

Beyond the Horizon: An Investigation to Unravel the Impact of AI on Jamaican Students' Performance

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Abstract This study explored the integration of artificial intelligence (AI) in educational settings in Jamaica, focusing on its current use by students and its impact on academic performance. A mixed-methods approach was employed, involving 100 students and 25 educators, across various high schools, colleges, and universities. Data was collected through questionnaires, interviews, and performance metrics to assess both qualitative and quantitative aspects of AI's role in education. The findings revealed that 79% of the students used AI for homework, 82% for projects, and 91% for research, highlighting its widespread use. Notably, 18% of the students reported that AI fully promoted teamwork, suggesting some collaboration benefits, though limited. Additionally, 56% of the students perceived no change in course difficulty post-AI integration, while 41% found courses more challenging before AI use, and 3% found them more difficult after AI was implemented. Moreover, 82% of the students linked improved performance to enhanced resources provided by AI, yet performance varied, with some students over-relying on AI tools. Educators have expressed that students must cross-reference the information obtained using AI tools with credible sources, across all academic levels, to verify their reliability. The most significant recommendation is providing AI literacy training for both students and educators, ensuring the effective and ethical use of AI tools. Educators urge institutions to encourage students to focus on using AI as a supplement to traditional learning methods, fostering deeper engagement and critical thinking skills. The study implies that while AI enhances personalised learning and resource accessibility, its full potential is hindered by issues related to content accuracy and collaboration. The findings suggest that educational systems must strike a balance between AI integration and human-centred pedagogical strategies, to optimise learning outcomes.

Keywords: students' performance, artificial intelligence (AI), learning process

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1. Introduction

In recent years, the integration of artificial intelligence (AI) into educational systems has become increasingly prevalent, promising to revolutionise traditional teaching methods and reshape the landscape of learning. AI technologies, from personalised learning platforms to advanced data analytics, are being explored to enhance educational outcomes. This global shift toward AI adoption in education has sparked considerable discussion about its potential impacts on students' performance, particularly in developing countries such as Jamaica, where educational reform is crucial for national development. This research study sought to explore how AI influences learning outcomes in Jamaican classrooms and what implications this might have for the future of

education across various educational levels, including high school (lower and upper school), undergraduate, graduate, and PhD students.

AI is gradually being woven into the fabric of Jamaica's educational landscape, as indicated by the government's commitment to integrating technology in schools. According to Jamaica's former Education Minister Fayval Williams, technology will remain a permanent feature of the educational system, with AI being a core part of this technological framework. The former Education Minister emphasised that AI tools, such as those for adaptive learning and data-driven insights, will play a pivotal role in supporting both teachers and students in enhancing the learning experience, as shared by Jamaica Information Service [1]. This commitment from the Ministry of Education reflects a broader international trend where AI is increasingly seen as a means aimed at bridging gaps in educational delivery and efficiency.

Globally, AI is being embraced for its ability to personalise learning experiences through to its' AI-powered educational technology, such as adaptive learning systems, that can tailor its content to students' individual needs, ensuring that each learner progresses at their own pace. Forbes [2] noted that AI-driven platforms can help teachers better understand their students' learning patterns, allowing for more targeted interventions and support. These systems also offer the ability to track progress in real-time, making it easier to identify areas where students are struggling and provide immediate assistance, as reported by Forbes [2]. This personalized approach can benefit Jamaican students at all educational levels – from upper and lower high schoolers levels grappling with exam preparations, to undergraduates and graduates navigating complex coursework or projects. AI tools have the potential to enhance academic support for students by offering tailored learning pathways.

In the context of Jamaica, this potential for personalised learning is particularly important. Jamaican classrooms are often faced with large student-to-teacher ratios, making individualised instruction challenging as was highlighted by Calvert [3]. For upper and lower high schoolers, who often deal with a broad curriculum and limited access to additional academic support, AI tools can help bridge the gap by providing tailored educational experiences outside of traditional classroom hours. Furthermore, a recent LinkedIn article reported by Hawthorne [4] underscored the benefits of AI in improving literacy among young learners – a model that could be particularly beneficial in Jamaica's early childhood education system – by offering personalised reading programmes. These advancements hold promise for improving not only literacy but also other areas of academic performance. For undergraduates and graduate students, AI tools could offer advanced assistance in research and project management, helping students to navigate complex academic tasks and develop critical thinking skills.

However, as AI permeates the educational system, it raises critical questions about equity, access, and the digital divide. In many Jamaican schools, access to digital devices and high-speed internet remains a challenge. The success of AI-driven educational tools depends on the availability of these resources, which are not uniformly distributed across the country. While urban schools may have greater access to technology, rural schools often lag behind, exacerbating existing inequalities. Ref [1] highlighted that the former Minister of Education Fayval Williams recognised the potential of AI to enhance traditional learning, but she also emphasized the pressing need to address significant infrastructural challenges to ensure that all students, from early childhood to tertiary level, benefit from these innovations.

Moreover, while AI offers numerous benefits, it also poses certain risks. One major concern is the potential for over-reliance on AI technologies, which could lead to diminished human interaction in the classroom. Educational experts warn that while AI can enhance learning, it cannot replace the value of human teachers, who provide emotional and social learning experiences that machines cannot replicate. According to Ref [5], the challenge for policymakers in Jamaica, therefore, lies in balancing AI integration with traditional pedagogical

approaches to ensure a holistic education for students across all academic levels. Furthermore, as AI continues to evolve, its role in education will likely expand. For Jamaica, this presents an opportunity to modernise its educational system and improve learning outcomes for students across the island, from early childhood to tertiary level. However, this transition must be managed with care, ensuring that technological advancements do not exacerbate existing educational inequalities. This research aims to provide insights into how AI can be harnessed effectively to support Jamaican students' academic performance, while also addressing the challenges associated with its implementation across different educational tiers.

1.1. Purpose of the Study

This study aimed to examine the current utilisation of artificial intelligence (AI) by students in educational institutions in Jamaica and assess its impact on their academic performance.

1.2. Research Questions

The study sought answers for the following research questions:

1. In what ways is artificial intelligence (AI) currently being used by students in the teaching and learning process in educational institutions?
2. What is the impact of the use of artificial intelligence (AI) on students' performance, based on their own use of it in their learning process?

1.3. Definition of Terms

Artificial Intelligence (AI) - refers to the application of advanced computational systems and algorithms that enable machines to perform tasks that typically require human intelligence. These tasks included personalised learning, adaptive assessments, real-time feedback, and data analytics that enhance teaching and learning processes. Adaptive learning platforms have been known to use AI to adjust educational content based on students' performance and needs, while intelligent tutoring systems provide real-time feedback and guidance, as outlined by Salido [6] and UNESCO [7].

Students' Performance - according to OECD [8] and Reeves [9], this refers to the measurable outcomes of students' learning, typically assessed through academic achievements, test scores, grades, and other criteria that reflect their understanding, skills, and competencies in specific subject areas. Performance is often evaluated based on students' ability to meet predetermined learning objectives and standards, such as their mastery of content, problem-solving abilities, critical thinking, and the application of knowledge in practical settings.

Disparity - Reardon [10] and UNESCO [11] stated that disparity refers to the unequal access, opportunities, and outcomes experienced by different groups of students, often based on factors such as socioeconomic status, race, geographic location, gender, and access to resources. Educational disparities manifest in various ways, including differences in academic performance,

graduation rates, availability of quality teachers, access to advanced coursework, and the provision of learning materials and technology.

Lower high-schoolers - refer to students in any Jamaican high school that are in Grades 7 through 11.

Upper high-schoolers or sixth formers - refer to students in any Jamaican sixth form programme in the high school or otherwise that are in Grades 12 and 13.

2. Literature Review

The integration of artificial intelligence (AI) into the educational landscape has generated substantial interest worldwide, with advocates suggesting that AI could revolutionise education by personalising learning experiences, improving student outcomes, and enhancing comprehension. AI's ability to adapt educational content to individual learning styles and paces has been recognised as a transformative tool that could lead to better academic performance. As Salido [6] noted, AI tailors learning experiences to students' needs, allowing for improved mastery of concepts and more effective educational outcomes. This is particularly important for lower and upper high schoolers who are in the process of developing foundational skills and preparing for critical exams like CSEC and CAPE. In the Jamaican context, where students' performance has historically been a concern, especially in Science, Technology, Engineering, and Mathematics (STEM) areas, challenges in achieving proficiency are most evident in CSEC mathematics, with consistently low pass rates attributed to factors such as inadequate teaching methodologies, limited resources, and a lack of engagement with real-world applications that make the subject relevant and accessible to students. According to Nationwide News Network [12], in 2024, Jamaican students showed a marginal improvement in their performance on the Caribbean Secondary Examination Council (CSEC) Mathematics exam, with a pass rate of 36%. This reflects a slight increase from previous years, but the overall results remain a point of concern for educational authorities. One of the Jamaican newspapers, Jamaica Observer [13] shared that the former Education Minister Fayval Williams expressed dissatisfaction with the mathematics results, indicating that while improvements were noted, the pass rate was still far from satisfactory. The regional context paints a similarly challenging picture, as pass rates in both Mathematics and English declined across the Caribbean, with Mathematics seeing a sharper decline. Ref [14] shared in The Gleaner, another Jamaican newspaper, that this trend highlights persistent issues in these core subjects. Despite the slight uptick in Mathematics performance in Jamaica, the broader regional results suggested that significant efforts were still needed to address systematic educational challenges. In comparison, English Language results were more stable but also experienced some decline, indicating that both subjects continued to present challenges for students. The former Ministry of Education remained committed to improving these outcomes, with plans to integrate additional resources and strategies as mentioned by the Jamaica Information Service [15]. Overall, while there were some improvements in

Mathematics, the results called for continued focus on interventions to boost student's performance in both Mathematics and English. It is believed that AI might hold the potential to address these gaps, particularly for lower and upper high-schoolers struggling to master core subjects.

Across educational institutions globally, AI is being integrated into the teaching and learning process in various ways. AI-powered systems, such as adaptive learning platforms and intelligent tutoring systems, provide real-time feedback to students and assist teachers in diagnosing learning gaps. The World Economic Forum [16] highlights how AI is reshaping classrooms by offering personalised learning pathways and improving access to quality education, particularly in resource-scarce environments. In Jamaica, according to KeyMakr [17] where disparities in educational resources are prevalent, these tools could provide a much-needed bridge, ensuring that students across different schools and socioeconomic backgrounds, from lower and upper high-schoolers to undergraduates, have access to tailored educational support.

In recent years, Jamaica's former Minister of Education has expressed interest in exploring AI's potential benefits for students. Former Education Minister Fayval Williams has outlined plans to explore how AI can be integrated into classrooms to enhance learning outcomes, particularly in areas where teacher shortages and overburdened staff limit personalised instruction as shared in The Jamaica Observer [18]. The government's support for AI in education reflects a broader trend seen globally, as more nations invest in AI technologies to optimise educational systems. The former Education Minister emphasised in The Jamaica Gleaner [19] that AI could support teachers by offering tools for personalised instruction and freeing up educators to focus on higher-order teaching tasks. Interestingly, there were AI educational tools, such as DreamBox, available to us before this eureka moment, particularly before the COVID-19 pandemic but little recognition until the pandemic forced widespread shifts to remote learning. These tools, which are designed to personalise educational content, were not widely utilised due to a lack of awareness, non-availability of resources (human and non-human), and the challenges of integrating technology into traditional teaching practices. However, as stay-at-home mandates required educators to become more familiar with various technology tools, including AI-powered platforms, the need for these resources became clearer. Despite their potential maximizing their use was often hindered by limited access to these resources (human and non-human). Now that the pandemic has passed, schools and educators are more open to experimenting with AI tools, recognising their ability to enhance student engagement and improve learning outcomes. Consequently, the former Minister of Education Mrs. Fayval Williams has decided to have the use of AI educational tools become more integrated into teaching practices. To establish, as shared by Jamaica Information Services (JIS) [20], the initiatives shared by the ministry, there are ongoing discussions about fusing AI and adaptive technologies into school curriculums, a move aimed at equipping students with 21st-century skills such critical thinking and problem-solving. Such policies are crucial in ensuring that students, including lower and

upper high-schoolers, and undergraduates, benefit from personalized learning tools and digital resources, thereby enhancing their educational outcomes. For lower and upper high-schoolers, this could mean more focused attention on developing critical thinking skills, while university students, particularly undergraduates, and graduates, could benefit from AI tools designed to aid in more complex research tasks to improve efficiency. Ref [21] shared that the Chancellor of the University of Technology, Jamaica (UTech), at a recent graduation, highlighted the importance of embracing artificial intelligence (AI) as a key driver for lifelong learning and career advancements in his address to graduates. This emphasis underscores AI's role in preparing students at various academic levels –upper high schoolers, undergraduates, and graduates – for the evolving demands of the global workforce. AI-powered tools according to Ref [20] and Ref [21], can support continuous skill development, ensuring that the students remain competitive in dynamic professional environments.

Despite the promising potential of AI, its use in education has sparked debates. Critics argue that while AI can offer personalised learning, it cannot replace the critical role that human teachers play in fostering social and emotional learning, particularly through relationship building. In the Jamaican context, Clarke [22] expressed concerns over students' growing reliance on AI tools such as ChatGPT for quick answers, leading to what he refers to as "Cashpot grades" - an indication that some students prioritise speed over comprehension. Clarke's critique raises important questions about whether the use of AI is enhancing or undermining students' deep understanding of subjects. The challenge in Jamaica, as in many developing countries, is to balance the potential benefits of AI with the need to maintain high educational standards. Lower and upper high schoolers may need more guidance in using AI as a supplementary tool, while graduate and PhD students must be encouraged to leverage AI to augment their research, rather than rely on it for shortcuts or surface-level responses.

