which refers to specialized systems designed to perform specific tasks, such as speech recognition or machine translation, and strong artificial intelligence, which involves the development of systems with general cognitive skills and the ability to understand and solve problems across a wide range of domains.

- The use of artificial intelligence in education

Artificial intelligence is increasingly being used in education. It is becoming increasingly evident to everybody that it offers many interesting possibilities for pupil/student learning outcomes and already promises significant assistance in reaching modern educational goals. We will look at some of the possible benefits of AI for students and teachers. AI benefits and potential in education by promoting the personalization of learning, delivering

quick feedback, and boosting assessment efficiency. Thus, artificial intelligence can be integrated into online learning platforms, allowing information and exercises to be tailored to each student's needs and knowledge level. Artificial intelligence can be used in learning management systems to provide personalized recommendations, and automatic feedback, and to track student progress. As a result, learners and students can gain access to information and resources that are appropriate to their specific needs. Virtual reality can also be utilized to enhance collaboration and teamwork among students, and tools such as social media can be used to connect students with their peers and professors. Additionally, AI can be used to construct tutorials and interactive virtual assistants, which are systems that can answer students' queries, provide extra explanations, and guide students through the learning process in real-time. Thus, through tutorials and virtual assistance, students can receive additional support and learn at their own pace while obtaining real-time coaching to aid in the learning process (Mahendra 2023). In terms of learning verification, AI can automate numerous time-consuming administrative processes in teaching and learning. Grading assignments, providing feedback on student work, and even detecting plagiarism are all possibilities. AI algorithms may be trained to recognize patterns and evaluate student responses in a variety of areas. This enables teachers to obtain timely and detailed feedback on student performance, deliver personalized interventions based on each student's unique needs, and save time and resources. The ability to adapt the learning process to the unique needs of pupils/students is one of the important characteristics of artificial intelligence's effect on education. AI can identify shortcomings and automatically change material and teaching approaches to help individual performance improvement by collecting and analyzing data on student/student growth and performance. As a result, a

more personalized and effective learning experience can be achieved. Forecasting performance through data analysis and recognizing patterns and trends is a very successful use of AI. AI can provide useful insights into individual performance and create predictions about a student's success or failure by gathering and analyzing data on student performance and behavior. This can assist teachers and schools in making informed decisions and providing early intervention to support students and children. I'm going to list some of the advantages of removing manual administrative work at schools, colleges, and universities, such as scheduling, rescheduling classes, marking attendance, grading papers, finance and accounting, and record keeping. The same can be said for duties such as handling big data sets, processing student requests, and planning extracurricular activities, all of which are time-consuming and may now be delegated to AI. Furthermore, the management of the premises frequently requires a significant amount of time. These repetitive duties, such as monitoring water and energy consumption and controlling heating or air conditioning, can be automated with AI capabilities. Student travel is another area where AI can have a significant impact. However, while artificial intelligence has numerous educational benefits, there are also obstacles and dangers linked with its broad application. These include personal data privacy and security, a lack of human interaction, which can affect the development of pupils'/students' social and emotional skills, and trust in the system, which necessitates transparency and clear explanations of how these systems arrive at conclusions and recommendations. I believe that the use of artificial intelligence in education provides various substantial prospects and benefits, notwithstanding the limits that have been highlighted. AI can improve the teaching and learning process by personalizing learning, delivering quick feedback, and automating assessment, resulting in

a more efficient and productive experience for students and teachers. However, a balance must be struck between technology and the human aspects of education.

- AI's Impact on Education:

AI's transformative power in education lies in its potential to revolutionize learning experiences and improve educational processes. AI offers personalized learning pathways tailored to individual students' needs, learning styles, and strengths, promoting better engagement and understanding. AI-powered tutoring systems can provide real-time feedback and adaptive learning materials, enhancing students' learning journeys. Administrative tasks can be streamlined through AI applications, reducing teachers' administrative burden and allowing them to dedicate more time to classroom interactions and addressing students' specific needs. AI can assist in data analytics, tracking students' progress, and identifying areas where additional support may be required. Moreover, AI-driven educational content creation allows for dynamic and interactive learning materials, engaging students in innovative ways. Language tutoring systems employing natural language processing help students improve their language skills, and computer vision enables educational tools to recognize and interpret visual information. AI's evolution has been marked by advances in computing power, data availability, and improved algorithms, enabling its integration across diverse industries. In the context of education, AI's transformative impact lies in personalized learning, real-time feedback, and streamlined administrative tasks, empowering educators to focus on individual student needs and creating a more efficient and engaging learning environment. As AI continues to advance, its potential to reshape industries and improve human experiences remains profound.

The Promise of AI in Education

Education is a crucial pillar of society that shapes the future by fostering young minds and preparing them for tomorrow's problems. Traditional education systems, on the other hand, frequently confront substantial problems, such as huge class numbers, variable learning paces, and limited resources, making it difficult for instructors to adequately respond to each student's particular needs.

Through personalized learning, artificial intelligence (AI) offers a possible answer to these difficulties, with the potential to improve education in the following ways:

1. **Personalized Education:** Personalized learning is one of the major promises of AI in education. Using AI-powered platforms and algorithms, educational content and teaching methods may be tailored to each student's specific needs and preferences. Through constant data analysis, AI can recognize students' strengths, limitations, and learning styles and customize the programme accordingly. This ensures that students receive the appropriate content at the appropriate moment, promoting deeper comprehension and engagement with the material.

2. **adaptable Learning Paths:** AI-powered systems can provide adaptable learning paths based on the development and performance of students. If a student excels in one subject, the AI system can deliver more difficult content to keep them engaged and motivated. If, on the other hand, a student is having difficulty grasping a subject, the AI can provide extra explanations, examples, and activities to help them understand.

3. Real-time Feedback: AI may provide students with instant and constructive feedback on their assignments, quizzes, and assessments. This quick feedback assists students in understanding their errors, correcting them, and reinforcing their learning. AI-powered feedback also helps educators by flagging frequent misconceptions or places where students may be suffering, allowing teachers to intervene and provide focused guidance as soon as possible.

4. Data-Driven Decision Making: Because AI can analyze massive volumes of educational data, educators and administrators may make data-driven judgments. AI can assist in discovering learning gaps, measuring the effectiveness of teaching tactics, and optimizing the curriculum to improve student outcomes by evaluating patterns and trends in student performance.

5. Augmented Teaching: AI is not intended to replace teachers; rather, it is intended to supplement human abilities. AI can free up instructors' time by managing administrative work, grading, and data analysis, allowing them to focus on developing meaningful relationships with students, offering individualized support, and nurturing social-emotional abilities.

6. Education Accessibility: AI has the potential to democratize education and make it more accessible to learners all across the world. Educational resources can be given to remote or underserved locations via AI-powered online learning systems, providing quality education to those who might not otherwise have access.

However, while AI's promise in education is exciting, it also poses ethical concerns. Ensuring data privacy, avoiding algorithmic bias, and retaining human oversight in AI-

driven education is crucial to fostering trust and attaining desired outcomes. The promise of artificial intelligence in education is in its ability to create personalized learning experiences, adjust to students' particular requirements, and assist instructors in developing more effective teaching methodologies. By using AI to analyze educational data and optimize learning pathways, education may become more inclusive, engaging, and effective, paving the way for a brighter future for learners all across the world.

