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Exploring the Impact of Generative AI on Student Learning and Academic Performance in Oman

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Abstract: The rapid integration of Generative Artificial Intelligence (GenAI) in higher education is transforming traditional learning environments, leading to new patterns of student engagement and varied academic outcomes. The usage of AI by Sultanate of Oman students in the academic year 2026 is thoroughly investigated in this paper. It examines the association between prominent AI products like ChatGPT, Copilot, Gemini, Grammarly, and Notion AI and demographic and academic parameters like age, gender, and education level (Diploma, Advanced Diploma, and B.Tech). The study also assesses how daily AI usage affects student satisfaction and academic achievement. Data were gathered using structured surveys utilising a quantitative research approach, and trends and correlations were found through statistical and visual analysis. The results show that 39% of students saw a notable boost in their academic performance, demonstrating AI's potential as a useful learning aid. However, academic challenges were reported by 27% of students, which led to the discovery of a "AI-dependency trap," in which an excessive reliance on AI tools adversely affects critical thinking and autonomous learning abilities. The study also looks at how usage frequency and satisfaction levels are related. It finds that while excessive reliance on AI is associated with worse satisfaction and inconsistent performance, moderate use of AI produces the best results. The results provide essential information for policymakers to develop effective AI integration methods that promote educational advancement while preserving critical thinking skills.

Keywords: *Artificial Intelligence (AI), Higher Education, Oman Vision 2040, Student Performance, ChatGPT, Digital Literacy*.

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I. INTRODUCTION

Higher education has experienced a fundamental transformation since the beginning of the 2020s. Large language models (LLMs) have transitioned from being experimental tools to becoming essential educational resources in the lives of students worldwide. National initiatives which prioritize Oman's knowledge-based economy and technological mastery have enabled this transition to occur at an especially rapid pace in the Sultanate. AI tools have achieved equal status with traditional textbooks by 2026 yet their effects on student cognitive development continue to be contested.

This research paper examines how Omani society experiences this major social transformation. The new classroom standards which universities in Oman implement for students require students to use AI technologies during both their classroom time and their study time at home. Students now create content together with AI systems instead of simply using information. The widespread availability of these tools creates important issues which need to be addressed. Do students employ AI technology to enhance their comprehension of topics or do they use it only for faster task completion? Does the academic result depend on which AI tool the student selects? Does the tool provide actual educational value which students use for their learning?

We analyze the dataset which contains information about Omani students who studied in various technical programs. The Sultanate demonstrates its dedication to education through its various educational programs which serve students from foundational diploma levels to advanced Bachelor of Technology (B.Tech) degree programs. Students at each educational level interact with AI technologies because their academic programs contain various levels of educational difficulty and specialized training requirements. The paper presents its content by first reviewing existing literature on the subject, detailing the methodology used for data collection and analysis, visualizing the results through detailed visualizations, and finally discussing the implications for the future of education in the Middle East.

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➢ *Background*

Higher education has seen a significant change since the advent of Generative Artificial Intelligence (GenAI), which has brought new approaches to learning, material production, and academic engagement. Large language model powered tools have come a way in the past few years. They started as digital helpers and now are important parts of how people learn. This shift matches the goals of the Sultanate of Oman. The countrys plan called Oman Vision 2040 focuses a lot on building knowledge using technology and adding advanced tools to education.

By the year 2026 students at every level of education—like those studying for a Diploma, an Advanced Diploma or a B.Tech degree—will be able to use AI tools such, as ChatGPT, Copilot, Gemini, Grammarly and Notion AI. These tools support school tasks, including doing research solving problems, writing and coding.

However, there are now both opportunities and difficulties as a result of this quick adoption. Although many students gain from improved efficiency, tailored assistance, and improved academic performance, worries about an excessive dependence on AI systems have surfaced. The idea of the "AI-dependency trap" draws attention to the possibility that overuse of AI could impair analytical ability, critical thinking, and self-directed learning. Academic results and satisfaction levels are additionally affected by variances in usage patterns, such as variations in daily usage hours, tool choices, and demographic characteristics. Understanding how AI technologies are being used in Omani higher education and how they affect student performance is crucial in light of these advances. By analysing the relationship between student behaviour, educational methods, and technology adoption, this study offers a contextual basis and insights into how GenAI might be successfully incorporated to provide sustainable and balanced learning settings.