The extent to which Clarke's observations reflect a broader issue across Jamaica remains a key question that this research seeks to address. Clarke [22] inferred, however, that while ChatGPT can provide valuable assistance, it should complement rather than replace traditional learning methods. Students should be encouraged to engage with course material actively, ask probing questions, and seek understanding rather than simply seeking correct responses. Moreover, educators play a crucial role in guiding students to use technology responsibly and fostering a learning environment that emphasises conceptual mastery and critical thinking skills, ensuring that exam scores reflect genuine learning rather than mere memorization or reliance on quick fixes.

Globally, AI in education is seen as a double-edged sword. On one hand, AI-powered platforms can offer students immediate feedback, adapt content to their learning needs, and provide teachers with valuable data insights to inform instruction. On the other hand, over-reliance on AI may lead to decreased critical thinking skills and a reduction in the role of human educators. UNESCO [23] emphasises the need for a cautious and thoughtful approach to AI integration, advocating for

policies that ensure AI enhances rather than replaces the human elements of teaching and learning. In educational institutions worldwide, students are increasingly using AI to assist in the learning process. From AI-based tutoring systems that offer one-to-one support to intelligent writing assistants that help students improve their essays, AI's role in education is expanding rapidly. Generative AI, for instance, has been praised for its ability to foster creativity and innovation in learning environments. NAFSA [24] noted that AI tools like ChatGPT can assist students in generating ideas and enhancing their writing, though it cautions that such tools should be used to complement, not replace, human instruction. Undergraduates and graduates, in particular, can leverage AI for research and writing assistance, but lower and upper high-schoolers must be taught how to use these tools responsibly to avoid academic misconduct and over-reliance on technology.

In Jamaica, the impact of AI on student performance is an area of growing interest. Early research suggests that AI tools can have a positive effect on learning outcomes, particularly when used as part of a blended learning approach. Both students and teachers in Jamaica can benefit from training in using AI to enhance students' understanding and, by extension, their performance. This training can empower educators to leverage AI tools effectively in the classroom, enabling them to create engaging and interactive learning experiences tailored to individual student needs. Additionally, students – whether in high school, university, or post-graduate education - can learn how to utilise AI-driven resources to supplement their learning, fostering a more dynamic and personalised educational environment overall. By embracing AI technology, both students and teachers can stay current with advancements in education and better prepare for the future workforce. The Jamaica Information Service [15] reported that teachers who attended workshops on AI integration have seen improvements in their students' engagement and understanding of complex concepts. These workshops focused on how to use AI tools effectively to supplement traditional teaching methods, with teachers reporting that AI helped to streamline administrative tasks, allowing them to focus more on teaching.

Moreover, AI systems can adapt educational content to match the learning pace and style of each student, helping them grasp concepts more effectively. This means that students with different learning speeds and preferences – ranging from high schoolers to PhD students - can receive tailored materials and exercises that suit their individual needs. For example, if a student learns best through visual aids, the AI system can prioritise presenting information in a visual format. Similarly, if a student struggles with certain concepts, the AI can provide additional explanations or exercises until mastery is achieved. Ultimately, this adaptability ensures that each student receives personalised support, leading to improved understanding and performance according to Pawar [25]. AI algorithms can analyse students' strengths and weaknesses to create personalised study plans, optimising their learning process and academic progress. Ayman et al. [26] stated that by collecting and analysing data on students' performance, the AI can identify areas of strength and areas that need improvement. Based on this analysis, AI can generate customised study plans that

reinforced strengths while targeting weaknesses. These study plans can include specific exercises, resources, and milestones tailored to each student's unique learning profile. As a result, students – from lower and upper high-schoolers to PhD candidates – receive targeted guidance that maximise their learning potential and accelerate their academic progress.

Despite these positive developments, there is a need for further research to assess AI's impact on student performance based on student's use of it in their learning processes. Clarke [22] points out that while students are using AI tools like ChatGPT to complete assignments, there is limited understanding of how this affects their overall academic performance. Are students simply using AI to complete tasks quickly, or are they using it to deepen their comprehension of subjects? This study aims to explore this question in greater detail, particularly for lower and upper high-schoolers and undergraduates who are more likely to use AI tools for routine assignments.

There is also a concern that AI tools, while beneficial, could exacerbate existing inequalities in the Jamaican educational system. UNESCO [7] warns that without proper infrastructure and equitable access, AI could widen the gap between students who have access to technology and those who do not. In Jamaica, this disparity is particularly significant for students at different educational levels – typically lower and upper high-schoolers may have greater exposure to AI tools as opposed to their rural counterparts who might struggle with limited to no access. Similarly, undergraduates and graduates in tertiary institutions with robust technological infrastructure may benefit disproportionately compared to those in under-resourced universities or colleges. PhD students, who often rely on advanced AI applications for research, may also face barriers if access to high-performance computing is unavailable. Thus, the implementation of AI in Jamaica must be accompanied by targeted efforts to bridge these gaps, ensuring that all students have access to the necessary tools and resources to benefit from these innovations. Moreover, while AI holds promise for improving educational outcomes, its success largely depends on how it is implemented. KeyMakr [17] stressed that AI should be used as a tool to support human teachers rather than replace them. In Jamaican classrooms, where teacher shortages are a significant challenge, AI could provide valuable support for teachers of lower and upper high-schoolers by automating administrative tasks or providing personalized feedback to students. At the undergraduate and graduate levels, AI tools could facilitate adaptive learning and the analysis of large datasets, while PhD students might benefit from AI's ability to streamline research tasks such as data analysis, literature review, and predictive modeling. However, these tools cannot replicate the nuanced and empathetic role of teachers, professors, or advisors in shaping students' learning experiences and critical thinking processes. Lewis [27] noted in the Jamaica Observer that while AI may help overworked teachers, its integration must prioritise maintaining high educational quality across all levels, particularly in contexts requiring mentorship, such as upper high-schoolers preparing for tertiary education or PhD students navigating complex research. It was shared in the Jamaica Observer [28] newspaper article titled “The

AI revolution and the viability of universities in Jamaica”, that it is essential to embrace AI in higher education to ensure that universities remain viable and relevant in an era of rapid technological change. Another critical area of concern is the digital divide in Jamaica, where access to AI-driven educational technologies may not be uniform across the country. Clarke [22] and UNESCO [23] highlighted that for AI to be effective, infrastructure challenges such as high-speed internet and digital devices must be addressed. This issue is especially pressing for all levels of high-schoolers in rural areas, where limited connectivity can impede the use of even basic AI tools. Undergraduates and graduates from remote locations face similar obstacles, potentially affecting their competitiveness in an increasingly digital academic and professional landscape. PhD students, whose research often depends on uninterrupted access to advanced AI-driven software, particularly in the STEM fields, may find their progress hindered by these infrastructural deficiencies. Addressing these foundational challenges is imperative to ensure that AI technologies enhance rather than hinder educational equity. This research study, therefore, aimed to examine both the benefits and challenges of AI use in Jamaican educational institutions. By exploring the integration of AI tools at various levels – high school, undergraduate, graduate, and PhD – it sought to understand how students across these categories are currently using AI in their learning processes. The study also assessed the impact of these tools on their academic performance, highlighting the unique needs and challenges faced by students at each stage of their educational journey. By doing so, this research will contribute to the ongoing discourse on how AI can be effectively and equitably integrated into education systems, particularly in developing countries like Jamaica.

3. Methodology

3.1 The Design

The research study utilised a mixed-methods design, combining qualitative and quantitative approaches to comprehensively understand how AI influences students' performance across academic levels and settings. By combining both quantitative and qualitative data, the study was able to capture not only measurable trends, such as changes in grade distributions and AI usage patterns across high schoolers, undergraduates, master's, and PhD students regarding AI's effectiveness and challenges, which educators across the same school levels support.

3.2 The Participants

The participants in this study included a diverse group of individuals, spanning both students and educators. The study used the snowball sampling technique to collect data using questionnaires from the students, where they were encouraged to share the link with their peers and also convenient sampling for the focus group discussions and interviews with students who were available and willing to participate in the study. Also, convenient sampling was conducted to collect data from educators who were

available and willing to be interviewed. All participants were informed about their consent to participate and withdraw from the study at any point in time. A total of 100 students participated, representing various educational levels. This group comprised high school students, undergraduate, and graduate students, including those pursuing master's and PhD degrees. The age of the students ranges from 13 years to over 45 years considering students from Grade 9 level to PhD level. There were 12 lower high-schoolers, 12 upper high-schoolers (sixth formers), 55 undergraduates, 18 master's, and 3 PhD students involved in this research. The study also involved 25 educators, all of whom are teaching professionals in the areas of English Language and Literature, Mathematics, Sciences, and Business. However, most of these educators teach mathematics. Eighteen (18) teachers from high schools teach Grades 7 to 13, 5 lecturers from the college, and 2 lecturers from the university level. All participants are from Jamaican parishes such as Kingston, St. Andrew, St. Ann, and St. Catherine. The inclusion of participants from different academic backgrounds and regions provided a broad perspective on the impact of AI in education, particularly in how it affects both teaching and learning across various educational stages.

3.3. Data Collection and Data Analysis

Quantitative data were gathered through student performance metrics and questionnaires, which provided measurable insights into how AI tools influenced academic outcomes in subjects like mathematics. Meanwhile, qualitative data were collected through interviews and focus groups with students and teachers, capturing nuanced experiences and perceptions of AI's impact on learning. This triangulation of data enhanced the study's validity and offered a holistic understanding of the educational shifts brought about by AI, ensuring that both numerical and personal experiences were thoroughly explored.

For the data analysis in this research, both quantitative and qualitative methods were employed. Quantitative data were analysed using descriptive analysis, specifically through the use of descriptive statistics such as mean, median, and standard deviation to summarise and present the data on student performance before and after the integration of AI tools in the classroom. Excel was utilised for organising and calculating these statistical measures, making it easier to visualise trends and compare results across different subjects like mathematics. The descriptive analysis helped in identifying patterns in students' academic outcomes and gauging the overall impact of AI on their learning. The quantitative data, including the percentages of students reporting improvements in academic performance and changes in engagement with AI tools, provided a solid foundation for generalising trends and patterns. This quantitative analysis was supplemented by qualitative data, which were thematically analysed to capture insights from interviews and focus groups, providing a richer understanding of the educational context. The qualitative data helped to uncover deeper insights into students' struggles with AI-generated content, their expectations for the future of AI in education, and how AI affected their study habits. Combining these methods allowed for a detailed

exploration of both numerical trends and the subjective experiences of students and teachers, ensuring the study addressed both the broader trend trends and the specific, context-driven experiences of Jamaican students.

4. Findings

The findings from the study are organised sequentially in terms of the research questions.

4.1. Results based on Research Question 1

In what ways is AI currently being used by students in the teaching and learning process in educational institutions?

This research question focuses on exploring how students are integrating artificial intelligence (AI) tools into their academic activities. This includes examining the use of AI for personalised learning, assistance in homework and assignments, real-time feedback from intelligent tutoring systems, and AI-driven platforms for self-paced learning.

The study revealed diverse age demographics among the participants. Twelve percent (12%) of the participants are under 18 years old, comprising lower high-schoolers in Grades 9 to 11 (see Figure 1 and Figure 2). Approximately 37% of the participants were aged 18-24, with 12 of them upper high-schoolers (sixth formers), while the others were undergraduate students at colleges and universities (see Figure 2). Figure 1 further illustrated that 27% of the participants were between the ages of 25-34, all pursuing undergraduate studies at colleges and universities. A smaller group, 6%, aged 35-44, were enrolled in graduate programmes, with 3% specifically pursuing doctoral degrees and the other 3% their master's. Lastly, 18% of participants were over 45 years old, completing either undergraduate or graduate degrees.

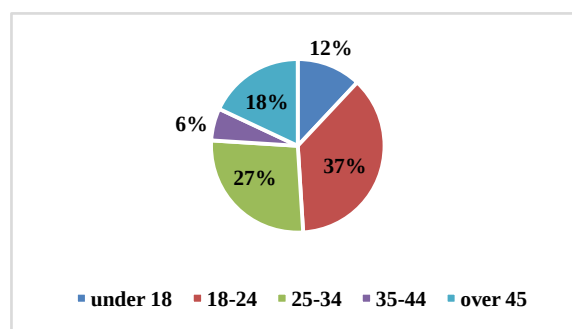


Figure 1. The age ranges of participants

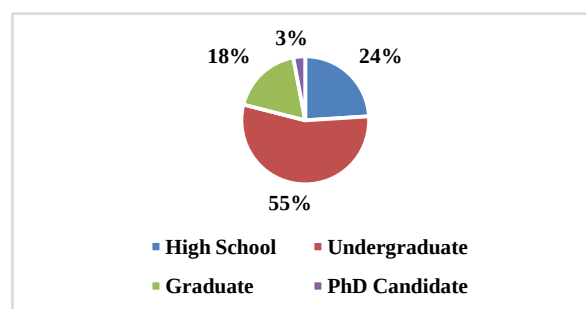


Figure 2. The academic levels of the participants

From the study, the demonstrated use of AI by participants was reflected in one way or another. The findings revealed that AI facilitated a variety of impactful ways to support the teaching and learning process within educational institutions. A comprehensive analysis of these findings highlighted the fact that AI is not just a supplementary tool but has become integral in facilitating different aspects of students' academic performance. [Table 1](#) offers a detailed breakdown of how AI was utilised, including aiding in understanding course content, improving retention of material, and enhancing collaborative learning. The analysis revealed that most of the participants have a very high rating (75% and over) of AI in enhancing their educational support with the least favorability of 50% for its use in improving retention of course content and ensuring the accuracy and usefulness of AI-generated feedback. The positive response to AI is evident, with 83% of the participants, comprising 45 undergraduates, 17 high-schoolers of which 8 were upper higher schoolers, 3 PhD students, and 18 master's students, reporting that AI significantly contributed to their understanding of course content. This widespread positive feedback suggests that AI tools are effectively supporting learning across various academic levels. The fact that participants from diverse educational stages (from high school to PhD students) are benefiting similarly indicates that AI's impact is not limited to any particular group but is appreciated across the educational spectrum. This underscores the potential of AI as a valuable tool for improving comprehension and facilitating deeper engagement with course material. This trend was further reinforced by [Figure 3](#), which shows that nearly half of the participants (49%) believed AI had "moderately enhanced" their understanding. Among this group, 16 were high-schoolers (from Grades 9-11 and sixth form), and the rest were undergraduate students. This suggests that AI tools were perceived as useful in improving comprehension, particularly for younger students still in the early stages of their academic journeys. Another 39% noted significant improvements in their understanding of AI. This group included 8 upper high-schoolers, 3 PhD students, 9 undergraduates, and 18 master's students. The mix of students across different educational levels – particularly at higher levels such as master's and PhD programmes – suggest that AI had a more pronounced impact on those with more advanced academic experience, possibly due to their ability to engage more deeply with AI tools and integrate them into complex learning processes. This distribution indicates that AI has a positive, albeit varied, impact on students' academic understanding, with a tendency for greater benefits seen at higher educational levels. However, the findings also point to the possibility that AI's effectiveness might be somewhat dependent on the students' academic maturity and the complexity of the content being learnt. Five of the teachers who taught all levels of high schoolers highlighted that these students are typically at the stage of developing abstract reasoning problem-solving, and critical thinking skills. So, if the AI