Understanding the Role of AI in the Classroom

The incorporation of Artificial Intelligence (AI) in the classroom is redefining the traditional educational environment by providing novel solutions to improve teaching and learning processes. The function of AI in education goes beyond simply introducing new technology; it aspires to empower both educators and students by providing personalized, efficient, and engaging learning experiences.

1. **AI-Powered Tutoring Systems:** AI-powered tutoring systems provide personalized learning experiences that are suited to each student's specific learning needs and pace. Machine-learning algorithms are used in these systems to assess a student's strengths, limitations, and learning styles. Based on the results of this analysis, the AI tutor can offer specific learning resources, exercises, and activities to improve the student's comprehension and recall of the content. This adaptive learning strategy ensures that students receive individualized assistance, resulting in improved academic achievements.
2. **Intelligent Virtual Assistants and Chatbots:** AI technologies that engage with students using natural language processing are known as intelligent virtual assistants and chatbots. These artificial intelligence-powered gadgets may answer students' inquiries, provide rapid

feedback on assignments, and provide study resources. The presence of these virtual assistants extends learning beyond typical classroom hours, allowing students to seek help and support at any time. This in-person engagement promotes a more dynamic and engaged learning environment.

3. AI-Driven Assessment and Evaluation: AI can help educators save time by streamlining the assessment and evaluation process. Multiple-choice questions, short answers, and even essay responses can be assessed quickly using automated grading and evaluation methods, decreasing the strain of manual grading. Furthermore, AI systems may analyze student performance data to detect trends and patterns, allowing educators to alter their teaching tactics and provide personalized help to individual students.

4. Interactive Learning Platforms: Artificial intelligence has enabled the creation of interactive and immersive learning platforms that engage students in novel ways. For example, virtual reality (VR) and augmented reality (AR) technology can build simulated worlds that allow students to interact with educational content more engagingly. These platforms improve students' comprehension of hard subjects while also making studying more interesting and entertaining.

5. Student Support and Learning Analytics: AI's data analytics capabilities are critical for comprehending student progress and behavior. AI can discover learning gaps, track students' academic achievement, and provide insights into their learning preferences and obstacles by analyzing massive datasets. This data enables teachers to make data-driven decisions, execute targeted interventions, and create personalized learning paths for individual pupils.

6. Administrative Efficiency: AI adds to administrative efficiency in educational institutions in addition to its impact on teaching and learning. Artificial intelligence-powered systems can automate administrative duties such as scheduling, resource management, and student record management, freeing up instructors' time to focus on instructional tasks and student engagement.

The Advantages and Challenges of Implementing AI in Education

Artificial Intelligence (AI) has emerged as a transformative force in various industries, and its potential impact on education is no exception. We explore the advantages, challenges, and concerns associated with the integration of AI in education. AI's ability to analyze vast amounts of data, personalized learning experiences, and automate repetitive tasks offers promising opportunities to revolutionize the learning process. However, along with the promises come important challenges and ethical considerations that must be carefully addressed to ensure the responsible and effective use of AI in educational settings. This chapter delves into the potential benefits of AI in education, such as personalized learning, improved student engagement, and AI-driven teaching support. We also examine the challenges related to data privacy and security, fairness and bias mitigation, and the potential overreliance on technology. By understanding the advantages and addressing the challenges and concerns, educational institutions can harness the full potential of AI to create innovative and equitable learning environments. In doing so, they can pave the way for a future where AI and education collaborate harmoniously to empower learners and educators alike.

Advantages of AI in Education

Artificial Intelligence (AI) has the potential to revolutionize education by enhancing various aspects of the teaching and learning process. Its ability to analyze vast amounts of data, adapt to individual needs, and automate repetitive tasks offers several advantages for educational institutions and learners alike. Here are some key advantages of AI in education.

Personalization and Adaptive Learning : Personalization and adaptive learning are powerful educational concepts that aim to tailor the learning experience to the individual needs of each student. AI in education has emerged as a transformative tool in achieving this goal, revolutionizing traditional one-size-fits-all classroom models. We explore the advantages of personalization and adaptive learning enabled by AI and how it positively impacts students and their learning outcomes.

Addressing Individual Learning Styles: Every student learns differently, and a teaching method that works well for one may not be as effective for another. AI-powered educational systems can assess and identify the learning styles, preferences, and strengths of each student based on their interactions with learning materials, assessments, and engagement with content. With this information, AI can customize the delivery of content, adapting it to suit the student's preferred learning method, be it visual, auditory, kinesthetic, or a combination of styles.

Tailoring Learning Paths : Traditional curricula often follow a linear progression, with all students moving at the same pace. However, not all students grasp concepts at the same speed, leading to potential gaps in understanding. AI can analyze individual learning

progress and proficiency in different topics, enabling the creation of personalized learning paths for each student. This means that students can advance at their own pace, focusing on areas where they need more practice and review while accelerating through concepts they have mastered.

Enhancing Student Engagement and Motivation: When students are actively engaged and interested in their studies, they tend to be more motivated to learn. AI-powered learning platforms can offer personalized content that aligns with students' interests and areas of expertise. By incorporating interactive elements, gamified experiences, and multimedia resources, AI can create an engaging learning environment that captivates students' attention and fosters enthusiasm for learning.

Continuous Assessment and Feedback : AI can provide continuous and immediate feedback to students on their performance. By analyzing responses to quizzes, assignments, and activities, AI algorithms can identify areas where a student may be struggling and offer targeted feedback or additional resources to address those challenges. This real-time feedback allows students to self-correct, reinforcing their understanding and building confidence in their abilities.

Supporting Differentiated Instruction : In traditional classrooms, teachers face the challenge of differentiating instruction to meet the diverse needs of their students. AI assists teachers in this task by providing valuable insights into individual student progress and learning patterns. Armed with this information, educators can adjust their teaching strategies and interventions to better support each student, ensuring that no one is left behind or held back.

Personalized Content Recommendations: AI-powered educational platforms can use data from a student's past performance and interests to recommend relevant and personalized learning resources, such as articles, videos, interactive simulations, or additional practice materials. These recommendations are tailored to suit the individual's learning preferences and help them explore topics of interest beyond the core curriculum.

Improved Learning Outcomes: Ultimately, personalization and adaptive learning driven by AI lead to improved learning outcomes. Students experience increased mastery of subjects, higher retention of knowledge, and a deeper understanding of concepts. As students' progress through their educational journey with personalized support, they are more likely to achieve academic success and develop a lifelong love for learning.

Personalization and adaptive learning, made possible through AI in education, revolutionize the traditional classroom model. By catering to individual learning styles, tailoring learning paths, enhancing engagement, providing continuous feedback, and supporting differentiated instruction, AI optimizes the learning experience for each student. The result is improved learning outcomes, increased student motivation, and a more inclusive and effective educational system. As AI continues to advance, its potential to revolutionize education and empower learners to reach their full potential becomes increasingly apparent.

Enhanced Teaching and Learning Methods

The integration of AI in education has paved the way for innovative teaching and learning methods beyond traditional approaches. AI-powered tools and resources have the potential to revolutionize how educators deliver content, engage students, and identify areas for

improvement. In this section, we explore the advantages of AI in enhancing teaching and learning methods and empowering teachers and students to achieve better educational outcomes.

