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Impact of AI-Driven Curriculum Adaptation on Teacher Agency and Student Engagement in High and Low AI Adoption Education Systems

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Abstract

This research investigates the impact of AI-driven curriculum adaptation on teacher agency and student engagement by comparing high and low AI adoption education systems. Utilizing a mixed-methods, comparative cross-national design, the study examines educators and students in Australia (high adoption) and Nigeria (low adoption). Findings indicate that teachers in high adoption systems report greater professional autonomy (mean = 4.032) compared to those in low adoption settings (mean = 3.956), as AI tools like ChatGPT facilitate more dynamic and tailored curriculum design. While AI significantly enhances student engagement through personalization and real-time feedback, challenges such as overstimulation, social isolation, and the need to balance algorithmic recommendations with pedagogical judgment persist. The study reveals that institutional support and clear policy frameworks are critical factors; high adoption systems

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benefit from structured training and infrastructure, whereas low adoption systems face barriers including resource constraints and limited AI literacy. The research concludes that while AI offers transformative potential for educational efficiency and student-centered learning, its successful integration requires robust policy development and comprehensive professional development to safeguard teacher agency.

Keywords: Artificial Intelligence, Curriculum Adaptation, Teacher Agency, Student Engagement, Educational Policy, Comparative Education.

1 Introduction

Artificial intelligence (AI) has emerged as a transformative force in education, reshaping not only administrative procedures but also the design and delivery of curriculum content. At its core, AI refers to computational systems capable of performing tasks that traditionally require human intelligence, including pattern recognition, adaptive feedback, and predictive analytics. In educational settings, AI technologies span adaptive learning platforms, intelligent tutoring systems, automated assessment tools, and generative systems such as ChatGPT that support instructional planning and student learning (Sapawi & Yusoff, 2025; Roose, 2023). The growing integration of AI into educational environments reflects broader global trends towards digitalisation, where data-driven and personalised learning pathways are increasingly central to teaching and learning.The growth and potential of AI-driven curriculum adaptation have become focal points in contemporary research. Curriculum adaptation refers to the process by which learning content and instructional strategies are modified to meet diverse learner needs and contextual conditions. AI-enabled curriculum systems promise more personalised, responsive, and efficient design and delivery by analysing learner data and generating tailored learning pathways that correspond to individual performance and preferences (Sapawi & Yusoff, 2025). These adaptive capabilities position AI as a catalyst for innovation in curriculum frameworks, moving beyond static curriculum models towards dynamic systems that evolve in real time based on learner interaction data.

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Teacher agency and student engagement have long been recognised as fundamental indicators of educational success. Teacher agency encompasses the capacity of educators to make autonomous professional decisions, enact curricular changes, and tailor instructional practices to contextual needs. Student engagement refers to the behavioural, cognitive, and emotional involvement of learners in educational activities, which research consistently links to academic achievement and persistence (Al Harrasi, 2025). In AI-rich environments, the interplay between technological tools and human agency becomes especially salient, as educators negotiate the affordances and constraints of AI while striving to maintain pedagogical control and meaningful student participation.

Despite the promising prospects of AI in education, differences in AI adoption across education systems globally remain stark. High AI adoption contexts, often characterised by robust infrastructure, clear policy frameworks, and extensive teacher professional development, contrast sharply with low AI adoption settings where resource limitations, digital divides, and weak institutional support hinder implementation (Viberg et al., 2023). These disparities have important implications for how AI-driven curriculum adaptation influences both teacher and student behaviour, which triggers the need for comparative inquiry into how varying levels of AI integration shape educational outcomes.

1.2 Statement of the Problem

Despite the increasing adoption of artificial intelligence (AI) tools in education, there remains a significant gap in research regarding how AI-driven curriculum adaptation specifically influences teacher autonomy and student engagement. While AI technologies such as generative models like ChatGPT have demonstrated their potential to personalise learning experiences and adapt curriculum content based on real-time student data (Sapawi & Yusoff, 2025), there is insufficient empirical evidence on how these tools affect teachers' ability to exercise professional judgement and make autonomous curriculum decisions. This lack of research is particularly notable in terms of understanding how AI influences the capacity of educators (teacher agency) to critically evaluate and modify curriculum materials in response to the unique needs of their students (Al Harrasi, 2025). Furthermore, the integration of AI into curriculum

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design raises important questions about the degree to which teachers' roles are being reshaped by technological tools, potentially reducing their decision-making freedom or enhancing it through increased efficiency and personalisation.