tools utilised by students are designed to scaffold learning, which they ensure while teaching, then these tools could effectively enhance comprehension. Some of these tools, according to the educators that offer interactive and visual learning aids are best for scaffolding which can significantly enhance these students' understanding of complex topics making abstract concepts more tangible. They stated further that AI primarily is a supplementary tool for this group of students, where they can benefit from immediate feedback and reinforcing foundational concepts already taught in the classroom. Moreover, due to the personalized ability of AI tools, AI can effectively support the individualised learning of high schoolers, particularly those who struggle with traditional methods. On the other hand, it was pointed out that upper high-schoolers could use AI for more advanced, analytical tasks. One of the lecturers [she] at a college referred to undergraduate students, and that students in their early years at the tertiary level are transitioning from guided learning to independent exploration [typically required at the tertiary level]. She further expressed that AI tools could facilitate this transition by offering adaptive feedback and promoting self-directed learning approaches. As such the perceived moderate enhancement shared by undergraduates might stem from the diversity in cognitive readiness and the varying degrees to which students integrate these tools into their learning strategies. Additionally, one of the lecturers who taught at the master's level stated that postgraduate students typically demonstrated advanced cognitive abilities, such as synthesis of complex ideas, critical analysis, and independent research; advised that students should tread with caution and not overestimate AI's capacity to replace nuanced human reasoning in academic work. The significant improvement reported by this group of students indicated that they leverage AI tools for specialized tasks, such as data analysis or literature synthesis. Another college educators, shared that she was uncertain of the level of mathematics comprehension concepts grasp by her undergraduate students utilising using AI tools, particularly ChatGPT. She added that in one instance, asked her students to prep for a particular topic ahead of teaching. Not surprisingly, they prepared utilising the ChatGPT platform, however, failed to cross-reference the information when asked. In enquiring further, she was informed that they did not see the need for it. She went on to say that she was gravely concerned about the accuracy of the information they were obtaining and had encouraged them to carefully cross-reference information found on ChatGPT with other credible sources. Overall, teachers and lecturers have expressed that the impact of AI typically varies for students, particularly in focusing on the alignment with cognitive demands, of not just each grade level but academic level as well. Thus, they suggested that it was important for students to be effectively trained to use AI tools, more so the lower-level high schoolers who lacked the necessary maturity to discern reliable AI-generated information.

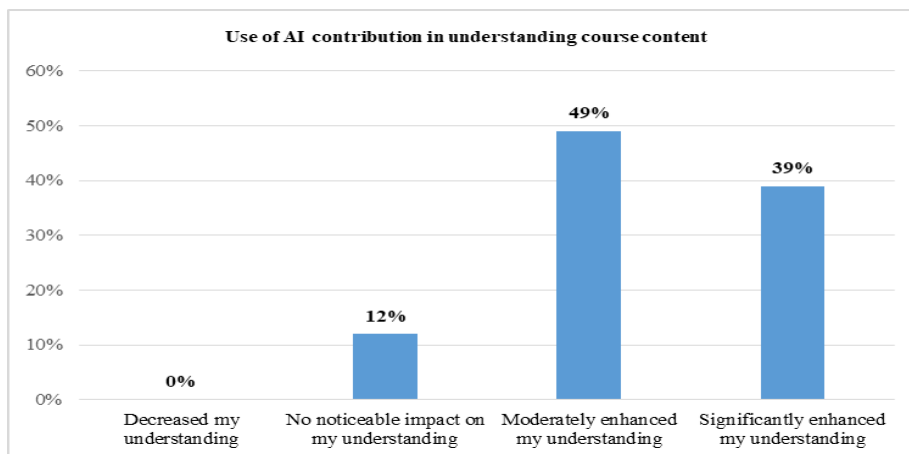


Figure 3. Contribution of the use of AI in understanding course content

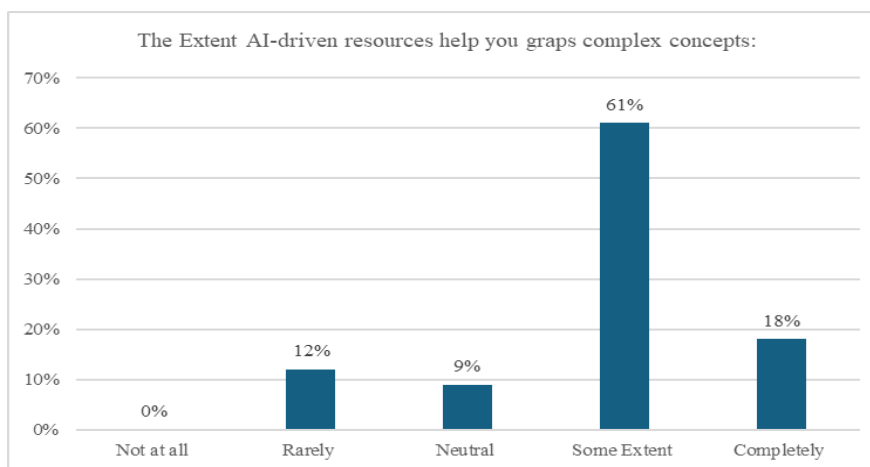


Figure 4. The extent to which AI-driven resources help students grasp complex concepts effectively

The use of AI to help students grasp complex concepts was another significant finding from the study. According to Table 1, a significant majority (75%) of participants reported that AI-driven resources improved their ability to understand challenging material. This group included 55 undergraduate students, 18 lower high-schoolers, 1 graduate, and 1 PhD student. This indicated that AI resources have a broad and positive effect on students across various educational levels, suggesting their potential utility in supporting diverse learning needs. Moreover, this is visually supported by Figure 4, where more than half (61%) of the participants indicated that AI tools helped them understand difficult concepts “to some extent”.

This group was 36 undergraduates, 3 PhD students, 14 high-schoolers (of which 4 were sixth formers), and 8 master’s students. The high percentage of undergraduates and graduates in this group suggests that AI tools were particularly helpful in aiding students at different stages of higher education to grasp complex topics. This moderate level of improvement pointed to AI’s capacity to assist in breaking down difficult content and facilitating a much clearer understanding. Additionally, a smaller proportion of participants (18%) stated that AI had “completely” assisted them in this regard. This group comprised of 6 high schoolers, (4 of which are sixth formers) 7 master’s students, and 5 undergraduates. This indicated that for some students, AI tools had a profound impact, allowing them to fully comprehend complex concepts. AI’s ability to break down complex topics into more digestible and

interactive formats played a critical role in this, providing students with tailored learning experiences that align with their individual needs. For example, AI-powered platforms often incorporate simulations, step-by-step problem-solving guides, and real-time feedback, all of which contribute to a deeper understanding of intricate academic content. At the high school level, students are in the early stages of developing abstract reasoning and problem-solving skills. AI tools that break down topics into bite-sized, interactive content can be invaluable, as they help students build foundational knowledge and grasp core concepts more effectively. These students reported that having step-by-step guides and simulations had—allowed them to actively engage with the material, aiding their transition from rote memorization to understanding concepts work in practice.

High school teachers in this study expressed their appreciation of AI’s role in making content more accessible and engaging for their students. They, however, expressed their concerns about students being over-reliant on AI for explanations, which might hinder their development of independent critical thinking and critical thinking skills. The presence of graduates and undergraduates in this group suggested that AI can be particularly effective for students who are more advanced in their studies and might benefit from more customized or in-depth learning tools. Undergraduates have shared that AI-powered platforms offer them simulations and problem-solving activities that allow them to experiment

and explore various solutions in a safe, low-stakes environment. Five of the undergraduates and three of the graduate students shared that the simulations afford them opportunities to explore real-world models such as biological processes, economic, and mathematics models that helped them to connect theoretical knowledge with practical application. Overall, the data revealed that AI-driven resources are valuable tools for enhancing students' understanding of challenging material. Their effectiveness appears to vary across educational levels, with a notable impact on undergraduate and graduate students. The ability of AI to break down complex topics into more digestible, interactive formats and offer tailored learning experiences, plays a crucial role in helping students better grasp difficult concepts, highlighting its potential as a powerful educational tool. The educators, however, expressed that they did not want the intellectual engagement of the students with the materials, problem-solving skills, and creativity to become overshadowed by the use of AI.

Table 1. Ways in which AI is currently being used by students in the teaching and learning process in educational institution

Ways	Indicators	Percentage of participants
Course Content	To understand course content	83%
	To grasp complex concepts more effectively	75%
	To improve retention of course material	50%
	To make course content more accessible and engaging	100%
Collaborative Learning	To use for teamwork and collaboration	92%
	To complete group projects	92%
Personalise Feedback	To contribute to academic performance	92%
	To ensure the accuracy and usefulness of AI-generated feedback	50%

In terms of retention, the findings revealed that AI tools also have a significant impact on students' ability to retain information. As per [Table 1](#), 50% of the participants acknowledged that AI-enhanced learning tools contributed to improvements in retention of course material. This group included 3 PhD students, 11 master's students, 14 high schoolers, (of which 8 were sixth formers), and 22 undergraduates. This suggests that AI tools have a broad and beneficial impact on retention across various educational levels, from high school to graduate studies. This is further illustrated in [Figure 5](#), where 46% of the participants, consisting of 3 PhD students, 9 master's students, 14 high-schoolers (inclusive of 8 sixth formers), and 20 undergraduates, noticed a significant improvement

in their retention of course material. The relatively high number of undergraduate students in this category suggests that AI tools may be particularly effective for students in higher education, helping them retain and recall complex material better. The fact that AI tools could lead to significant improvements in retention demonstrates this potential to enhance memory retention and long-term learning outcomes. An additional 30% saw moderate progress in their retention of material, including 15 undergraduates, 4 lower high-schoolers, 4 upper high-schoolers, and 7 master's. This indicates that while AI tools may not have a profound effect for some students, they still contribute positively to retention, helping students retain information to a noticeable degree. The fact that a substantial portion of participants reported moderate improvements suggested that even partial enhancement in retention can still have a meaningful impact on overall learning. Moreover, the findings revealed that AI-enhanced tools like spaced repetition, interactive quizzes, and personalised review schedules played a role in these results. The educators from the high schools and colleges shared that AI-powered tools increase classroom interactions and engagement through gamified platforms and simulations. Also, these tools facilitated immediate feedback and helped sustain students' motivation. These educators further expressed that AI facilitated hybrid and blended learning environments by integrating online and in-person training. One educators [she], who taught high schoolers in Grades 7 through 13, stated that AI helped to make the teaching and learning process more efficient and relevant, particularly in lesson planning and content delivery. Another educator shared that she used AI tools such as Photomath and Third Space Learning in her mathematics classroom. She explained that Photomath allowed students to take pictures of math problems and provided step-by-step solutions for each. Third Space Learning, on the other hand, is an AI-based tutoring platform that offered personalised mathematics tutoring to students; this tool also adjusted teaching strategies based on students' performance, improving engagement and outcomes in the teaching and learning process. She stated further that due to the adaptive nature of these AI tools, she found that her students' problem-solving and conceptual understanding of mathematics had improved. By constantly adapting to students' learning patterns and offering frequent review opportunities, AI tools helped reinforce the material in a way that aligns with cognitive retention theories, thus aiding long-term memory. AI tools have been known to play a significant role in aiding long-term memory by reducing cognitive load and enhancing the efficiency of learning processes. According to Cognitive Load Theory, as outlined by MindTools [29] learning was most effective when instructional design aligns with the brain's ability to process information without overwhelming working memory. Disprz [30] stated that AI tools, such as personalised learning platforms and intelligent systems can optimise information delivery by tailoring content to learners' individual needs helping them to focus on core concepts and reducing extraneous cognitive load. Pathan [31] shared that by facilitating efficient information processing, AI supported the transfer of knowledge from

working memory to long-term memory, enabling learners to retain information more effectively over time. With all the good that AI tools could facilitate, educators emphasised once again that caution must be considered to avoid students' over-reliance on AI learning. They expressed that it was imperative to ensure a balance where AI should serve as a tool to enhance learning, not replace traditional study habits like notetaking, summarising, and self-reflection. Additionally, having a teacher could help foster a deeper understanding of course material due to invaluable human interaction as feedback to students could be provided based on learning styles and/or learning needs.