1. Virtual Tutors and Educational Chatbots : AI-powered virtual tutors and educational chatbots are valuable tools that provide students with immediate and personalized support. These virtual assistants can answer questions, clarify concepts, and guide students through problem-solving processes. The availability of virtual tutors and chatbots extends the learning experience beyond regular classroom hours, allowing students to access help whenever needed. This accessibility fosters independent learning and self-directed study, promoting student autonomy and confidence in tackling academic challenges.

2. Interactive Simulations and Gamified Learning : AI-driven educational applications offer interactive simulations and gamified learning experiences that make learning engaging and enjoyable. Simulations allow students to interact with complex concepts and phenomena, facilitating better understanding and retention of knowledge. Gamified learning employs game elements such as rewards, challenges, and competition to motivate students and enhance their learning experience. By leveraging AI to design interactive and immersive learning environments, educators can create a dynamic and stimulating atmosphere that captivates students' interest and enhances their learning outcomes.

3. Immersive Virtual Reality (VR) Environments : AI's integration with virtual reality technology opens up new possibilities in education. Immersive VR environments can transport students to historical events, remote locations, or even microscopic worlds, offering a unique and realistic learning experience. This hands-on approach helps students grasp abstract concepts and stimulates their curiosity. For instance, students studying

history can virtually visit ancient civilizations, while biology students can explore the human body at the cellular level. Immersive VR experiences promote active learning, making complex subjects more accessible and memorable.

4. AI-Driven Analytics for Personalized Instruction: AI-driven analytics enable teachers to gain deeper insights into students' learning progress and performance. By analyzing data collected from assessments and interactions, AI can identify students who may be struggling with specific concepts or topics. Armed with this information, educators can adapt their instructional strategies and interventions to meet the individual needs of each student. This data-informed approach empowers teachers to provide targeted support, personalized feedback, and additional resources to help students overcome challenges and achieve academic success.

5. Adaptive Learning Platforms : AI can power adaptive learning platforms that dynamically adjust content and learning materials based on individual student performance. These platforms continuously monitor students' progress, identifying areas of strength and weakness. As students' progress, the AI adapts to the content's difficulty and complexity, ensuring that learners are appropriately challenged and engaged.

Adaptive learning platforms can reduce the time spent on topics already mastered, allowing students to focus on areas that require more attention, thus optimizing learning efficiency.

AI's integration into education has introduced a range of enhanced teaching and learning methods that empower both educators and students. Virtual tutors and educational chatbots provide immediate support, while interactive simulations, gamified learning and immersive VR environments make learning engaging and enjoyable. AI-driven analytics

assist teachers in identifying students' learning needs, enabling personalized instruction and interventions. Additionally, adaptive learning platforms dynamically adjust content, optimizing learning paths for each student. These advancements contribute to a more student-centered and effective educational experience, fostering a deeper understanding of concepts, increased engagement, and improved learning outcomes. As AI technology continues to advance, its potential to transform education and enrich the teaching-learning process becomes even more promising.

Improved Administrative Efficiency

The integration of AI in education not only enhances teaching and learning but also streamlines administrative tasks, leading to improved efficiency and cost savings for educational institutions. By automating routine administrative processes and providing data-driven insights, AI empowers educators and administrators to focus on their core responsibilities, ultimately benefiting the entire educational ecosystem.

1. Automating Routine Administrative Tasks: AI-powered systems can handle a wide range of routine administrative tasks, reducing the burden on administrative staff and educators. These tasks include managing timetables, scheduling classes, coordinating events, and handling routine communications with students and parents. By automating these processes, educational institutions can optimize their workflow, minimize errors, and free up valuable human resources for more strategic and impactful tasks.

2. Tracking Attendance and Monitoring Student Progress : AI can streamline attendance tracking by using facial recognition or biometric systems, eliminating the need for manual record-keeping. Real-time attendance data allows educators and administrators

to monitor student attendance patterns, promptly address absenteeism issues, and ensure a safe learning environment. Additionally, AI-powered systems can monitor student progress through data collected from assessments, enabling early identification of struggling students, and facilitating timely interventions.

3. Efficient Grading and Assessment : AI-driven grading and assessment tools can automate the evaluation of objective questions, saving educators significant time. By leveraging machine learning algorithms, these systems can accurately grade assignments, quizzes, and exams with speed and consistency. Educators can then focus on providing personalized feedback and assessing more subjective aspects of student performance, fostering deeper learning and understanding.

4. Generating Reports and Analytics: AI-driven analytics can generate comprehensive reports on student performance, class progress, and overall institutional data. These insights help administrators and educators identify trends, spot areas for improvement and make data-informed decisions. By having access to timely and relevant information, institutions can adapt their strategies to ensure effective teaching and learning, allocate resources efficiently, and improve student outcomes.

5. Streamlining Resource Allocation : AI can optimize resource allocation by analyzing data on student needs, class sizes, and resource availability. This data-driven approach enables institutions to allocate teachers, classrooms, and other resources efficiently. By avoiding underutilization or overcrowding of resources, institutions can maximize their budget and enhance the overall learning experience for students.

6. Data-Driven Curriculum Design: AI-driven analytics can analyze student performance data and feedback to inform curriculum design. This data-driven approach ensures that curricula are tailored to meet the learning needs of students and are aligned with the latest educational standards and trends. By continuously analyzing student outcomes, institutions can adapt and refine their curricula to foster better learning outcomes and prepare students for the challenges of the future.

AI's impact on administrative efficiency in education is significant. By automating routine administrative tasks, tracking attendance, streamlining grading and assessment, generating reports, and providing data-driven insights, AI empowers educators and administrators to focus on more strategic and student-centred activities. The increased efficiency not only saves time and resources but also enhances the overall quality of education by enabling data-informed decision-making and a more personalized learning experience. As AI technology continues to evolve, its potential to optimize administrative processes in education becomes even more promising, supporting educational institutions in their mission to deliver high quality and effective learning experiences.

- Challenges of AI in Education

Privacy and Security Concerns: The collection and analysis of large amounts of personal data from students could pose a risk if it falls into the wrong hands. Institutions must ensure that they are taking appropriate measures to protect students' privacy and prevent data breaches. **Lack of Trust** Students may be hesitant to accept grades or feedback generated

by an AI system, preferring to have human input and evaluation. It is important to establish trust with students and make them feel comfortable with the technology.

Cost: AI systems can be expensive to implement and maintain, which can be a challenge for educational institutions that are already facing budget constraints. Institutions must carefully consider the costs and benefits of implementing AI systems in their classrooms.

Potential Bias: AI systems can be biased, particularly if they are trained on biased data. This can result in unfair treatment of certain students and perpetuate existing inequalities. Institutions must ensure that their AI systems are unbiased and do not perpetuate existing inequalities.

Ethical Considerations: **Ensuring Accessibility:** AI-based education systems must be designed with accessibility in mind, ensuring that all students, including those with disabilities, can access and use the technology.

Transparency: AI systems must be transparent, with clear explanations of how they make decisions and why. This can help build trust with students and ensure that they understand the technology.

Fairness: AI-based education systems must be fair, ensuring that all students are treated equally and not discriminated against based on their race, gender, or other factors.

Future of AI in Education: The future of AI in education is bright, with opportunities for innovation and growth. AI has the potential to transform the way we teach and learn, making education more personalized, efficient, and effective. In the future, we can expect to see more advanced AI systems that can understand and respond to human emotions,

provide more nuanced feedback, and even create personalized lesson plans for each student.