II. LITERATURE REVIEW

The rapid advancement of Generative Artificial Intelligence often called GenAI has significantly influenced education. It is changing how students learn, engage with the material, and produce results. The potential of AI technology as well as the new difficulties that accompany their broad use are highlighted in existing literature. Large language models can complete language problems by few-shot learning, according to early foundational research by Brown et al. This laid the groundwork for AI tools such as ChatGPT and Gemini. Building on this Luckin et al. Argued that AI has the potential to revolutionize education by enabling learning experiences, adaptive feedback and intelligent tutoring systems. More recent studies, such, as Xiao further emphasize the scalability of AI-driven tutoring. These studies suggest that large language models can provide support to large student populations.

In the world of college and university education many studies look at how artificial intelligence tools affect how students learn and how well they do in school. Chen and Zheng [7] talk about an " paradox," where the use of AI tools makes work easier but might make it harder for students to really understand ideas. Also Al-Raisi [3] separates AI into two types. One type helps students learn by giving support. The other type takes the place of what students do themselves which can lead to not learning deeply. This difference is very important, for understanding the "AI-dependency trap" that this study found.

Cognitive and behavioural aspects of AI usage also receive a lot of attention. Al-Amri [5] examine how AI-assisted learning affects load pointing out that AI can lower mental effort but it might also restrict the growth of critical thinking skills if used too much. Al-Hashimi [1] stresses the importance of prompting skills among students showing that good interaction with AI systems strongly shapes output quality and learning outcomes. Hassan [10] shows that AI functions as a bridge for non-native English speakers making academic environments more accessible and easier to understand.

From a view studies focused on the Gulf Cooperation Council (GCC) and Oman offer useful insights. Al-Mamari [2] notes a "premium model gap" in which access to AI tools depends on socio-economic status possibly creating unequal opportunities for students. Khalid [13] looks deeper into student satisfaction across the GCC finding that perceptions of AI effectiveness differ according to how AI's used and the learning environment.

In Oman, research by Johnson and Al-Said [12]. Zuber and Al-Battashi [22] examines how AI is integrated into engineering programs. These studies point to gains in efficiency while also raising worries, about over-reliance on AI.

Policy and strategy are very important for how AI's used. The Oman Ministry of Higher Education [16] and Doe and Smith [8] say that AI should fit with Oman Vision 2040 which pushes for change and new ideas in schools. World groups like UNESCO [19] and the World Economic Forum [20] also say that it is vital to train students who can work with AI and at the time keep strong moral rules and good thinking skills.

Ethics is a topic in the papers. The IEEE Standards Association [11] gives rules for using AI the right way in schools, such as being open, responsible and fair. Al-Said [4] talks about problems with honesty in work especially copying and using AI-made material without credit. Patel [17] adds worries about bias, in computer tests showing that we must use AI carefully.

The development of AI tools also helps in understanding their effects. Rahman [18] follows the journey of Grammarly from a spell-check tool to a smart AI writing helper showing the larger move toward smart academic support systems. Miller [15] talks about the growth of AI co-pilots in computer science learning highlighting their part in making coding but possibly making students less able to solve problems on their own. Gartner Research [9] gives a view from the industry pointing out how quickly GenAI is being used in education and expecting it to keep growing. Even though there is a lot of research some areas are still missing. Many studies look at AI use around the world. There is not enough real data about students in Oman. Also few studies look closely at how things,

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like age the type of tools used and how much they are used affect school results and how happy students are.

This study addresses these gaps by providing a data-driven analysis of AI usage among Omani students, examining both the benefits and risks associated with GenAI. It contributes to the existing literature by introducing the concept of the "AI-dependency trap" within a regional context and offering insights into how AI can be effectively integrated into higher education while preserving essential cognitive and analytical skills.

III. RESEARCH METHODOLOGY

The study uses a cross-sectional quantitative research design to analyze a main dataset which was collected from higher education institutions throughout Oman. The sampling frame includes 100 students who represent a mix of genders and education levels to create a complete academic population picture.