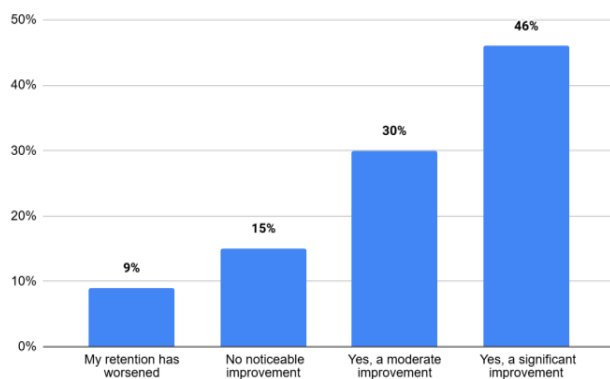


Figure 5. Shared students' perceptions of their noticeable improvements in their ability to retain of course material due to AI-enhanced learning tools

Collaborative learning is another area where AI has demonstrated its efficacy. Table 1 shows that 92% of participants used AI tools for teamwork and collaboration, particularly in completing group projects. This indicated a strong preference for AI tools as part of collaborative learning and suggested that students across various educational levels – PhD, graduate, undergraduate and high school were integrating these technologies into their group work activities. The participants who used AI for teamwork comprised 55 undergraduates, 3 PhD students, 18 master's students, 12 upper high-schoolers, and 4 lower high-schoolers. This diversity in usage across different education levels highlights that AI tools were viewed as valuable resources for students at various stages of their academic careers, from high school through graduate studies. It suggested that AI tools were perceived as supportive in streamlining communication, fostering organisation, and offering shared digital workspaces, thereby facilitating overall productivity in group projects. As such, AI tools could make it easier for students to work together, share information, and manage the workload in group settings. Many AI-driven platforms provided features such as automated task assignment, real-time editing, and virtual brainstorming sessions, which allowed students to collaborate effectively regardless of physical location. This highlighted AI's capacity to not only enhance individual learning but also facilitate collective academic efforts, ensuring that students could work together more seamlessly and productively. In addition to collaboration, the ability of AI to offer personalised feedback has had a noticeable impact on students' academic experiences. Moreover, Figure 6 indicates a range of opinions on the extent to which AI promotes

teamwork and collaboration among students. Specifically, 18% of participants, representing the group of graduates [master's students], reported that AI completely fostered collaboration. While 27%, including 20 undergraduates, 3 PhD students, and 4 lower high-schoolers, agreed that AI contributed to collaboration to some extent. This suggested that AI tools have varying levels of effectiveness in promoting teamwork across different academic levels, but the mixed responses point to areas where AI could be further optimized to enhance its collaborative features, particularly for students who may not fully utilize these tools for effective teamwork. However, a larger proportion remained neutral on the matter, with 31%, comprising 10 high-schoolers (inclusive of 3 sixth formers), and 21 undergraduates, expressing no strong opinion on AI's collaborative benefits. Based on this neutral stance, it suggested a contradiction in the findings related to the use of AI for collaboration and teamwork as revealed by Table 1 and Figure 6. This indicated that while many students were utilising AI tools in collaborative settings, their perceptions of how these tools contributed to their success in teamwork might not be as strongly positive or negative, thus leading to a neutral response. Possible factors that might have contributed to this neutrality could be inconsistent experiences with AI tools, varying levels of familiarity with these tools, or challenges in integrating them into existing workflows.

Additionally, 6%, representing 3 sixth formers and 3 undergraduates, felt that AI rarely contributes to teamwork, and 18%, including 11 undergraduates, and 7 high-schoolers (inclusive of 6 sixth formers), claimed that AI does not promote collaboration at all. These varied responses suggest that while AI had the potential to facilitate group work and cooperation, its effectiveness in this area may depend on the specific tools or platforms used, as well as how they were integrated into academic projects and assignments, and teachers' awareness of how to use the platforms effectively for stronger collaboration. It appears that some students believe that AI streamlines communication and task delegation within group projects, while others experience limitations due to the platform's functionality or familiarity with the tools.

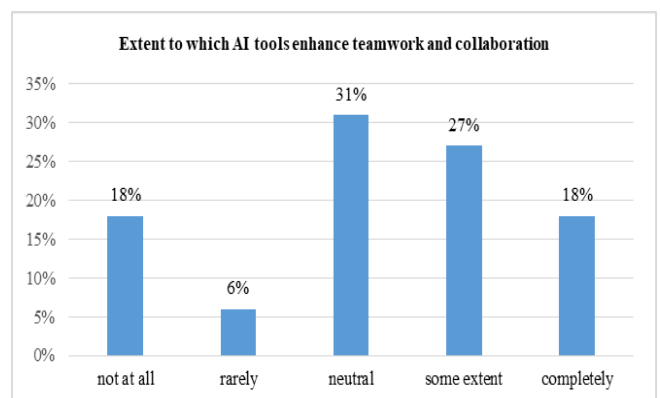


Figure 6. The extent that AI promotes teamwork and collaboration among students

Table 1 indicates that 92% of the participants, comprised 54 undergraduates, 3 PhD students, 18 master's students, and 17 high-schoolers (inclusive of 12 sixth

formers), believed AI contributes positively to their academic performance through personalised feedback. However, only 50%, including 28 undergraduates, 10 master's students, 3 PhD students, 4 high schoolers, and 5 sixth formers, reported that the feedback provided by AI tools was consistently accurate and useful. This finding highlighted a potential area for improvement, as AI feedback mechanisms still required fine-tuning to ensure the feedback was not only quick but also contextually appropriate and meaningful. Personalised feedback crucial in modern education, as it allowed students to identify their strengths and weaknesses and adjust their learning strategies accordingly. AI's capacity to analyse performance in real-time and provide immediate feedback was invaluable, but the quality and depth of that feedback needed refinement.

Moreover, students have reported that AI made course content more accessible and engaging, with 100% of the participants agreeing with this statement (see Table 1). AI achieves this by offering a range of multimedia resources, including videos, interactive modules, and gamified learning, which cater to different learning styles. This facilitated the learning more engaging and accessible, especially for students who may have struggled with traditional methods of instruction. The inclusion of AI in education had democratised access to diverse resources, allowing students to learn at their own pace and in ways that best suit their individual preferences.

Figure 7 reveals that a majority of the participants (61%) encountered challenges when using AI in their academic work. This group includes 36 undergraduates, 3 PhD students, 14 high-schoolers (inclusive of 4 sixth formers), and 8 master's students. The fact that the challenge was widespread across different academic levels (high school to PhD) suggested that difficulties students face with AI were not confined to any specific group but were experienced across various stages of education, although undergraduates made up the majority of those reporting difficulties. This revealed that undergraduates lack exposure to using advanced academic tools compared to graduate or PhD students. These challenges ranged from technical issues like incorrect information generated by AI, difficulty identifying proper sources and authors, and citations not being formatted as required. The issue of potential plagiarism also surfaced, with students expressing concerns over originality when using AI-generated content. These technical imitations highlight that AI tools, while helpful, were not yet perfect in terms of accuracy, reliability, and their ability to meet academic standards (such as proper citations). This may suggest a need for more refined AI tools and better guidance on how to use AI effectively for academic purposes. Some students also pointed out that all lecturers encouraged them to use AI but there was a fear of content similarity across assignments. This reflects a broader issue in academia about maintaining academic integrity and originality when using AI, which could result in students feeling less confident about the authenticity of their work. Group work challenges also emerged, such as consensus on project direction, lack of diversity in information, and group members with unreliable internet access. This indicated that while AI can be a valuable tool for group work, its effectiveness can be hampered by logistics issues

such as inconsistent access to technology and the potential for AI tools to limit the diversity of viewpoints and information in collaborative projects. Additionally, some found it hard to understand AI platforms or struggled with the accuracy of the responses, as mentioned by a subset of the participants. This points to a broader issue of usability – AI platforms may not always be intuitive or user-friendly, which could prevent students from fully harnessing their potential. Also, the accuracy of AI-generated responses for some students indicates that the current iteration of AI may not always provide precise or reliable outputs for academic tasks.

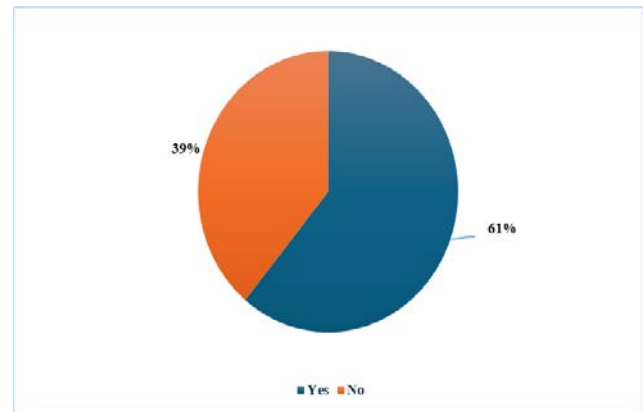


Figure 7. The indication whether students experienced challenges or not

In contrast, Figure 8 showed that the overwhelming majority (91%) experienced significant benefits from using AI. This group comprised 46 undergraduates, 3 PhD students, 18 master's students, and 24 high-schoolers. Students identified numerous advantages, such as easier access to information and resources, faster completion of assignments, and improved grades. They also highlighted the utility of AI tools in organising presentations, generating ideas, and dividing tasks efficiently during group projects. This pointed to AI's potential to enhance not only individual learning but also collaborative efforts. Many students noted that AI provided correct answers and facilitated research and development processes, underscoring the speed and convenience that these tools bring to academic work. Additionally, the personalised and interactive features of AI tools were praised for helping students to better grasp complex topics and concepts.

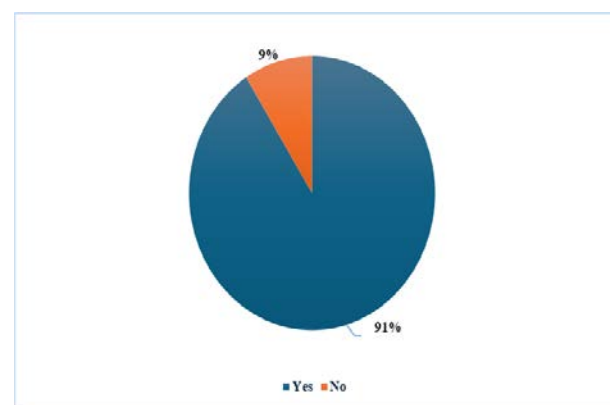


Figure 8. The indication whether students experienced benefits or not

Figure 9 further expanded on AI usage illustrating the various academic tasks where AI tools were applied. The

most common use was in research, with 91% of students, comprising 46 undergraduates, 3 PhD students, 18 master's students, and 24 high-schoolers, relying on AI for this purpose. This highlighted the central role AI plays in assisting students with gathering information, analysing data, and supporting their academic work across different levels of education. Undergraduate, graduate, and PhD students reported using AI to assist with their research projects, including writing theses. Specifically, they found AI helpful in organizing each chapter of their thesis and presenting literature readings in a clearer, more understandable format. This suggested that AI was a valuable tool for improving both the structure and clarity of complex academic writing. AI was also heavily used for homework, as reported by 79% of the participants, comprising 24 high-schoolers, and 55 undergraduates. Additionally, 82% of the participants, which included 3 PhDs, 55 undergraduates, 10 master's students, and 14 high-schoolers (inclusive of 8 sixth formers), rely on AI for completing projects. The high schoolers and sixth formers shared that they used it to aid the completion of their SBA studies for CSEC and CAPE. While a smaller yet significant percentage (64%) used AI for classwork, with 40 undergraduates, and 24 high-schoolers, incorporating AI into their daily academic activities. Moreover, 55% of the participants, including 30 undergraduates, 8 high schoolers, 8 sixth formers, and 9 master's students, utilised AI tools for preparing for tests and exams. This suggests that AI is seen as a valuable resource for reviewing and reinforcing material before assessments. Additionally, 42% of the participants, comprising 24 high-schoolers, 4 master's students, and 14 undergraduates, used them for notetaking. This indicates that AI is not only helping students with studying for exams but also plays a significant role in assisting with the organization and recording of class materials. Overall, it has been revealed that AI is playing a multifaceted role in education, being utilised across different aspects of academic tasks, with research and homework taking precedence. The widespread use of AI in these areas highlights how integral these tools have become in the modern academic environment.

The study also investigated students' satisfaction with AI-generated feedback, as depicted in Figure 10. Twenty-

seven percent (27%) of the participants, with 10 undergraduates, 5 master's students, and 12 high-schoolers (inclusive of 6 sixth formers), expressed being "very satisfied" with the personalised feedback they received from AI tools. A larger group 49% of participants, consisting of 33 undergraduates, 7 master's students, 2 PhD students, and 7 high schoolers (including 3 sixth formers), were "somewhat satisfied" with the AI-generated feedback. On the other hand, a small minority (18%) of participants, including 8 undergraduates, 5 high-schoolers (inclusive of 3 sixth formers), and 5 master's students, expressed neutrality regarding the feedback they received, indicating a mixed experience. Finally, an even smaller fraction (6%) of participants, comprising 1 PhD, 4 undergraduates, and 1 master's student, were dissatisfied. The high level of satisfaction reflected the positive impact that personalised feedback had on students' learning experiences. AI's ability to provide real-time and tailored feedback allowed students to track their progress and make necessary adjustments, contributing to their academic success. However, the neutral and dissatisfied percentages, though small, indicate that there was room for improvement in terms of the students' abilities to use the feedback constructively, suggesting a need for more targeted support or guidance to help students better understand and apply the feedback they receive to enhance their academic performance.