Personalized Learning : AI can help personalize the learning experience for each student, allowing them to learn at their own pace and according to their individual needs and abilities. This can lead to improved learning outcomes and increased student engagement.

Increased Efficiency: AI can automate repetitive tasks such as grading, data analysis, and administrative tasks, freeing up time for teachers and students to focus on more meaningful tasks.

Improved Student Engagement: AI can help improve student engagement by providing interactive and engaging learning experiences. For example, chatbots and virtual assistants can make learning more fun and interactive, and adaptive learning technologies can help students stay engaged by presenting material at their level of understanding.

Better Data Analysis: AI can analyze large amounts of data and provide insights into student performance, allowing teachers to better understand their students and tailor their instruction accordingly. This can lead to improved learning outcomes and better student performance.

- Benefits of AI in Education

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Benefits of AI applications in education:

Personalized learning systems, automated assessments, facial recognition systems, chatbots (social media sites), and predictive analytics tools are being deployed increasingly in educational settings; they are powered by machine-learning systems and algorithms (Holmes, W.,(2023). These applications of AI have shown promise to support teachers and students in various ways: (a) providing instruction in mixed-ability classrooms, (b) providing students with detailed and timely feedback on their writing products, (c) freeing teachers from the burden of possessing all knowledge and giving them more room to support their students while they are observing, discussing, and gathering information in their collaborative knowledge-building processes (Hrastinski, S.,(2019). Below, we outline the benefits of each of these educational applications in setting before turning to a synthesis of their ethical challenges and drawbacks.

Personalized learning systems:

Personalized learning systems, also known as adaptive learning platforms or intelligent tutoring systems, are one of the most common and valuable applications of AI to support students and teachers. They provide students access to different learning materials based on their individual learning needs and subjects . For example, rather than practicing chemistry on a worksheet or reading a textbook, students may use an adaptive and interactive multimedia version of the course content . Comparing students' scores on researcher-developed or standardized tests, research shows that instruction based on personalized learning systems resulted in higher test scores than traditional teacher-led instruction (Ladson-Billings, G. (1995). Microsoft's recent report (2018) of over 2000 students and teachers from Singapore, the U.S., the UK, and Canada shows that AI supports students' learning progressions. These platforms promise to identify gaps in students' prior knowledge by accommodating learning tools and materials to support student's growth. These systems generate models of learners using their knowledge and cognition; however, the existing platforms do not yet provide models for learners' social, emotional, and motivational states . Considering the shift to remote education during the COVID-19 pandemic, personalized learning systems offer a promising form of distance learning that could be reshaped for the future .

Automated assessment systems:

Automated assessment systems are becoming one of the most prominent and promising applications of machine learning in education (Murphy, R. F. (2019). These scoring algorithm systems are being developed to meet the need for scoring students' writing, exams and assignments, and tasks usually performed by the teacher. Assessment

algorithms can provide course support and management tools to lessen teachers' workload, as well as extend their capacity and productivity. Ideally, these systems can provide levels of support to students, as their essays can be graded quickly . Providers of the biggest open online courses such as Coursera and EdX have integrated automated scoring engines into their learning platforms to assess the writings of hundreds of students (Murphy, R. F. (2019) . On the other hand, a tool called “Gradescope” has been used by over 500 universities to develop and streamline scoring and assessment . By flagging the wrong answers and marking the correct ones, the tool supports instructors by eliminating their manual grading time and effort. Thus, automated assessment systems deal very differently with marking and giving feedback to essays compared to numeric assessments, which analyze right or wrong answers on the test. Overall, these scoring systems have the potential to deal with the complexities of the teaching context and support students' learning process by providing them with feedback and guidance to improve and revise their writing.

Literature Review

The integration of artificial intelligence (AI) into education has gained considerable attention in recent years, as educators and policymakers seek to leverage technology to enhance the learning experience. In Riyadh's universities, like educational institutions worldwide, AI's potential to revolutionize education is being explored. This literature review provides an overview of key themes, trends, and insights from existing research on AI in education, focusing on ethical considerations and data privacy.

AI in Education:

The adoption of AI in education is driven by its potential to provide personalized learning experiences, automate administrative tasks, and improve learning outcomes. AI-powered educational tools, such as intelligent tutoring systems and adaptive learning platforms, have been shown to enhance student engagement and academic performance.

Ethical Considerations:

Ethical concerns surrounding AI in education revolve around issues of privacy, fairness, transparency, and accountability. AI systems may collect and analyze vast amounts of student data, raising questions about how this data is used, stored, and protected. The potential for algorithmic bias and discrimination in educational AI systems is also a critical ethical concern.

Data Privacy:

Data privacy is a central concern when integrating AI in education. Research has highlighted the need for robust data protection measures to safeguard students' personal information. Data breaches and unauthorized access to student data pose significant risks, necessitating stringent data privacy policies and practices.

Algorithmic Fairness:

Algorithmic fairness is a critical consideration when AI systems are used for assessments, admissions, or decision-making in education. Biased algorithms can perpetuate discrimination, making it essential to develop and employ fairness-aware machine learning techniques to mitigate bias.

Transparency and Accountability:

Transparency and accountability in AI systems are crucial to building trust in educational institutions. Stakeholders, including students, parents, and educators, should have a clear understanding of how AI systems make decisions and their potential impact on educational outcomes.

Regulations and Guidelines:

Various countries and regions have started to develop regulations and guidelines for AI use in education. These include frameworks for data protection, ethics, and privacy. The European General Data Protection Regulation (GDPR) and emerging legislation are setting standards for data privacy and ethics.

Case Studies and Best Practices:

Researchers and educational institutions have conducted case studies and shared best practices for implementing AI in education while addressing ethical concerns. These examples offer valuable insights into how to strike a balance between the advantages of AI and ethical considerations.

Student Perspectives:

Understanding student perspectives on AI in education is critical. Research has shown that students are concerned about data privacy and algorithmic fairness and wish to have a say in how AI is used in their educational experience.

- Artificial Intelligence in Education: Exploring the Potential Benefits and Risks

AI in education has piqued the interest of both researchers and educators, with some heralding it as a game-changing tool for boosting teaching and learning. One of the most significant advantages of AI in education is its ability to personalize learning experiences for individual pupils. AI algorithms, as Kelleher and Tierney (2018) point out, can be used to construct personalized learning programmes for students based on their unique requirements, interests, and talents. Students are more likely to be motivated by content that is suited to their interests, which can aid increase learning outcomes and engagement. Furthermore, adopting AI can assist teachers reduce their burden by allowing them to spend less time planning and more time interacting with individual pupils. For example, artificial intelligence (AI) can evaluate assessments, freeing up teachers' time for other activities (Mandernach, 2018). Furthermore, AI systems can provide useful data on student performance that can be utilized to inform training and improve learning outcomes (Baker