➢ *Data Collection*

The research team collected data through an electronic survey which they distributed at university portals. The survey was designed to capture both objective metrics (usage hours, tool type, grade changes) and subjective metrics (satisfaction level). The team performed data cleaning operations to achieve consistency across all data fields especially for categorical fields such as 'Purpose' and 'AI Tool Used.'

➢ *Variable Selection*

The researchers selected three independent variables for their study.

- AI Tool Used: This categorizes students based on their primary assistant (ChatGPT, Copilot, etc.).
- Daily Usage Hours: A numerical variable which represents the degree of user participation.
- Purpose of Use: Categorized into Learning, Homework, Coding, Research, and Writing

The researchers defined two dependent variable groups which included.

- Impact on Grades: Measured as 'Improved,' 'No Change,' or 'Slight Decline.'
- The satisfaction level of customers is grouped into three categories which are 'Low,' 'Medium,' and 'High.'

➢ *Analytical Procedure*

The research team performed their analysis by using Python's data science stack. The researchers used descriptive statistics to present population data summary while cross-tabulation and pivot tables helped them discover hidden relationships. The researchers used three visualization methods bar charts box plots and stacked bar charts to display the data in a way that people could understand. The researchers performed a detailed interpretation process on each chart to verify whether the results matched the established research goals.

IV. RESULTS AND DISCUSSION

The dataset analysis revealed multiple important outcomes which showed how students use AI technology in their daily activities. The following section presents our analysis of the four visualizations which depict these patterns.