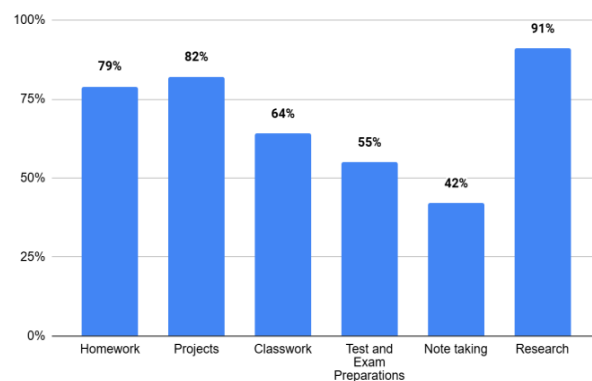


Figure 9. The ways that students applied AI tools used to assist students in the learning process

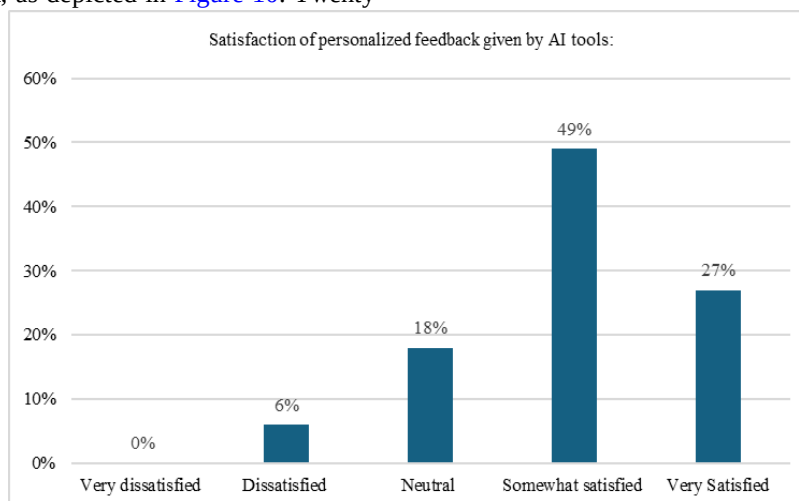


Figure 10. Students expressed levels of satisfaction with the personalised feedback by AI tools in their courses

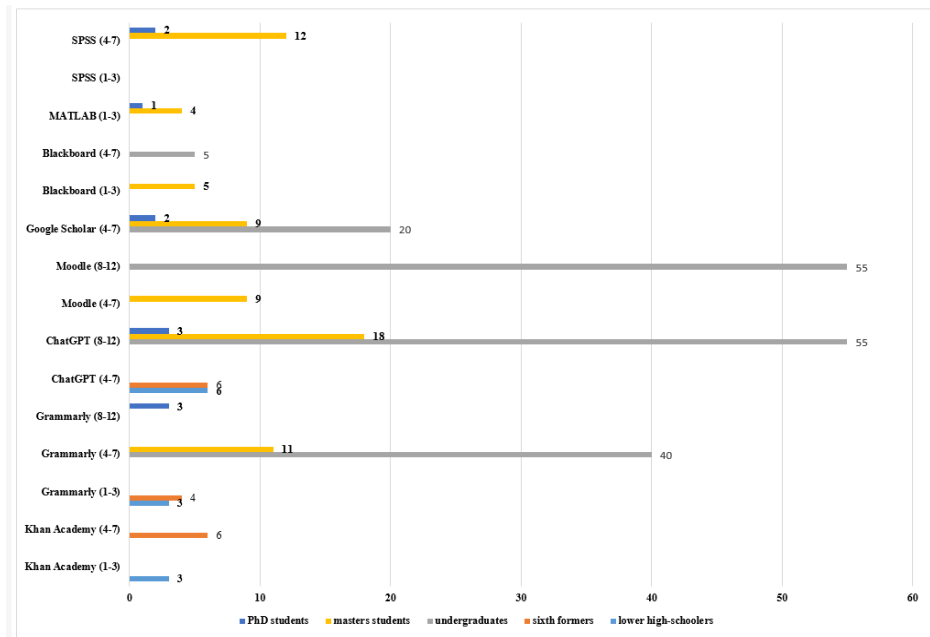


Figure 11. Students' AI usage frequency in their overall academic activities and types of AI tools used for concept understanding, studying, and completing assignments

The data in Figure 11, revealed a clear trend of increasing AI tool usage as students progress through the educational system, from high school to PhD levels. This aligns with the growing demands for independent learning, research, and academic development at higher academic levels. The study uncovered lower high-schoolers and sixth formers exhibit lower usage of AI tools compared to their older counterparts. Lower high-schoolers, for example, primarily engage with AI tools like Khan Academy and Grammarly, with an average of 2 sessions per week for Khan Academy and 3 sessions for Grammarly. Notably, ChatGPT appears to be a popular tool among lower high-schoolers, with 6 sessions per week. This suggests that lower high-schoolers are using AI primarily for homework and supplementary learning particularly to assist with their studies, understanding concepts, and completing their assignments. Sixth formers, who are preparing for university, show a slightly higher engagement with AI, especially ChatGPT (7 sessions per week), followed by Khan Academy (4 times per week). Despite this, the usage frequency for most AI tools remains relatively low compared to higher education levels. Undergraduates, on the other hand, exhibited signs of heavy usage of AI tools such as Moodle and ChatGPT. Moodle was used on average 10 times per week by all undergraduate students, while ChatGPT was used on average 8 times per week by all undergraduates (see Figure 11). Grammarly was also used, an average of 5 times per week by 40 undergraduates. These findings suggest that undergraduates are leveraging AI tools not only for basic learning and assignment completion but also for more advanced tasks, such as literature review (using Google Scholar) and to facilitate research discussions (using ChatGPT). The widespread use of Moodle highlights its role in course management, content delivery, and interaction with course materials. At the master's level, students continue to utilise AI tools intensively, with notable usage of Grammarly (6 sessions per week), ChatGPT (9 sessions per week), and Moodle (6

sessions per week). These tools seem to be used primarily for advanced academic writing, and facilitating research and data analysis tasks. Also, using Google Scholar (5 sessions per week) highlights the importance of AI in research at this level, helping students to be able to access academic papers and other scholarly resources efficiently. The educators at the tertiary level in Jamaica have emphasized that Moodle is currently the most widely used Learning Management System (LMS) at undergraduate and master's levels. Moodle's versatility and user-friendly interface have made it a central hub for managing academic tasks, engaging student engagement, and providing a seamless learning experience, particularly as institutions continue integrating digital tools into their teaching practices.

Furthermore, the PhD students were found to exhibit the highest usage frequency for some AI tools, particularly ChatGPT (10 sessions per week), SPSS (7 sessions per week), and Grammarly (8 sessions per week). This reflects the need for these students to engage in extensive academic writing, editing, research, and data analysis, which are very essential components of their overall academic tasks due to the nature of their programme of study. The low usage of MATLAB (3 sessions per week) is because as the student stated it is less frequently required for his study. PhD students' reliance on Google Scholar (7 sessions per week) further demonstrates the tool's significance in helping them conduct advanced research and find relevant academic articles.

Despite the advantages, Figure 12 showed that 30% of the participants, comprising 3 PhD students, 20 undergraduates, 5 master's students, and 2 high-schoolers (inclusive of 1 sixth former), experienced challenges related to the accuracy and usefulness of AI-generated feedback. Another 30% (4 sixth formers, 20 undergraduates, and 6 master's students) voiced concerns about the relevance of the feedback provided, indicating that the AI tools may not always align with their specific academic needs. On the other hand, 34% of participants,

comprising 15 high-schoolers (inclusive of 7 sixth formers), 15 undergraduates, and 4 master's students, reported no concerns or challenges, suggesting a positive experience with the AI feedback. Additionally, 6% of the participants, consisting of 3 lower high-schoolers and 3 master's students, stated that they did not receive any AI-generated feedback, highlighting a gap in accessibility or use of the tool for some students. These findings suggest that while AI feedback was generally appreciated, a significant portion of students were still unsure of its reliability and accuracy. This reinforces the need for more robust and contextually appropriate AI systems to ensure that feedback was not only prompt but also meaningful. Delving further into the specifics, Figure 13 provides insight into the types of challenges and concerns faced regarding AI-generated feedback. Internet challenges were the most commonly cited issue affecting 43% of participants, including 21 undergraduates, 14 high-schoolers (inclusive of 9 sixth formers), and 8 master's students. This suggested that inconsistent or unreliable internet access was a significant barrier for many students when trying to fully benefit from AI tools. The second most common issue was incorrect feedback, reported by 41%, consisting of 30 undergraduates, 3 PhD, 5 high-schoolers (inclusive of 3 sixth formers), and 3 master's students. This pointed to a recurring concern about the accuracy of AI-generated responses, which may lead to confusion or misunderstandings for students relying on technology for academic support. Thirdly, a lack of understanding of AI platforms was noted by 34% of participants (18 undergraduates, 4 master's students, 1 PhD student, 6 lower high-schoolers, and 5 sixth formers), indicating that some students may not be fully equipped to navigate or utilise AI tools effectively, perhaps due to inadequate training or familiarity with the platforms. Moreover, some students (34%), comprising 7 lower high-schoolers, 16 undergraduates, 6 sixth formers, and 5 master's students, indicated that educational institutions-imposed restrictions on the use of AI. This reflected a possible barrier where educational institutions may limit or regulate the use of AI tools, potentially hindering students' access to valuable learning resources. A small number of students (3%), [3 undergraduates] reported facing challenges such as regional restrictions, sign-in issues, and minor inaccuracies in the information provided by AI. Additionally, some students noted that the AI presented information that was unfamiliar to them and that certain features of AI required payment to access, highlighting the ongoing issue of the digital divide.

These findings highlighted the technical and institutional barriers that could hinder the full potential of AI in academic settings. While internet access was a critical issue, restrictions imposed by schools also played a role in limiting the benefits students could derive from AI tools. One of the educators shared that besides the digital divide and institutional barriers, "some students have become so reliant on the use of AI tools, so they were unable to function without it". In turn, students seemingly struggle more with problem-solving in their various subjects, particularly the Science, Technology, Engineering, and Mathematics (STEM) ones. The educators in this study, also shared that like themselves, students may question the reliability of AI-driven

evaluations, particularly if they feel that the Feedback was overly generalized or might even lack the depth of understanding that a human teacher could provide. Lecturers shared that this was even more noticeable at the university and college levels, amongst undergraduates and graduate students in the feedback they receive in enhancing their critical thinking and research skills particularly in writing essays and completing deep reasoning problems. One college lecturer stated she was concerned about the "use of AI without human analysis", explaining that the students were indeed getting information to help complete their assignments but when she met with them requiring explanations of what they did, it was clear that they did not understand the content downloaded. This lecturer indicated that she was teaching pre-service early childhood educators at the time, and she believed with this kind of mentality, there would be problems when entering the classroom to teach, where they were giving content but could not explain to the students what it meant. Moreover, they hoped that the AI-generated feedback would not adversely affect students' intellectual growth.

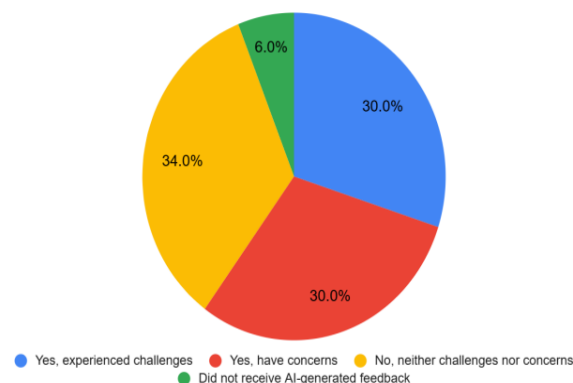


Figure 12. Students' indication of any possible challenges or concerns regarding the accuracy and usefulness of AI-generated feedback

Nevertheless, satisfaction with the overall integration of AI in the educational experience was largely positive, as demonstrated by Figure 14. A majority of students (55%), including 40 undergraduates, 8 master's students, 3 sixth formers, 2 PhD students, and 2 lower high-schoolers, reported being "satisfied" with the use of AI tools in their academic work. Additionally, 24% of participants, comprising 14 undergraduates, 6 master's students, 1 PhD student, 1 sixth former, and 2 lower high-schoolers, expressed being "very satisfied", reflecting a strong endorsement of the role AI played in enhancing their educational experience. However, a smaller proportion of students expressed dissatisfaction. Twelve percent (12%) of the participants, including 2 master's students, 6 sixth formers, and 1 undergraduate, 3 lower high-schoolers, were "somewhat dissatisfied" with AI integration. An even smaller proportion, 9%, consisting of 2 master's students, 2 sixth formers, and 5 lower high-schoolers, expressed being "very dissatisfied". The high satisfaction rate suggested that students appreciated the integration of AI into their learning processes, but the presence of dissatisfaction indicated that certain aspects of AI integration might not be meeting all students' needs. Addressing these concerns could involve improving the

user-friendliness of AI platforms, ensuring more accurate and useful feedback, and providing better support for students facing technical difficulties.

Finally, Figure 15 explored the specific aspects of AI integration that students found most beneficial. The majority of the participants, 67% (44 undergraduates, 12 master's students, 8 lower high-schoolers, and 3 PhD students) identified enhanced accessibility to resources as the primary advantage of using AI. This suggested that students valued AI for making learning materials and resources more easily accessible, which likely contributes to improving their academic performance. Following this, 27%, of participants (10 sixth formers, 8 undergraduates, 4 lower high-schoolers, and 5 master's students) reported that they appreciated the customised learning experience offered by AI. This indicates that many students feel AI tailors learning experiences to their individual needs, which can lead to more effective learning outcomes. A smaller percentage (3%) found that AI helped organise and build on their ideas when given appropriate prompts, with 1 sixth former, 1 undergraduate and 1 master's

student sharing this benefit. Another 3% (2 undergraduates and 1 sixth former) highlighted that AI improved their engagement with coursework, suggesting that the interactive nature of AI tools made their learning experience more interesting and motivating. One educator who taught the undergraduates shared that AI tools made it easier for students to complete assignments by minimizing the length of time it took to research and write. She reported that her students found it particularly helpful in completing lesson plan writing and assessment activities for practicum activities, improving professional writing, particular for proper grammar checks. Another educator who taught Grades 7 to 11, shared that he believed that there was a dire need for teachers to incorporate AI tools into their classroom strategies with clear guidelines on how to interpret AI feedback rather than students mostly venturing on their own in using AI. This would offer additional opportunities for peer review and collaborative discussions to ensure that students develop understanding of the feedback and its relevance to their work.