& Siemens, 2014). However, there are risks to using AI in education. One of the key worries is that students may utilize AI tools to cheat on tests or otherwise avoid the learning process. As Kavale and Forness (2019) point out, AI can generate papers or finish student assignments, weakening the educational value of the activity. In response to this issue, some educators have advocated for reconsidering standard examinations in favor of more creative and open-ended activities that machines cannot easily perform . Furthermore, the rise of AI in education has underlined the necessity of instilling in pupils "human" abilities such as critical thinking, creativity, and problem solving, which robots cannot simply imitate (Gee, 2018). As a result, while AI can improve teaching and learning, educators must be aware of the risks and take steps to mitigate them while prioritizing the development of vital human skills in their pupils. One strategy is to create tasks that involve creativity, critical thinking, and problem-solving abilities that machines cannot duplicate. Project-based learning projects that require students to collaborate, solve complicated problems, and communicate their findings to an audience, for example, are good approaches to develop these skills. Open-ended exercises, such as essay writing or research projects, can also be used to measure students' comprehension and ability to synthesize material in their own words. Educators may ensure that pupils are actively engaged in the learning process and gaining abilities that will be necessary for future success by designing assignments that machines cannot easily complete. Educators must interact with their pupils in the classroom to provide quick feedback and assistance, in addition to developing projects that promote human skills. According to Kelleher and Tierney (2018), AI systems cannot take the position of teachers in giving personalized guidance and feedback to pupils. Teachers should also priorities teaching fine and gross motor abilities, such as handwriting,

which AI cannot imitate. These abilities are vital for cognitive growth and performance in a variety of vocations (Sulik, Huerta, & Ziegler, 2017). Teachers can ensure that their pupils develop the distinctive attributes that distinguish them from robots in the future by emphasizing and practicing these talents in the classroom. Furthermore, educators may guide their students through the rise of AI by teaching them how to ask appropriate questions that robots can answer. As AI advances, it will become increasingly necessary for people to understand how to connect effectively with these systems. Students can learn to utilize AI's power to boost their learning and problem-solving abilities by developing critical thinking skills and learning to ask questions that require higher-order thinking. This will help people prepare for the future labour market, comprehend the powers and limitations of AI, and ultimately appreciate what makes humans unique. Another issue with employing AI in education is the potential for it to increase the digital divide. According to Liao et al. (2021), not all students have equal access to technology or the internet, which might result in discrepancies in their capacity to profit from AI-powered tools and resources. This digital divide has the potential to worsen existing disparities in educational access and performance. As a result, schools must make AI tools available to all students and take initiatives to bridge the digital divide, such as giving access to technology and internet resources in impoverished communities. In addition to guaranteeing fair access to AI-powered tools, educators must also learn how to properly incorporate AI into their teaching processes. As artificial intelligence (AI) becomes more ubiquitous in education, teachers must stay current on the latest breakthroughs in AI and how to use it to improve their teaching. Understanding how to leverage AI-powered tools and platforms, such as adaptive learning software and chatbots, as well as how to build

practical AI-powered exams, are all part of this. Furthermore, teachers must be trained in integrating AI into their teaching techniques, assessing the usefulness of AI tools, and detecting and addressing possible ethical difficulties. We can ensure that AI is utilized responsibly and effectively in the classroom by giving adequate training to educators, and that kids benefit the most from these powerful tools. According to the National Education Association's (NEA) (2020) report, "educators must receive training and support to effectively integrate AI and other emerging technologies into their instruction." The paper emphasizes the significance of providing teachers with the skills and knowledge they need to effectively employ AI technologies in the classroom, including how to understand and analyze AI-generated data.

- Psychology of Learning Spaces, Impact on Teaching and Learning

Recently, higher education institutions have been challenged to rethink the formal and informal spaces where learning takes place (Long & Ehrmann, 2005; Oblinger, 2006). Traditional classrooms, characterized by sterile rows of desks with a single point of instruction, are being replaced with technology-infused classrooms with multiple points of instruction and flexible chairs, pod-style student seating, and moveable furniture that allows for a variety of configurations (Oblinger, 2006). These changes parallel the paradigm shift in education from lecture-based instruction to collaborative and active learning types of educational experiences. Research on how classroom space and physical environment might impact teaching and learning is still relatively new. Neill and Etheridge (2008), as well as Wilson and Randall (2012), performed small-scale studies at the college level, redesigning classrooms into podstyle seating (tables with six chairs facing each

other), to test how teaching and learning differed from traditional setups. These studies demonstrated that both students and faculty felt the redesigned rooms enhanced interactivity between students and faculty, which contributed to effective group work and improved learning. Another set of studies and projects utilized pedagogy as a theoretical blueprint for designing classrooms (Brooks, C. 2012). Drawing on the best practice research for instructional methods, such as collaborative, problem-based, and team-based learning strategies, rooms were designed with enhanced technology, multiple display screens, flexible tables and chairs, with the absence of a “front of the room” instructor area. Massachusetts Institute of Technology’s Technology Enabled Active Learning (TEAL) rooms (Dori, Y. 2003), North Carolina State University’s Student Centered Activities for Large Enrollment Undergraduate Programs (SCALE-UP) rooms (Beichner, R. 2007), the University of Iowa’s Transform, Interact, Learn, Engage (TILE) rooms (Van Horne, S. (2012) and the University of Minnesota’s Active Learning Classrooms (ALC) (Brooks, 2010) were all designed specifically for the types of instructional methods faculty intended to use in their courses. Studies of these spaces have shown increased opportunities for interaction with other students, more classroom discussions, more student-faculty private consultations, and better grades and test scores, compared to comparable classes held in traditional classrooms . These projects focused on the teaching and learning that took place in the physical classroom space; however, the environmental conditions within these spaces such as temperature, color of the walls and floor, lighting, air quality and acoustics also can impact student learning.

- Artificial Intelligence for Equity and Accessibility

The development of AI systems has been promised to increase educational equity and close academic gaps among varied groups of students (Holstein & Doroudi, 2021). Furthermore, Popenici and Kerr (2017) highlighted that AI systems based on machine learning algorithms may serve people of various capacities, ushering higher education institutions into a new era. AI is being used to ensure that all students have equal access to education by providing marginalized people and communities, such as the disabled, refugees, those who have dropped out of school, and those who live in isolated areas, with adequate learning opportunities under Sustainable Development Goal 4, which seeks to provide all people with access to high quality education and encourage lifelong learning opportunities. UNESCO (2019) also stated that when developing AI policies in education, equity and inclusion should be priority considerations. As a result, governments should proactively propose policy measures aimed at closing the digital divide in underdeveloped countries. In Bangladesh, for example, the government established digital centres no more than 4 km from each individual (Chowdhury, 2022). Furthermore, in Uruguay, Plan Ceibal, a programme designed to provide "one laptop per student" and internet connectivity, was announced as an educational initiative to digitize education but later evolved into a social justice plan for the country (Pombo et al., 2018). This project arose because only the wealthy and more fortunate in Uruguay had access to electronics and the internet (Pombo et al., 2018). IBM's Simpler Voice: Overcoming Illiteracy Project is an example of an AI tool that aids in accessibility in which adult learners who are illiterate or have limited reading abilities get help in navigating texts with more ease by having the text translated to them and having the content provided to them through images or simple spoken words, which assists people in overcoming severe challenges in their daily lives (UN). However,