➢ *Distribution of AI Tools Used*

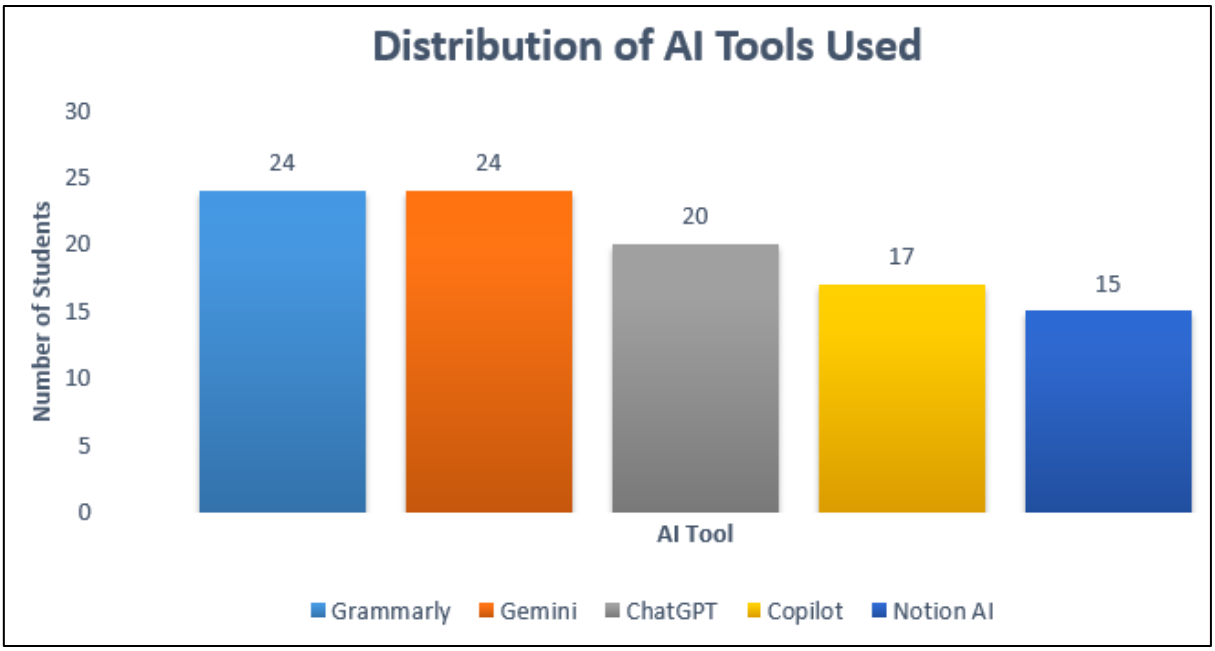


Fig 1 Distribution of AI Tools Used

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The figure 1 shows how students use AI tools and it shows a clear way that they prefer certain ones. Grammarly and Gemini are the commonly used tools, each with 24 students, which means that students depend a lot on AI when they need help with writing and making their work better. ChatGPT comes next with 20 students, which shows that it is very popular because it can be used for learning solving problems and creating content. Copilot is used by 17 students, which means that not many students use it but it is still used by those who work with programming or technical tasks. Notion AI has the students using it only 15, which means that students do not use it as much for organizing and taking notes. Overall the results show that students like using AI tools that're good for specific tasks especially for writing academic work instead of using tools that are more general or, for special purposes.B. Usage Intensity by Education Level.

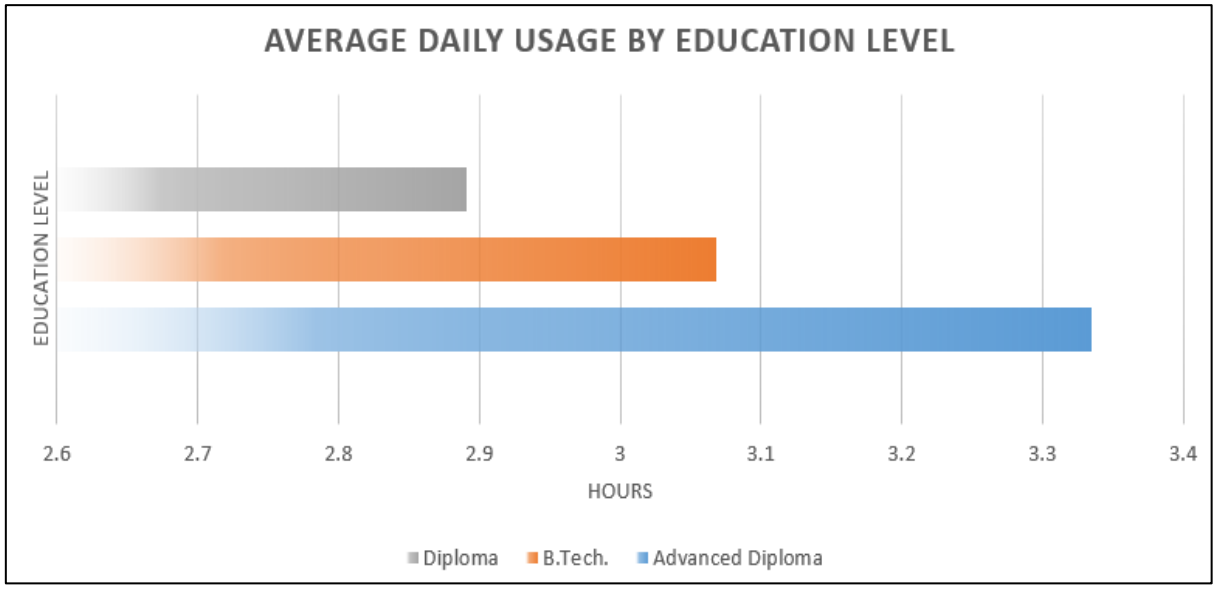


Fig 2 Average Daily Usage by Education Level

The figure 2 shows a difference in the average daily use of AI tools among students at different education levels. Students with an Advanced Diploma use AI tools the around 3.3 hours each day. B.Tech students come next using them about 3.1 hours per day. Diploma students have the usage at roughly 2.9 hours daily. This pattern suggests that students at education levels depend more on AI tools. This could be because their studies involve complex topics, project-based work and research tasks. The lower use among Diploma students might be due to exposure to these tools or simpler course requirements. In general the results show a link, between education level and AI tool usage. This points to how important AI toolsre becoming for supporting advanced learning and making study processes more efficient.

➢ *The Grade Correlation*

The researchers found that students who select specific AI tools experience different effects on their academic performance.