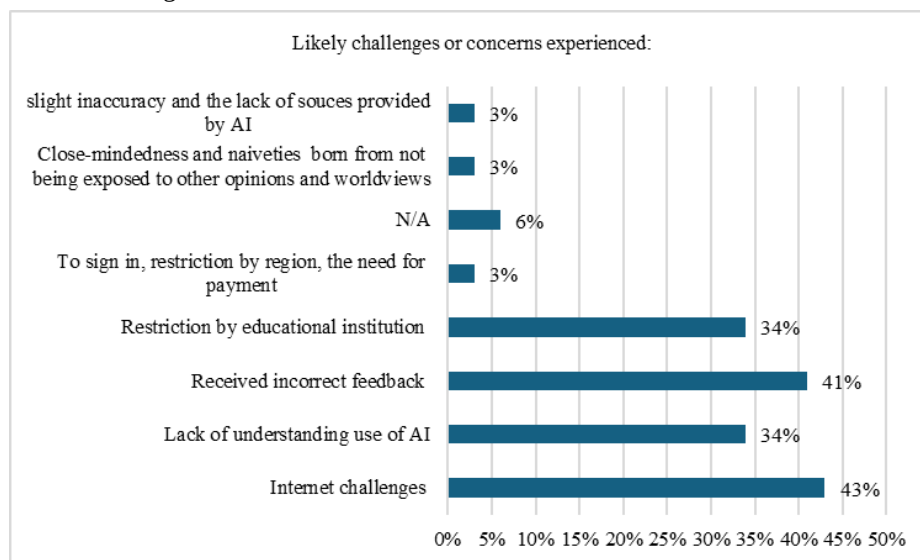


Figure 13. Students identified challenges or concerns regarding the accuracy and usefulness of AI-generated feedback

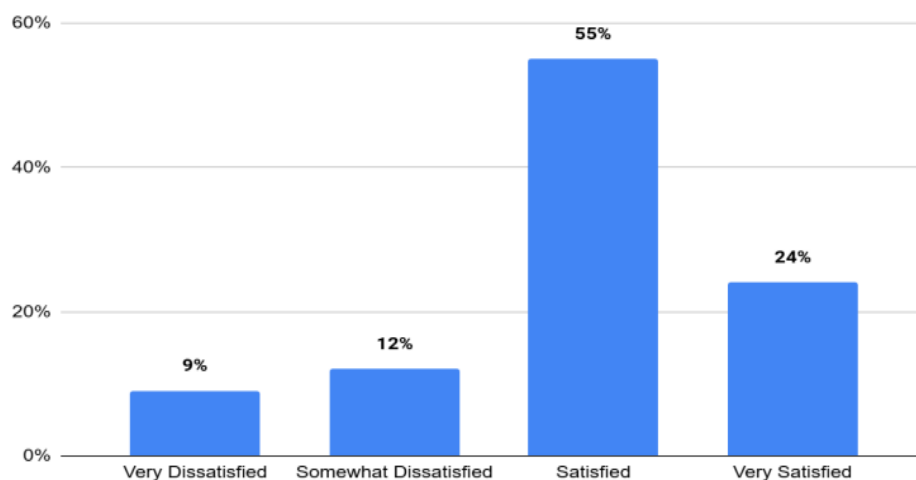


Figure 14. Students' satisfaction with the overall integration of AI in their educational experience

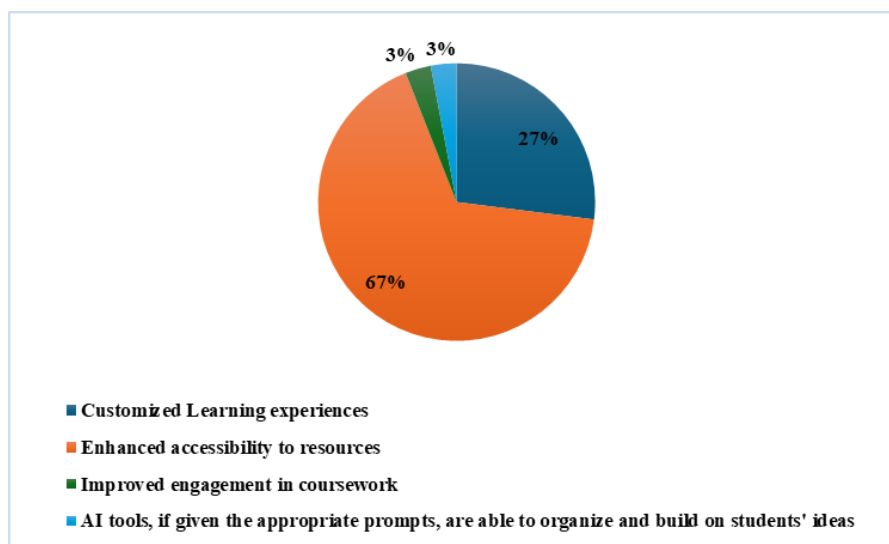


Figure 15. Specific aspects of AI integration that students find most beneficial

4.2. Results from Research Question 2

What is the impact of the use of AI on students' performance based on their own use of it in their learning process?

This research question explored how students' engagement with AI tools influenced their academic outcomes. The focus was on understanding whether students perceived improvements in their performance, such as enhanced comprehension, retention, and application of course content, as a result of integrating AI into their learning routines. By examining the relationship between AI usage and performance metrics such as grades, task completion, and conceptual understanding, the study aimed to assess how effectively AI supported individualised learning, problem-solving, and collaboration among students.

The findings revealed a nuanced view of how AI integration had influenced academic outcomes. Students' perception of their academic performance since the introduction of AI tools reflects optimism. As shown in Figure 16, 18% of the students (2 PhD students, 4 master's students, 8 undergraduates, 1 lower high-schooler, and 3 sixth formers) rated their performance as "excellent", suggesting that for some students, AI tools have had a highly positive impact, enhancing their learning and academic success. Additionally, 52% (33 undergraduates, 8 master's students, 5 lower high-schoolers, 1 PhD student, and 5 sixth formers) considered their performance to be "good", indicating that a large majority of students saw AI as beneficial in improving their academic outcomes, even if it has not led to top-tier performance for everyone. This indicated that most students (70%) felt that AI contributed positively to their academic success. Meanwhile, 30% (18 undergraduates, 2 master's students, 6 lower high-schoolers and 4 sixth formers) assessed their performance as "fair", implying that while AI helped, its impact might be more modest for this group, suggesting that AI's effectiveness varied among students. However, the varying levels of perceived improvement suggested that AI's effectiveness in improving academic outcomes might depend on factors like the students' level of study, engagement with the tools, and

the type of tasks involved. The shift in performance was also reflected in Figure 17 and Figure 18, which showed changes in students' average grades before and after incorporating AI into their learning process.

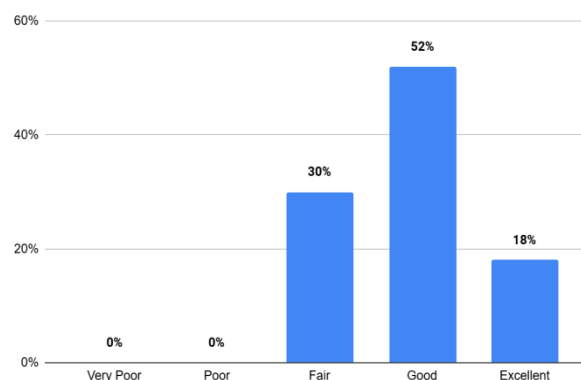


Figure 16. Rating academic performance then versus now since the integration of AI in the teaching and learning process

Before using AI tools, a substantial number of students (31%), including 19 undergraduates, 4 lower high-schoolers, 5 sixth formers, and 3 master's students, achieved an A grade, which indicates a strong academic performance. Additionally, 3% of the participants (1 undergraduate, 1 PhD student, and 1 master's student) obtained an A+ grade, reflecting exceptional performance. The distribution of A- grades also appeared significant, with 9% of the students (5 undergraduates, 2 master's students, 1 sixth former, and 1 lower high-schooler) earning this grade, showing that a proportion of students were performing well but not at the highest level. These students could be considered academically competent without AI assistance. This may suggest that AI was not the sole factor influencing academic success but rather an enhancer of existing strengths. On the other hand, the majority of students, 50% (31 undergraduates, 2 PhD students, 4 lower high-schoolers, 10 master's students, and 3 sixth formers) fell into the B range, or slightly lower, as seen in Figure 17. This distribution suggested a wide range of performance levels, with many students achieving moderate success. Overall, based on the grades

achieved prior to the introduction of AI tools into the teaching and learning process showing moderate success, there seem to be other contributing factors that affected their grades. The study uncovered that due to the pandemic stress and mental health levels, students were not performing as well as they would have desired. Also, coming out of the pandemic, the shift to return to face-to-face after struggling to thrive in an online environment where they had to try to adapt seemingly affected some students' self-motivation. Also, the varying grades may be a result of academic background and discipline. Students from various academic levels (undergraduate, graduate, and PhD) showed diverse performances. The distribution of grades suggests that while many undergraduates achieved A or B grades, master's and PhD students may have faced different academic challenges compared to their undergraduate counterparts, as reflected by the smaller proportion of higher grades in these groups. This could indicate differences in the level of difficulty, research requirements, or expectations at each educational stage. Also, academic performance was often closely tied to study habits and learning strategies. Students who received A and A- grades may have demonstrated strong time-management skills, study discipline, and effective learning strategies. Conversely, those in the B range could be students who were more average in their study approaches, potentially lacking the consistency or techniques that lead to higher grades. Some of the students, particularly the undergraduates (8), lower high-schoolers (5) and sixth formers (4), shared they needed access to resources and guidance which they believed could have helped them achieve higher grades. It is also noteworthy to mention that quality of instruction plays a critical role in students' academic performance. Teachers and professors who use effective teaching methods, provide timely feedback and engage students actively could positively influence their academic outcomes. Students in environments with less effective teaching might not achieve their full potential, leading to lower grades.

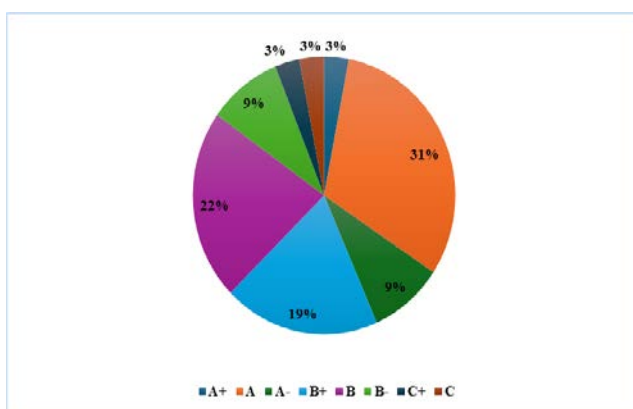


Figure 17. Students' average grade profile prior to using AI tools

However, after integrating AI tools, grade distributions shifted to some extent (see Figure 18). The study revealed that AI tools became more prominent among students, particularly after the COVID-19 pandemic, when online learning became the norm, mostly the latter part of 2023 as shared by all participants. This shift might have influenced students' familiarity with technology and online tools, which could have contributed to their

performance improvements. The percentage of A grades increased slightly to 36%, including 22 undergraduates, 5 lower high-schoolers, 6 sixth formers, and 3 master's. This increase suggests that AI tools might have contributed to improved academic performance among students, helping them achieve higher grades. The percentage of students achieving A+ grades increased to 10% (6 undergraduates, 2 master's students, 1 sixth former, and 1 lower high-schooler), up from 3% before AI integration. This was a significant increase, suggesting that the use of AI tools had enabled some students to achieve top-tier academic results more frequently. The rise in A and A+ grades suggested that AI tools could have supported these students in refining their work and improving their understanding by providing tailored feedback and more efficient learning methods. Moreover, there was an increase in A- grades to 10% (5 undergraduates, 3 master's students, 1 sixth former, and 1 lower high-schooler) indicating a slight improvement in their performance. Additionally, there was an increase in B+ grades to 26% (10 undergraduates, 2 PhD students, 4 lower high-schoolers, 10 master's students, and 2 sixth formers), suggesting that more students were now performing above average. The rise in B+ and A- grades may be due to the greater support AI provides in areas such as research, problem-solving, and revision. This suggested that AI tools might be helping students to perform above average, potentially leading to an overall shift toward higher grades. It was important to note that while more students were achieving A and B+ grades, there was still a significant portion (26%) who remained in the B and lower range (B+ category before AI integration). This indicated that while AI tools have aided the improvement of some students, not all students have experienced the same level of improvement and additional factors may still be influencing their outcomes.