there are other barriers to employing AI for equity and accessibility. In high-stakes circumstances, fairness, accountability, and transparency in AI systems have received significant attention (Holstein & Doroudi, 2021). According to Holstein and Doroudi (2021), poorer areas typically have less access to technology than wealthy areas, and even if they do, the technology assumes that all students speak the same language and at the same proficiency level, putting non-language speakers at a disadvantage. The bulk of AI technologies used in education necessitate a certain level of technical and linguistic proficiency. As a result, AI may widen rather than close educational inequalities for marginalized communities, between the wealthy and the poor, between able-bodied and disabled students, and between those who have access to reliable internet infrastructure and those who do not (Biggs et al., 2018). Furthermore, because human intelligence is at the heart of some AI-powered technologies, notably digital assistants, they respond to queries based on the data they've been provided, thus if the data on which the algorithm was trained is biased, the outcome will be biased as well (Dhawan & Batra, 2021). According to Dhawan and Batra (2021), in 2016, Microsoft created Tay, a Twitter chatbot that was forced to be removed within 24 hours of its launch due to racist, sexist, and other inappropriate material. Tay was created to mimic a young American millennial female in order to conduct research on conversational understanding by casually conversing with millennial Twitter users; however, users began tweeting racial and offensive content, and Tay responded with racist, sexist, and offensive content, causing Microsoft to shut it down within 24 hours (Suárez-Gonzalo et al., 2019). Disregarding differences while building an AI tool or programme is hard, therefore acquiring a representative sample is critical to avoiding algorithm bias (Baker & Hawn, 2021). This, however, raises the question of how

much data is enough data. "Three core categories have received most of the attention from researchers in a study by Baker & Hawn (2021): race/ethnicity (but not indigenous learners), gender (but not non-binary or 22 transgendered students), and nationality (for a small number of nationalities; in terms of learners' current locations)" Baker and Hawn (2021). The UNESCO (2021) report on AI in education provides policymakers with information on the potential of AI to promote fairness, inclusion, and accessibility in education. AI-based solutions can provide personalized learning experiences that are tailored to each student's unique needs and abilities, as well as assist in addressing educational barriers faced by marginalized and disadvantaged groups, such as language barriers, disabilities, and socioeconomic status (UNESCO, 2021). The research, however, emphasizes the potential risks of AI in exacerbating existing prejudices and inequities. The report emphasizes the importance of ethical considerations and stakeholder interaction in the development and implementation of AI-based solutions to enable the responsible use of AI in education (UNESCO, 2021). To maximize the potential of AI in supporting equitable and inclusive education, policymakers and stakeholders must priorities equity, inclusion, and accessibility.

- Integration of Technology in Education:

The use of technology in the educational system results in a more effective, efficient, adaptable, personalized, and comfortable learning environment for students. This integration draws students' attention and increases their interest in the teaching and learning process. It can also give students models and graphics to assist them in understanding mathematical ideas. Students will work together to solve problems and determine the learning process, and they will play a role in managing their learning environment using

interactive tools, information on the Internet, and communication tools (Domingo & Marques, 2011). Cloud classrooms, online courses, smart classrooms, and other technologies are used in education to develop a blended approach (Kyriakides, Mavrotheris, & Prodromou, 2016). Certain schools are implementing smart classrooms to improve teaching and learning (Malik & Shanwal, 2017). Using technology and smart education to improve education is becoming a new trend in the worldwide educational system. Technology is vital in smart education, and smart classrooms help to adopt the correct technology based on the requirements and skills of the students. According to Gwak (2010), smart learning is an effective and intelligent technique of learning that can be adjusted for learning using advanced IT infrastructure while focusing on learners' successes. The use of technology in teaching and learning can improve students' achievement, interest, and motivation, among other things. According to Othman (2007), a computer-assisted teaching technique has a favourable effect on students' achievement in Geography topics whether they are in urban or rural settings. Meanwhile, Bharathy (2015) discovered that the usage of Computer-Assisted Teaching and Learning approaches aids in both the teaching and learning processes. Hussein (2006) refers to the efficiency of technology integration in education as a quasi-experimental approach for studying the usefulness of multimedia software utilisation in teaching and learning Mathematics topics for Form Two pupils. The findings demonstrated that using multimedia software to teach the concept of Loci in Two Dimensions can both attract and improve students' performance. This is backed by Min, Bryant, and Bryant (2019), who found that computer-assisted learning improved students' understanding and performance in mathematics. The advantage of adopting technology-assisted teaching materials is that it encourages student

involvement during teaching and learning sessions. With the use of technology as a learning tool, the teacher functions as a facilitator and student-centred learning process (Condie & Munro, 2007). In addition, the use of technology can boost students' motivation and interest in mathematics. Furthermore, Neurath and Stephens (2006) demonstrated substantial evidence that students perform better in the Algebraic topic when information and communication technology is used in the teaching and learning process. Huang, Liu, and Chang (2012) and Taw (2013) conducted studies on the integration of technology in teaching and learning. Huang et al. discovered that by using a system in the web network, students increased their performance in completing mathematical issues. The technology-assisted teaching was effective, and students demonstrated a high level of readiness when using the system. Taw can also be used to support the success of technology integration in education. Taw investigated the association between the level of ICT use and student interest in the learning process. The data revealed a substantial positive association between the factors, and technology is a key medium for motivating and attracting pupils to study Mathematics. Furthermore, the incorporation of technology in the classroom demonstrated a significant impact on improving students' understanding and attitude towards learning. According to Shaharuddin and Khairi (2011), using technology such as multimedia and visual aspects in the learning process might boost students' interest and help them absorb the lecture content more readily. Software-based technology-based learning is a novel way that can be utilised as a reference material since it can be applied to various learning activities, which can entice students to study (Shadaan & Leong, 2013).

- Smart Classroom

A smart classroom has a computer and audiovisual technology that allows teachers to use

a range of media. The visual features of smart classes and other media can add a dynamic perspective to education, providing a clear grasp of the subject. Students benefit greatly from using the Internet since they can obtain data relating to their subject(s). Students' curiosity and interest in studying will be piqued by using online resources. Students can find instant answers to their questions online and do not need to consult their teachers if they do not choose to. They can also investigate a wide range of related information, which promotes engagement, learning, and analysis and results in a better outcome, while also digesting knowledge communicated by the teacher and other complementing tools utilised in class. A smart classroom is appropriate for kids with varying IQs because it incorporates a variety of media and sources that allow students to modify and profit from it. The smart classroom creates an interactive atmosphere that promotes students' interest and involvement in learning. It would simplify a subject that would be difficult for pupils to visualize without technology, improving learning and academic performance (Chachra, 2015). According to Kumari and Denisia (2013), a smart classroom allows students to learn at their own pace, is interactive, stimulates collaboration, and encourages creativity, and students can utilize the online portal to search for information (Malik & Shanwal, 2017). A smart classroom, on the other hand, assists teachers in developing students' talents and performance, as well as accessing multimedia content and information that can supplement teaching. Students will be able to understand and visualize the context more quickly, which will increase their performance (Menon, 2015). Zengin (2017) used the FC model in a study involving 28 students in a Mathematics education programme in Turkey to demonstrate that the FC learning environment improved students' academic performance (Zengin, 2017). In a similar study, Zhonggen and Wang (2016) employed the FC model to

assess its effectiveness in English writing classes, and the results revealed that students performed better than students in the control group, who were taught using traditional methods. Contrary to this, (Cabi, E. (2018) employed the Flipped Classroom model to demonstrate that the FC approach did not affect students' grades or academic performance. (Sharma, H. (2016) used a sample of 40 children to study the utilisation of the Edu comp Smart classroom for teaching Mathematics in elementary schools and discovered that academic performance outperformed that of the control group. Chachra (2015) examined students' academic performance in traditional and smart classrooms. The results reveal that technology attracts students, and they prefer smart classrooms, are prepared to put in extra hours of teaching, and do not report any distractions when studying. It also aids their understanding of the subject. Bano and Ganaie (2016) evaluated the academic performance of science students in smart and traditional classrooms and determined that students in the former performed better than those in the latter. They cited several elements that contributed to this, including supplemental resources offered to students, encouragement and reinforcement provided to all students for each progress, stress-free assessments, and an enjoyable teaching environment (Bano & Ganaie, 2016). A study conducted by Taleb and Hassanzadeh (2015) involving students in Mathematics courses found that the application of the smart training strategy boosted student learning. A comparable study conducted among Mathematics students by Zameni and Kardan (2011) found that using ICT boosted mathematical learning. However, Marcellus and Ghayeb (2002) proposed that a hybrid of traditional and smart classrooms be adopted. A smart classroom is ideal for displaying solutions and other vast amounts of data. Some students, however, believe that it is difficult to concentrate in a smart classroom because they are already familiar with the

content of the slides. Some students have commented that it allows them to skip class without fear of repercussions because the complete lecture notes are already properly prepared.