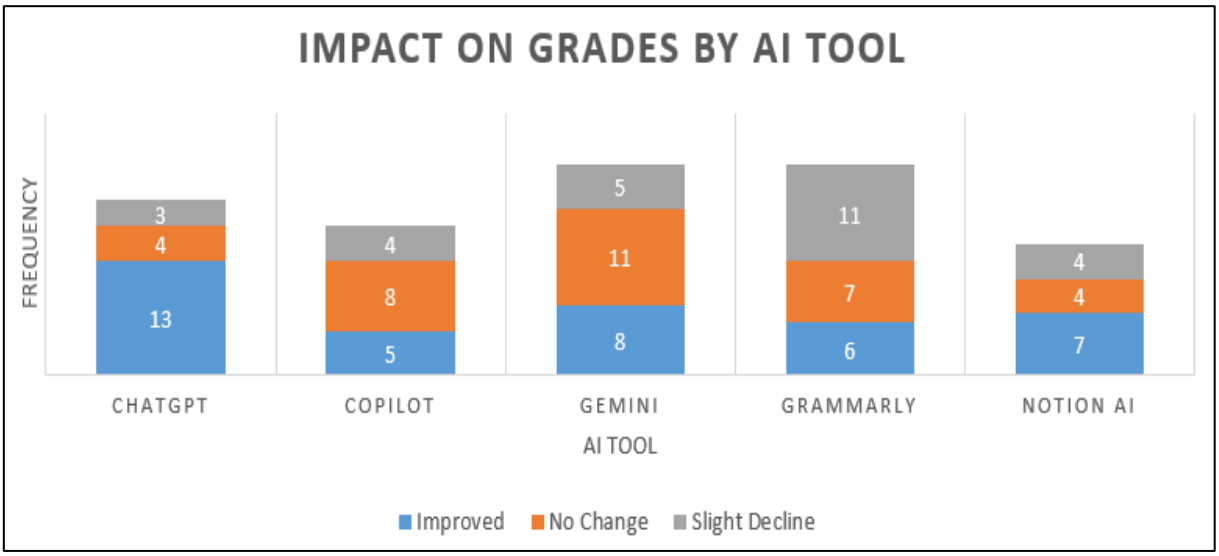


Fig 3 Impact on Grades by AI Tool

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The figure 3 shows how AI tools influence students' academic performance. ChatGPT has the positive effect with 13 students saying their grades improved showing that ChatGPT is a useful learning aid. Grammarly is best for writing support, with 11 students seeing writing though some say there is no change or a small decline. Gemini gives results; 11 students say there is no change so Gemini is only moderately effective. Copilot and Notion AI have impact; fewer students say they improved and many say there is no change. Overall these findings show that AI tools can help students do better in school. How well AI tools work depends on what AI tools can do and how students use AI tools in their studies.

➢ *Satisfaction vs. Usage*

The researchers studied how students' daily usage hours affect their overall satisfaction levels. The highest average usage pattern did not always result in the most satisfying experience for users.