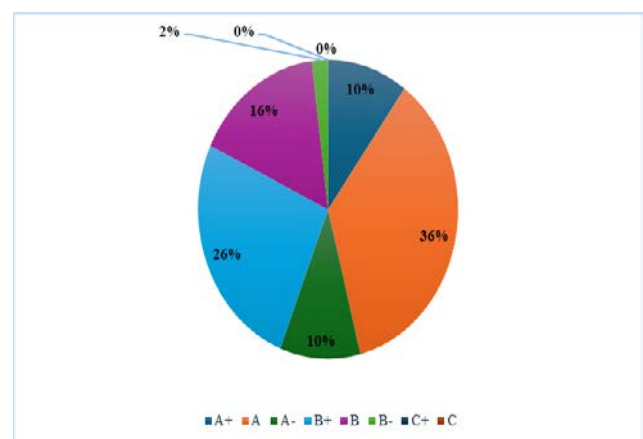


Figure 18. Students' average grade profile after using AI tools

Furthermore, students across different subject areas reported improvement in comprehending specific courses. These courses (and subjects) ranged from Mathematics, Finance, and Calculus to more essay-based courses like English and Research (as indicated by the students' qualitative responses). The impact on courses requiring problem-solving and quantitative skills, such as mathematics, was particularly noted. In addition, AI tools facilitated improvements in research-oriented courses where the organisation and cross-referencing of large

amounts of information were crucial. These findings suggest that AI tools were not just enhancing performance in one specific area but across a diverse range of subjects, benefiting both technical and non-technical courses.

An educator reported that AI's integration has led to greater student engagement and improved critical thinking skills, especially in subjects like mathematics and science in her primary school classroom. She noted that AI tools such as gamification promote critical thinking, with fast feedback loops aiding performance. However, it was noticed that AI benefited different student groups, but it required constant evaluation to ensure equity. Students who were found to be at-risk were identified very early in the academic year with the aid of DreamBox, which facilitated improvement in overall academic outcomes since early interventions were possible to help these students. On the other hand, she pointed out that over-reliance on AI usage might reduce critical thinking and problem-solving skills of students. She went further to share that for AI to be more sustainable in Jamaica, infrastructure, teacher training, and support systems must be improved.

In [Figure 19](#), 82% (55 undergraduates, 3 PhD students, 6 lower high-schoolers, 11 master's students, and 7 sixth formers) of the students noted that AI tools enhanced learning resources, allowing for easier access to information and supporting their academic success. AI's ability to provide automated grading and feedback as reported by 21% of the students (10 undergraduates, 2 PhD students, 4 lower high-schoolers, 3 master's students, and 2 sixth formers) and intelligent tutoring systems as expressed by 18% (9 undergraduates, 2 PhD students, 2 lower high-schoolers, 3 master's students, and 2 sixth formers) also contributed to students' success, indicating that AI was streamlining many administrative and instructional tasks that traditionally required more time and effort. These findings highlighted the multi-faceted role of AI in improving students' performance, from content accessibility to feedback on assignments. Two educators shared that AI has the potential to close the achievement gap by providing marginalised populations with access to top-notch learning tools, which could improve learning outcomes and by extension students' performance. One of two male educators explained that this was particularly because AI tools have been known to facilitate engagement and motivation due to its nature in providing immediate feedback through simulations and interactive games. He went on to express his concerns about unequal resource allocation in Jamaica stating that if AI tools was not distributed fairly, inequality could worsen the digital divide, especially in less affluence areas. Another educator elaborated that besides the digital divide which the school made every effort to address, AI tools have directly enhanced students' performance at her school, particularly in mathematics. She shared that the AI tools used for improved problem-solving showed improved performance in standardised tests. She stated that both high-performing and struggling students have benefited from these tools, suggesting that AI positively impacts students across different performance levels. Another educator also expressed her concern that while AI has the potential to make lessons more exciting, students

often become over-reliant on AI resulting in decreased problem-solving skills, which in turn reduced their performance. She further shared that based on her experience, high-performing students tend to rely less on AI were more willing to tackle problems independently. Moreover, she also noticed that struggling students were impacted negatively once AI tools were removed from the learning environment, heavily impacting their critical thinking skills and performance. This teacher went on to say that since the integration of AI tools in the learning environment at her school, she perceived that the students' critical thinking and independent learning skills have decreased due to their dependence on AI.

A closer examination of specific case studies, such as Grade 9 mathematics class with a sample of six (6) students, provides further insight into the impact of AI on student performance. As seen in [Figure 20](#), there were mixed results following the introduction of AI tools and Polya's problem-solving model. Before the use of AI, two students (N and Q) had average scores above 50%), while four students (L, M, O and P) performed below this threshold. After AI tools were introduced, there were both improvements and declines in performance. Students L, M, N, and O experienced decreases in their average scores, with student N showing the most significant decline, from 60% to 13%. However, students P and Q improved, with student P's average increasing by 21%, although only student Q managed to maintain an average above 50%. These results highlight the complex and varied effects of AI integration, showing that while some students benefit, others may struggle to adapt. The decreases in performance among certain students attributed to several factors, such as the students' initial familiarity with AI tools, how they were applying the AI-generated insights in practice, and students seemingly reliant on AI. Students who saw decreases may have relied too heavily on AI without fully grasping the underlying concepts, leading to poorer outcomes in exam conditions where AI was not available for direct use. This suggested that while AI can significantly aid in learning, its role must be carefully balanced with traditional teaching and learning strategies to ensure deep understanding.

The statistical analysis based on [Figure 20](#) provides further clarity. Before the strategy, the mean score was 40%, with a median also of 40%, indicating that students' performance hovered around this mid-point. The standard deviation of 16.73% revealed significant variation in scores, signalling disparities in student understanding. After AI implementation, the mean increased to 48.33%, the median rose to 45%, and the standard deviation dropped to 9.83%. This indicated that, while overall performance improved, the results became more consistent, showing less variance. The improvements observed in students P and Q demonstrate the potential of AI to support students who may have previously struggled. The increases in their scores indicated that AI tools might offer targeted assistance, whether through practice problems, intelligent tutoring, or adaptive learning pathways, that catered to individual needs. This further supported the notion that AI can personalise the learning experience, helping some students achieve better results over time.

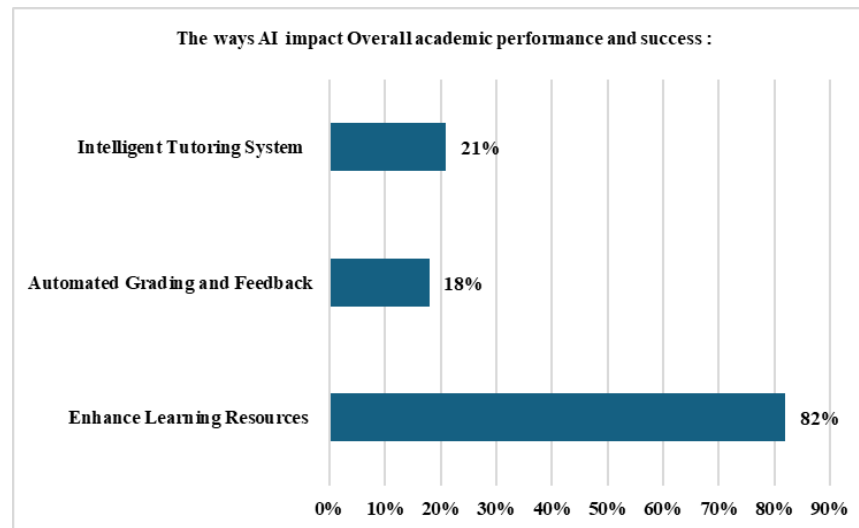


Figure 19. Perceived ways in which AI impacted students' overall academic performance and success

TEST RESULTS OF ALL SIX STUDENTS BEFORE AND AFTER THE IMPLEMENTATION OF THE STRATEGY

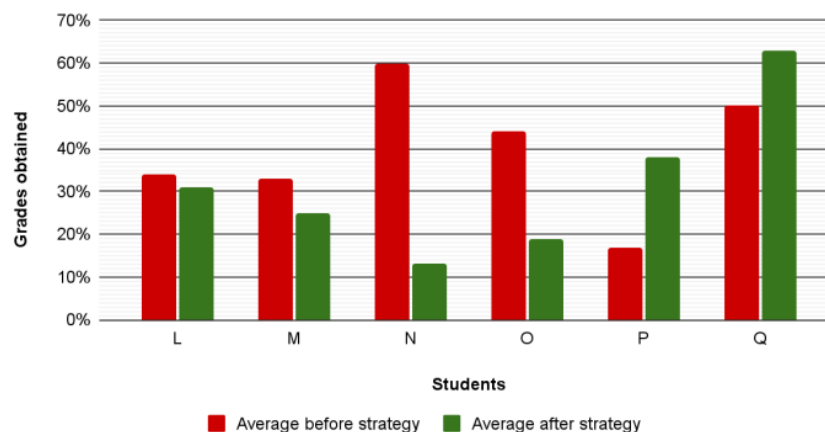


Figure 20. Sample of students' academic performance in a Grade 9 mathematics class before and after the usage of AI tools in the teaching and learning process

Moreover, the findings displayed in Figure 20 emphasised the need for educators to implement AI in a way that complements traditional teaching methods rather than replacing them entirely. While some students improved, the overall decrease in certain scores called for a more strategic approach to AI integration, ensuring that students were not overly dependent on the technology without fully engaging with the material. The balance between AI-enhanced learning and students' cognitive efforts would be key to maximising academic outcomes, ensuring that students used AI as a learning aid.

4.4. Further Discussions and Implications

The findings for research question 1 revealed diverse ways in which AI is being used by students in educational settings. As shown in Figure 9, AI tools are increasingly integrated into academic tasks, with 79% of students using AI for homework, 82% for projects, 64% for classwork, and 91% for research. These figures underscore AI's role in enhancing productivity by streamlining processes that require the gathering and organisation of large volumes of

information, particularly in research and mathematics. Research from Clarke [22] supported this trend, noting that AI provides students with quick access to resources and computational tools that would typically take much longer to manually assemble. Furthermore, Clarke [22] went on to say that the extensive use of AI for project work highlights its potential to facilitate collaborative learning, where AI assists in task allocation and management within groups. Regarding the challenges students encounter with AI tools, Figure 7 sheds light on several key issues, including inaccurate information, difficulty identifying credible sources, and concerns about plagiarism. These challenges reflect broader concerns in the education sector, as discussed by UNESCO [23], which emphasises that AI's limitations, such as inconsistencies in generating information, require students to develop critical thinking skills to evaluate AI-generated content. Additionally, it was shared in the Jamaican Observer [18] that the fear of plagiarism remains a significant issue, with some students worried that reliance on AI for content generation may inadvertently lead to academic dishonesty. Nonetheless, the user-friendly

design of some AI platforms has had positive outcomes, especially in improving students' grammar and writing tasks, reflecting the dual nature of AI's impact - both as a facilitator and a source of concern.

Research question 2, on the other hand, examined AI's influence on student performance, and revealed a nuanced picture. As depicted in Figure 17 and Figure 18, after AI implementation, the percentage of students achieving A+, A, A-, and B+ grades increased. This suggests that AI might be more effective in helping students who were previously struggling, rather than further improving the performance of high-achieving students. This finding aligns with Salido [6], who argues that AI's personalised learning features benefit students who need tailored resources, particularly in subjects requiring problem-solving and writing tasks. The fact that 82% of the students credit AI with enhancing their academic performance, especially through improved learning resources and automated feedback systems, reinforces this perspective as shared by UNESCO [7] (see Figure 19). However, it also highlights the importance of balancing AI's role as an educational tool with students' need to engage deeply with the material. Moreover, the Grade 9 mathematics class further exemplifies AI's varied impact on academic performance. As seen in Figure 20, some students experienced increases following the use of AI and Polya's problem-solving model, while others saw a decline. This disparity seemingly stemmed from the way students engage with AI tools, with some relying too heavily on AI without fully grasping the underlying concepts as mentioned by KeyMakr [17]. AI's role as a supplement to traditional learning becomes critical here, as students must actively engage in problem-solving to benefit fully from AI integration. This sentiment is echoed by Clarke [22], who argues that AI should not replace traditional learning methods but rather complement them to ensure students develop core cognitive skills.

Interestingly, the perception of course difficulty among students has remained relatively unchanged since the implementation of AI tools. As shown in Figure 21, 56% of the students (26 undergraduates, 2 PhD students, 8 lower high-schoolers, 11 master's students, and 9 sixth formers) reported that their courses were equally difficult before and after AI integration; while AI may simplify certain academic tasks, it does not necessarily make the overall learning process easier for all students. This could be linked to the continued need for critical engagement with AI-generated content, as discussed by the World Economic Forum [16], which stresses that AI is a tool for enhancing learning, not replacing critical thinking, creative problem-solving, or subject mastery, particularly in certain fields. The unchanged perception of course difficulty might suggest that AI does not fully replace the need for traditional learning methods such as studying, engaging with professors and teachers, or participating in discussions. Moreover, students might still be facing challenges in understanding complex course material or dealing with the rigours of assignments, regardless of AI's support. The fact that the majority felt no significant change in course difficulty highlights that AI is seen more as a tool to assist with the academic process rather than a solution to all educational challenges. Additionally, the

distinction between task-specific help and overall course difficulty is important. AI may help students perform individual tasks more efficiently, such as conducting research, managing time, or receiving feedback. However, these tools do not necessarily change the intrinsic challenge of mastering course content or tackling exams and assignments. For instance, while AI can provide quick answers or summaries, students still need to interpret and apply this information in the context of their broader academic work, which may still be perceived as difficult.