Methodology

Research methodology is a systematic process used to gather, analyze, and interpret information in a structured manner. The choice of research methodology depends on the nature of the research question and the objectives of the study. Here's an overview of common research methodologies:

Literature Review: Conducting a comprehensive review of existing literature helps researchers understand the current state of knowledge on a particular topic. It aids in identifying gaps, controversies, and areas that need further investigation.

Research Design: This involves outlining the overall plan of the study. It includes specifying the type of research (e.g., descriptive, experimental, case study), the population or sample, data collection methods, and data analysis techniques.

Sampling: Determining the target population and selecting a representative sample is crucial. Different sampling techniques (random, stratified, purposive) may be employed based on the research goals and resources available.

Data Collection: Depending on the research design, data can be collected through various methods such as surveys, interviews, observations, experiments, or archival research. Each method has its strengths and weaknesses.

Data Analysis: Analyzing the collected data is a critical step. Techniques may include statistical analysis, content analysis, thematic analysis, or other methods relevant to the nature of the data and research questions.

Qualitative vs. Quantitative Research: Qualitative research focuses on understanding and interpreting phenomena in their natural settings. It often involves in-depth interviews, focus groups, or content analysis. Quantitative research involves numerical data and statistical analysis to identify patterns and relationships.

Ethical Considerations: Researchers must adhere to ethical principles, ensuring the rights and well-being of participants. This includes obtaining informed consent, maintaining confidentiality, and addressing potential conflicts of interest.

Validity and Reliability: Validity ensures that the research measures what it intends to measure, while reliability ensures consistency and replicability of the results. Researchers must employ valid and reliable instruments and methods.

Triangulation: Triangulation involves using multiple methods or data sources to corroborate findings. This enhances the credibility and robustness of the research.

Timeframe and Budget: Establishing a realistic timeframe and budget is essential for planning and executing the research. It helps ensure that the study is feasible within the available resources.

Dissemination of Results: Communicating research findings is crucial. This may involve writing research papers, creating presentations, and sharing results with the academic community or the broader public.

Iterative Process: Research is often an iterative process. Researchers may need to revisit and refine aspects of the methodology based on preliminary findings or unexpected challenges encountered during the study.

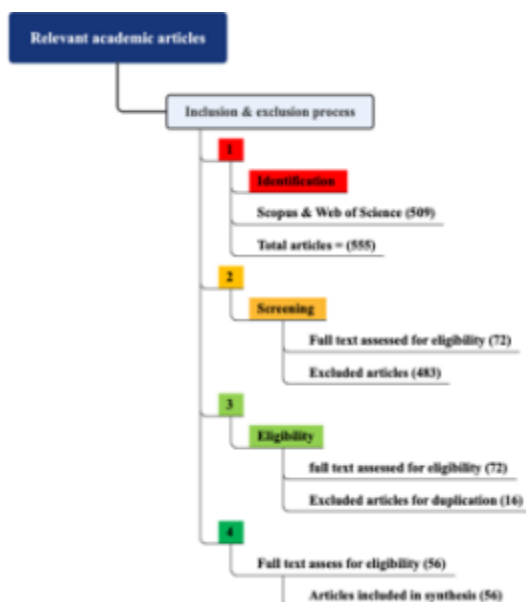
It's important for researchers to carefully consider each step of the research methodology and tailor it to the specific requirements of their study. The methodology chosen should align with the research questions and contribute to the overall rigor and validity of the research.

- This systematic review seeks to synthesize and analyze the most recent academic literature published in the last few years on the influence of artificial intelligence (AI) on higher education. The research question was formulated using the PICOT framework, emphasizing prognosis and forecasting: Will the deployment of AI in higher education affect the future of education? A systematic search strategy was employed using the Boolean AND operator and keyword combinations to ensure the inclusion of relevant literature. Conforming to the PRISMA criteria for a systematic review, the meta-analysis and systematic review were transparently and exhaustively reported (Liberati, A.,(2009) . In addition, a methodical qualitative approach was used to search for evidence from qualitative primary studies and conclusions (Seers, K. (2015). . The screening process for papers in the review followed a stringent protocol, including title processing, abstracts, and paper content. It was restricted to systematic research conducted following predefined criteria. The selected articles were exported to Rayyan Software for additional screening. Bibliometric analysis was performed using VOS viewer to generate co-authorship and keyword occurrence statistics for AI and higher education by country. The protocol was

created to reduce bias, increase transparency and applicability, and demonstrate the study's viability

Eligibility assessment

The researchers utilized Software, a web application made available by Saudi University, to conduct a systematic literature review. This system allowed the researcher to maintain a thorough screening. The search resulted in the discovery of 509 articles, which were then imported into Endnote for evaluation against the inclusion and exclusion criteria established earlier. It was decided to look at fifty-six articles from Scopus, Web of Science, and ERIC. The researchers used thematic coding in Excel to identify the four primary areas of interest, which are as follows: the quality of education, learning and teaching, assessment, future careers, and the moral implications of AI in higher education. (Please refer to Figure 1 for any further information.)

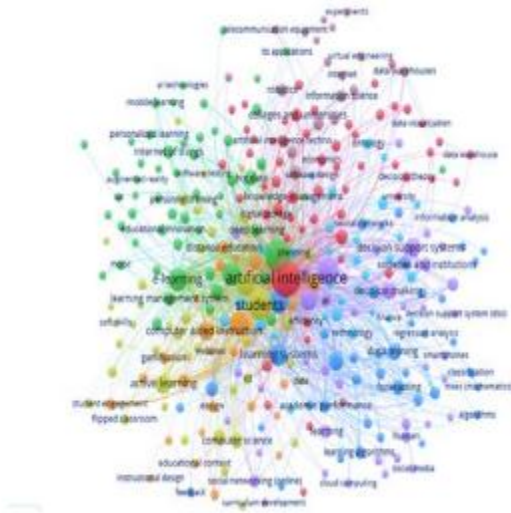


Inclusion and exclusion criteria

The inclusion procedure constitutes the criteria for participation in this study: during the first phase, 509 articles were located and imported into Endnote for screening according to the inclusion and exclusion criteria established beforehand. Articles must have been published in English-language academic journals; the setting of the study must have been within higher education institutions and focused on artificial intelligence; and the researchers must have determined that the results reported in the articles are consistent and appropriate.