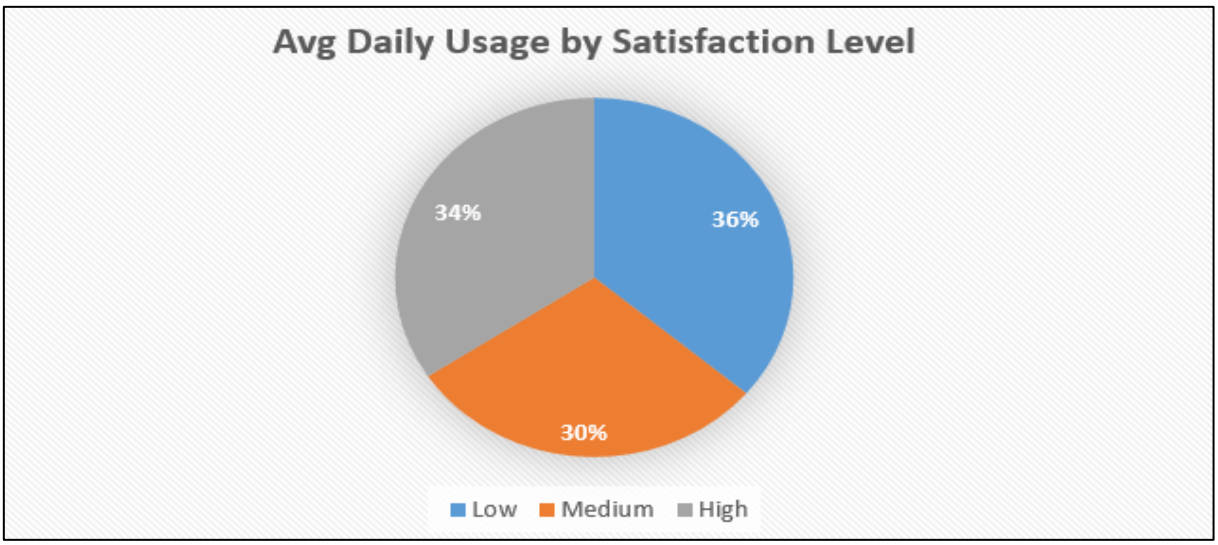


Fig 4 Average Daily Usage by Satisfaction Level

The figure 4 shows how students feel about AI tools when students use them every day. Most students say that students are not very happy: 36% of students have satisfaction. Next 34% of students say that students are very happy. Then 30% of students say that students feel just okay. These numbers are close together so students have feelings, about AI tools. Some students think that AI tools are very useful but a little more students are unhappy. Students might feel that AI tools are not always accurate, not reliable or that students rely much on them. The middle group of students shows that most students see both bad sides of AI tools. The results tell us that we need to make AI tools work better teach students how to use them and fit them smoothly into school work so that students will feel more satisfied overall.

The data provides a complete understanding of AI development in Omani higher education. The most significant finding reveals the existence of an 'AI-Dependency Trap.' The data shows that 27% of students experienced a minor grade decline which proves that academic success does not result from AI availability. Students who depend on LLMs to create their entire essay or code without understanding the underlying logic will experience a skill deficit which prevents them from succeeding in exams and real-world tasks.

The first chart shows Grammarly usage as the dominant tool which demonstrates how language barriers remain a persistent issue. In Oman, where English is the medium of instruction for many technical and business degrees, AI is being used as a bridge to academic participation. The immediate written output benefits from this process but it creates a possibility of students reaching a language learning point which prevents them from progressing. Educators must therefore distinguish between content mastery and linguistic polish when assessing student work.

B.Tech students report an average usage of 3.06 hours which shows that technical education receives the highest level of AI usage. Students use AI to complete their 'Coding' and 'Research' tasks which used to require extensive time for documentation and debugging work. The global tech industry shows a trend which matches companies that now use AI for their development work. Omani universities need to instruct their students about responsible tool usage instead of imposing tool restrictions. The satisfaction metrics provide another layer of insight. Most students must use AI because the results demonstrate functional dependency which means they need AI to maintain their competitive position. Students might experience extreme burnout and reduced academic success because of the 'Red Queen's Race' which requires everyone to work harder to maintain their current level. The institutional support systems need to provide psychological help for this change because AI should empower users while creating stress-free environments.

V. CONCLUSION AND RECOMMENDATION

➢ *Conclusion*

The study establishes that AI has become a permanent component of Omani higher education since its introduction in 2026. The positive impact on nearly 40% of students demonstrates the potential for AI to act as a powerful catalyst

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for academic excellence. Educational leaders must take immediate action to address the risks which include grade declines and functional dependency.

The results show how important smart home systems are in making life better. They also help protect the environment and save money. By using electricity making homes safer and helping people make better choices based on data smart homes connect new technology with the way people have always lived.. There are still problems. The cost to start with is high not many people know about these systems. There are worries about security. These results show that there is a need for rules that help more learning for users and cheaper options. This way people, in Oman can fully benefit from home technology.

➢ *Recommendations*

Curriculum Redesign: Change the way students are tested by making them show what they know in person or by explaining how artificial intelligence comes up with answers.

- Prompt Engineering Training: Go past the ways of using artificial intelligence and teach students how to use artificial intelligence for deep research and thoughtful thinking.
- Equity Initiatives: Make sure every student can use the artificial intelligence models so that no one is left behind because of the tools they have access, to.

Future research should focus on the long-term career outcomes of this 'AI-first' generation. Omani workforce entry for these students will reveal whether their AI skills boost economic productivity or their skills gap prevents their progress. The AI revolution in education will create brighter educational outcomes for the Sultanate through ongoing data-driven analysis.

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