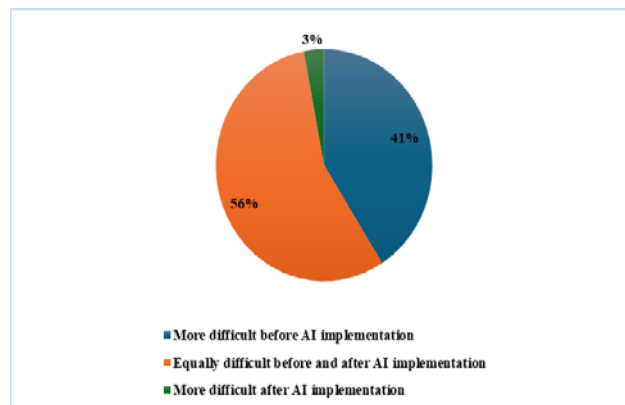


Figure 21. Perceived difficulty level of courses or subjects before AI implementation compared to after

Furthermore, Figure 22 indicates that while 52% of students (25 undergraduates, 2 PhD students, 7 lower high-schoolers, 10 master's students, and 8 sixth formers) reported changes in their study habits after AI implementation. These changes could include using AI tools to access information faster or more efficiently, as well as adopting new techniques for organizing their study materials or researching academic content. This shift could reflect an increasing reliance on AI for academic support, indicating that students see it as an integral part of their study process, potentially enhancing productivity or improving learning outcomes. On the other hand, 24% (15 undergraduates, 1 PhD student, 3 lower high-schoolers, 3 master's students, and 2 sixth formers) noticed no significant changes in their study habits. This suggests that these students may have already established effective study habits that do not require much adjustment with the introduction of AI tools, or they may have not yet fully embraced the AI tools due to a lack of familiarity, limited access, or a preference for traditional study methods. Another 24% (15 undergraduates, 2 lower high-schoolers, 5 master's students, and 2 sixth formers) were unsure. This could indicate that students are still adjusting to the presence of AI tools and may not fully recognize how AI has impacted their study routines; which may require them to reflect on how AI tools can assist in shaping their approach to studying. Furthermore, this variability suggests that AI's impact on study habits is uneven, likely benefiting students who utilise AI's adaptive learning features to tailor their study experience as shared by Salido [6]. However, the unchanged habits among some students indicate that AI has not yet transformed the learning approaches of all students. As AI evolves, its ability to offer more personalised learning experiences could grow, further influencing how students approach their studies.

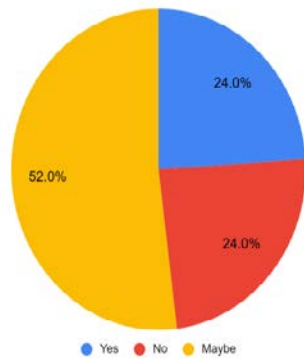


Figure 22. Students' notice of any changes in their study habits or learning approach after AI implementation

Looking forward, students are optimistic about AI's future role in education. As shown in Figure 23, a significant number (64%) of students (37 undergraduates, 2 PhD students, 7 lower high-schoolers, 10 master's students, and 8 sixth formers) expect AI to provide more personalised learning experiences. Additionally, 58% of the students (35 undergraduates, 12 master's students, 8 high schoolers, and 3 PhD students) believe that AI will improve accessibility to learning resources. Furthermore, 30% of the participants including 12 undergraduates, 2 PhD students, 4 lower high-schoolers, 10 master's students, and 2 sixth formers, see AI as a tool to enhance grading efficiency. This optimism aligns with broader educational trends noted by UNESCO [23], which emphasised that AI has the potential to transform education by making it more accessible and tailored to individual needs. However, as The Jamaica Gleaner [19] pointed out, these benefits must be balanced with a focus on maintaining academic integrity and ensuring that AI tools promote, rather than undermine, deep learning and collaboration.

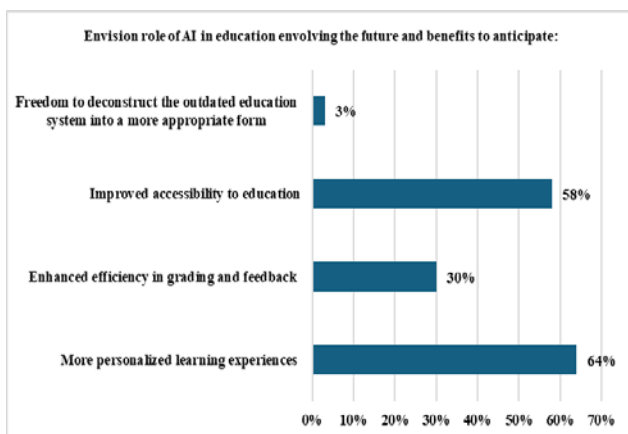


Figure 23. Students' vision of the role of AI in education evolving in the future and the benefits they anticipate

The findings of this study carry significant implications for both educators and policymakers as AI becomes more integrated into education systems. First, the widespread use of AI by students for tasks such as homework, projects, and research suggested that AI tools have the potential to reduce academic workload and enhance learning efficiency. However, as noted, AI has not fully transformed students' perceptions of course difficulty or study habits, indicating that while it aids certain aspects of

the learning process, its role in fostering deeper understanding and long-term learning skills remains limited. Educational institutions should focus on ensuring AI tools are utilised as supplements rather than replacements for critical thinking and traditional teaching methods, thereby promoting balanced learning experiences.

The mixed results concerning AI's impact on student performance also point to the need for more targeted approaches to integrating AI into classrooms. While some students saw improvements, especially in lower-performing groups, the challenges of over-reliance and difficulty with AI-generated content must be addressed. This highlights the importance of ongoing teacher involvement, ensuring students are guided in their use of AI tools to prevent superficial learning and encourage concept mastery. Furthermore, the discrepancies in how students perceive the difficulty of their coursework before and after AI implementation emphasise the need for training on how to use AI effectively for academic purposes. Educators must provide frameworks that help students critically engage with AI-generated information and develop digital literacy skills.

The future implications of AI in education also call for strategic planning. As students anticipate more personalised learning experiences and improved accessibility through AI, educational technologies must be designed to meet these expectations without compromising equity and access. Policymakers must also address the potential risks associated with AI, such as academic dishonesty and issues surrounding data privacy, ensuring a balanced integration that fosters both innovation and ethical considerations. Additionally, educators must continuously monitor how AI is affecting student collaboration, ensuring that it enhances, rather than diminishes, teamwork and communication skills.

4.5. Conclusion

The study concludes that AI has already begun to reshape the educational landscape, with students across various academic levels – including high schoolers, sixth formers, undergraduates, graduates, and PhD students – utilising AI tools for a wide range of tasks such as research, homework, and projects. Notably, 91% of students, including 46 undergraduates, 2 PhD students, 18 master's students, and 24 high schoolers, rely on AI for research purposes, highlighting its significant impact on students' ability to manage large datasets and engage in complex problem-solving. This demonstrates AI's capacity to enhance learning efficiency and support academic success, particularly in tasks that require time-consuming data analysis. Educators also agree with the vast benefits that can be derived from using AI tools across various academic levels. However, they pointed out that students' cognitive abilities affect their usage and the benefits they derive from using the tools. Teachers emphasized that while lower high-schoolers and sixth formers are still developing foundational skills in critical thinking and problem-solving, AI tools should be integrated into their learning as supplementary aids rather than primary resources. For these students, AI can provide interactive, personalized learning experiences that cater to individual needs, reinforcing basic concepts and offering

instant feedback. Also, the data clearly demonstrated that AI tool usage increase as students progress through academic careers, with PhD students exhibiting the highest usage frequencies, particularly for academic writing, research, and editing tasks. While lower high-schoolers and sixth formers primarily use AI tools for homework and supplementary learning to assist with improving study habits and complete assignments, undergraduates and master's students integrate AI tools more deeply into their research and academic development. The use of specialized tools like Moodle, Google Scholar, SPSS, and MATLAB is especially prevalent among undergraduate and postgraduate students, indicating the growing role of AI in managing and advancing academic tasks at these levels. As AI tools continue to evolve, their integration into the academic workflow of students across all levels will likely expand, leading to further enhancements in educational outcomes. However, educators stressed the importance of maintaining traditional learning methods alongside AI to ensure a balanced development of cognitive skills. In contrast, for undergraduates, graduates, and PhD candidates, AI tools can offer deeper engagement with complex concepts, particularly in areas that require advanced analytical thinking and research. At these higher levels, students are more capable of utilising AI to complement their academic skills, conducting sophisticated analysis, and refining their critical reasoning abilities. Additionally, the study also highlights several limitations, including students' challenges with AI-generated content, particularly in verifying accuracy and avoiding plagiarism. These challenges were particularly noted by 30% of students, including 3 PhD students, 20 undergraduates, and 5 lower high-schoolers who expressed concerns about the reliability of AI feedback. Educators indicated that students, while being able to complete assignments on time struggle to explain and utilize the contents thereof. Also, some students at the undergraduate level were found to be using only ChatGPT to complete research of information but have not done any cross-reference of information using credible sources. Moreover, while AI has contributed to improved performance for some students, particularly those who were previously underperforming (such as a slight increase in A grades from 31% to 36% post-AI implementation), it has not consistently led to significant improvements in the performance of high-achieving students. The grade distribution shift observed in Figure 18, with increases in A+ and A- grades, indicates that while AI may benefit students in the middle-performance range, its effects on top-tier students remain inconclusive.

The findings also suggest that AI's integration into the learning process has not drastically altered students' perceptions of course difficulty or study habits. Over half of the students (56%), including 26 undergraduates, 2 PhD students, 8 lower high-schoolers, 11 master's students, and 9 sixth formers, reported that the perceived difficulty of their courses remained unchanged after AI integration, indicating that the use of AI has not yet fully transformed how students approach learning. However, students expressed optimism about the future role of AI. A majority, including 64% of students representing students (37 undergraduates, 2 PhD students, 7 lower high-

schoolers, 10 master's students, and 8 sixth formers), believe AI will lead to more personalised learning experiences, and 58% foresee improved accessibility to resources. Additionally, 30% anticipate AI will enhance efficiency in feedback and grading, showing that students value the time-saving potential of AI in academic processes. For AI to realise its full potential in education, a balanced approach is necessary - one that emphasises both its benefits and its limitations, ensuring that AI serves as a complementary tool to traditional teaching methods rather than a substitute. In essence, it cannot replace the need for critical thinking, concept mastery, and collaboration. To ensure that AI serves as an effective educational tool, the study calls for strategic efforts from educators and policymakers. These efforts should focus on developing frameworks that help students use AI responsibly, improve digital literacy, and address concerns around academic integrity. Only through such a balanced approach can AI truly support educational outcomes and help prepare students for future challenges.

4.6. Limitations

This study revealed some limitations such as the sample size and the scope of the study. For instance, the sample size was relatively small compared to the larger population of Jamaican students. For example, while the study included 100 students from a variety of academic levels - including high-schoolers, undergraduates, master's students, and PhD students - this representation still does not fully capture the diversity of students across Jamaica. While the findings were found to provide valuable insights, a broader sample size might have allowed for greater generalisations and facilitated a more comprehensive understanding of AI's impact across diverse socio-economic and educational contexts in Jamaica. Additionally, the limited student participation did not allow the study to capture a much wider array of experiences, learning environments, and performance metrics.

Moreover, the scope of the study primarily focused on schools and students with access to infrastructure such as the Internet and AI tools. As such some schools particularly in rural or underserved areas where AI integration faces significant barriers such as limited technological resources and training for educators were excluded. Addressing these challenges in future research would help provide a more balanced view of the disparities in AI adoption as well as its potential benefits or drawbacks for all Jamaican students. Consequently, the study can be expanded to include more participants and a broader range of schools that would better enable a deeper understanding of the systemic factors influencing AI's impact on student performance.

4.7. Recommendations

Based on the findings of this study, the following recommendations are made to optimise the integration of AI in education and address the associated challenges:

- **Enhanced AI Literacy and Training for Students and Teachers:** Educational institutions should provide training for both students and teachers on how to use AI tools effectively in learning and

teaching processes. High schoolers, undergraduates, master's, and PhD students each interact with AI differently, and tailored instruction would help mitigate challenges like misinformation, plagiarism, and over-reliance on AI. By equipping all students regardless of their academic level, with a deeper understanding of both the advantages and limitations of AI, educators can foster more responsible and informed use of AI technology.

- **AI as a Supplement, Not a Substitute:** AI should be integrated as a complement to traditional teaching methods rather than a replacement. While undergraduates and graduates may benefit from AI tools that support advanced research and project work, high schoolers and sixth formers require a balance between AI-driven personalised learning experiences and face-to-face teaching that focuses on conceptual understanding and critical thinking. Educators must ensure that AI enhances, rather than replaces human engagement and the development of essential academic skills.
- **Development of AI-Enhanced Collaborative Tools:** AI's role in promoting teamwork remains under-utilised. Developers should focus on creating AI tools that foster genuine collaboration among students across different levels of study. For example, PhD students and graduates could benefit from AI-enhanced collaborative platforms for research, while high schoolers and sixth formers may require more intuitive tools that promote peer learning and group projects. These tools should blend AI's organisational strengths with the interpersonal skills necessary for successful collaboration.
- **Addressing Accuracy and Ethical Concerns in AI Usage:** Given concerns about the credibility of AI-generated content and academic misconduct, institutions should implement guidelines and frameworks that ensure ethical AI usage. Lower high-schoolers and sixth formers, who are in the early stages of their academic careers, need to develop strong critical thinking and evaluation skills to assess AI-sourced information. Similarly, graduates and PhD students should be trained in the ethical use of AI, particularly in academic research, to uphold integrity and avoid unintended bias in AI-generated outputs.
- **Continuous Assessment of AI's Impact on Learning:** Educational policymakers should regularly assess AI's effects on student performance across different learning environments. This ongoing evaluation with help, identify patterns of success and areas for improvement, ensuring that AI implementation strategies meet the diverse needs of all students, from high schoolers to PhD candidates. Insights gained from this data will allow for more targeted interventions and adjustments to AI usage, enhancing the overall effectiveness of AI tools in education.
- **Encouraging Adaptive AI Technologies:** Further development and use of AI systems that adapt to individual learning styles and paces should be encouraged. Underperforming students, especially at the high school and sixth form levels, could

greatly benefit from more targeted support through adaptive AI tools. Similarly, graduate and PhD students, who often face unique research challenges, could use AI to personalize their academic journey. Encouraging the widespread use of such technologies would improve overall academic outcomes and support students with diverse learning needs.

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