Findings

The final sample of 56 scientific publications utilized in this study provided evidence on a variety of themes in higher education, including artificial intelligence (AI) ethics, learning and teaching and prospective future vocations. This study's conclusions cover four crucial areas in higher education: (1) AI's impact on educational quality, (2) AI's impact on the process of learning and teaching, (3) AI's impact on evaluation, and (4) AI's impact on ethics and future jobs in higher education. The data used in this study were obtained from Scopus and visualized using VosViewer to evaluate co-authorship tendencies in AI and higher education by country. Figure 3 emphasizes the importance of AI in higher education by displaying a network visualization of term occurrences linked to the issue. This research demonstrates the presence of eight major clusters of keywords related to artificial intelligence and higher education. These clusters reflect the field's breadth and depth, as well as the many interconnected subtopics.



AI impact on education Quality

Artificial intelligence (AI) in education has been shown to have a transformative impact on educational quality. In research, AI has been found to help learners enhance their communication and connection to the world (Breaux, J., ((2017) . Integration of AI, IoT, and cloud technologies has been seen as advantageous for building and developing higher education curricula (Limani, Y.,(2019) . Similarly, the use of artificial intelligence in education has lowered the requirement for academic personnel while strengthening financially independent institutions. AI has also been found to improve individualized education and the creation of online learning platforms (Sekeroglu, B., (2019) .

Furthermore, AI has been demonstrated to improve the functionality of learning management systems and predict the needs of learners (Yakubu, M (2020). Artificial intelligence, according to Bojorque (Bojorque, R.,(2020) , can process organized and unstructured data, reducing management's effort and speeding up decision-making. Furthermore, artificial intelligence has improved creative problem-solving, effective time management, and interpersonal communication (Korepin, V. N.,(2020) . Furthermore, AI

has been demonstrated to improve strategic planning, learning, and teaching efficacy. AI integration has also improved cognitive abilities, learning flexibility, and decision-making speed .

AI's influence on teaching and learning in higher education

Much study on the application of AI in educational settings has been conducted, and the findings continue to show the critical role that this technology plays in improving many areas of the teaching and learning process. Several studies have emphasized the benefits of AI in areas such as recognition mechanisms, tutoring, emotional awareness, language education, personal and group skill development, and cognitive learning process evaluation, (Aparicio, F., (2018). However, while artificial intelligence has the potential to significantly improve education and training, there are concerns about its limitations and potential biases. (N. Bhalla (2019) emphasizes the importance of empathic reasoning in AI for decreasing prejudice and delivering more comprehensive feedback input and solutions. In addition, (Fan, J.,(2020) emphasized the importance of ongoing research and development. They went on to claim that AI might adapt and improve in response to rapidly changing technology and the digital ecosystem.

AI impacts assessment, future careers, and ethics in higher education

While AI is utilized in HE assessments and has beneficial impacts, it is important to recognize that there are limitations and potential issues to address. Sanjinis (Sanjinés-Tudela, G. N. (2012) explains how AI affects assessments by emphasizing the legitimacy of AI in various stages of reviews. However, it is critical to examine any potential biases

in these AI-assisted reviews. Similarly, Campos (Campos, F.(2016) believes that AI validates academic credit efficiently by 89.4%, but it is critical to consider the possibility of errors and faults in this process. According to Deo (Deo, R. C.,(2020) , artificial intelligence has effectively analyzed assessment variables and reinforced treatments for improved graduate features. However, it is critical to evaluate the ethical implications of using AI in this fashion, as well as to ensure that the AI is not reinforcing any preexisting biases. Furthermore, while the findings show that AI allows for multilingual domains and generates comprehensive, interactive evaluations, it is critical to consider the potential for AI to perpetuate language biases as well as the need for diverse perspectives in the development and implementation of AI in education. AI generates detailed, interactive evaluations. To summarize, while AI can considerably improve evaluations, it is necessary to critically scrutinize its limitations and potential biases, as well as to ensure that various perspectives are considered in its development and application. While Pana's (Pana, L. (2006) findings emphasize the necessity of moral systems in AI, it is vital to critically assess the offered methods for endowing AI with "spirit and consciousness" via technical, theoretical, and psychological supplements. According to Wu (Wu, W.,(2020) , directing AI with ethics and values would ensure that it serves the interests of all societal groups. This assumption, however, should be scrutinized. The possible negative effects of AI and robotics on specific professions, such as librarianship and radiography, as mentioned by should be considered as well. Furthermore, as Garcia (Garcia-Sanjuan, F.,(2018) pointed out, any biases in forecasting future jobs for learners should be closely assessed. As a result, as stated by , it is vital to critically analyze the potential societal, geographical, and government ramifications of AI's rapid changes in the quality and quantity of work

RELEVANCE TO THE DEPARTMENT

Proposing a research topic on the impact of Artificial Intelligence (AI) on the development of interior design deliverables at Riyadh's universities signifies an innovative approach to understanding the importance of technology in the arts, especially within the Interior Design Department context. Here's how you can illustrate its relevance:

- **Pertinence to the Specialties of the Department:** Analyze how the department has incorporated technology and AI into education and practice so far. Highlight the areas of design where AI can be beneficial, such as project planning, design layouts, materials selection, or even predicting upcoming trends.
- **Alignment with Department's Interests:** If the department promotes the combination of creativity with cutting-edge technology, or if there's an existing focus on futuristic and innovative approaches to interior design, your research directly aligns with these interests.
- **Explanation of Connection:** Elaborate on how your study can expand the department's knowledge base. Discuss how AI can help build more efficient design workflows, generate new creative possibilities, or improve the accuracy and speed of creating design deliverables. Cite specific ways your research could bridge the current understanding and future potentials.
- **Acknowledge the Role of AI:** Demonstrate your knowledge about the utilization and impact of AI in interior design. Discuss both the potential advantages, such as

improved efficiency, and any potential drawbacks or challenges that need to be overcome.

- **Promote AI Innovations:** Display how your research strives to harness the latest AI-driven tools to upgrade the quality of education and design practice within the department. For instance, AI could help generate a wide variety of design options based on predefined rules, offer more accuracy in cost estimations, or predict the success of specific design features.

RESEARCH PLAN AND TIMELINE

Timeline: 6 Weeks.

Week 1 – Literature Review and Project Scoping: Review relevant literature on the use of AI in interior design and its potential impacts. Identify the specific topics that you want your project to focus on and develop your research questions.

Week 2 – Preliminary Research and Methodology: Conduct preliminary research on how AI is currently being used in Riyadh’s universities’ interior design departments. Develop a suitable methodology for assessing the impact of AI on design delivery quality, efficiency, and innovation.

Week 3 – Data Collection: Engage and liaise with local universities, their interior design departments, and students. Gather data using your designed methodology, which may include surveys, interviews, observation, etc.

Week 4 – Data Analysis: Analyze the data collected using appropriate statistical methods to identify patterns, trends, and possible correlations.

Week 5 – Drafting Initial Findings: Draft your initial findings into a structured format. Start with the introduction, literature review, methodology, then results sections.

Week 6 – Review and Final Draft: Review your initial draft, revise it, and finalize the draft to ensure it is ready for submission. Have a couple of test readers (mentors or peers) for feedback and proofreading.

This timeline is only a guide. Depending on the scope of your project and other unforeseen circumstances (like data collection delays), the timeline might need adjustments. Regularly reviewing your progress against your timeline will be essential to keep your research on track.

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