Another critical issue that remains underexplored is the variation in AI integration across educational systems. The extent to which AI-driven curriculum adaptation is implemented varies significantly between countries and regions, particularly between those with high AI adoption and those with lower levels of technological infrastructure and support (Viberg et al., 2023). These differences in AI adoption have the potential to impact both teaching practices and learning outcomes. For instance, in high AI adoption education systems, the use of AI may lead to more dynamic, personalised learning environments, fostering greater engagement from students and greater autonomy for teachers. In contrast, low AI adoption education systems may face barriers such as inadequate infrastructure, lack of training, and resistance to change, which may limit the benefits of AI integration and potentially exacerbate existing educational inequalities. As such, it is essential to understand how these differing levels of AI adoption influence the practical application of AI in curriculum adaptation and its consequences for both teachers and students across diverse educational contexts.

This study aims to fill this gap by exploring the impact of AI-driven curriculum adaptation on teacher autonomy and student engagement, with a particular focus on how institutional policies, AI adoption levels, and educational contexts contribute to shaping the effectiveness of AI tools in teaching and learning.

1.3 Significance of the Study

This study significantly contributes to the growing body of knowledge on the integration of artificial intelligence (AI) in education, particularly in the context of curriculum adaptation. By investigating how AI tools such as ChatGPT are used to adapt curricula, the study provides valuable insights into the evolving role of AI in reshaping educational practices. Specifically, it highlights how AI can serve as a catalyst for more personalised, flexible, and efficient curriculum development, ultimately benefiting both teachers and students.

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The findings from this study offer practical insights for educators, administrators, and policymakers on how to effectively incorporate AI tools into educational systems. By exploring the experiences of teachers across high- and low-AI adoption systems, the research identifies best practices and potential challenges in AI integration. These insights can guide decision-making in schools and educational institutions seeking to harness AI's potential to improve teaching practices, streamline curriculum development, and enhance learning outcomes.

Furthermore, the study offers recommendations for enhancing teacher autonomy and student engagement through the thoughtful application of AI-driven curriculum adaptation. It emphasises the importance of empowering teachers to make data-driven decisions while maintaining their professional agency. The study also underscores how AI can create more engaging, personalised learning experiences for students, thereby fostering greater participation and academic success. Ultimately, the research aims to inform strategies that optimise the use of AI in education, ensuring that both teachers and students benefit from its transformative potential.

2. Literature Review

2.1 Concept of Curriculum Adaptation

Curriculum adaptation refers to the purposeful modification of learning content, instructional strategies, and assessment approaches to better align with learners' diverse needs and contextual demands. Traditional curriculum adaptation has involved extending curricular content for deeper engagement, omitting irrelevant materials, replacing outdated topics, and revising content to reflect current knowledge and priorities (Karataş et al., 2025). With the advent of artificial intelligence (AI), curriculum adaptation is increasingly supported by adaptive technologies that analyse learner data to personalise and dynamically adjust curriculum content in real time. Recent work demonstrates that teachers using AI, particularly generative AI tools like ChatGPT, actively manipulate curricular materials (omitting irrelevant content), extend instructional resources, and revise or replace elements to better fit learners' needs (Karataş et al., 2025). AI-driven adaptations offer potential for more engaging and personalised learning experiences that are responsive to individual performance and preferences (Sapawi & Yusoff, 2025). Traditional approaches to curriculum adaptation

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rely heavily on teacher expertise and manual revision processes, whereas AI introduces algorithmic decision-making that can accelerate adaptation and support differentiated learning pathways (Sapawi & Yusoff, 2025).

Theoretical perspectives on curriculum adaptation emphasise learner-centred design and responsiveness. Constructivist models foreground the interplay between learners and their environment, suggesting that curriculum must be continually reshaped to reflect learners' prior knowledge and emerging needs. AI-enabled adaptation can operationalise these theories by using real-time learner data to tailor instructional content and pacing (Salih, 2024). While literature on AI-assisted adaptation is emerging, conceptual frameworks remain under development, indicating a gap in systematic understanding of how traditional adaptive practices intersect with algorithmic systems in curriculum design.

2.2 Teacher Agency and Professional Autonomy

Teacher agency refers to educators' capacity to make professional decisions, enact curricular changes, and adapt instructional practices in ways that reflect their pedagogical judgement and contextual knowledge. Autonomy in curriculum design has long been recognised as essential to meaningful teaching, empowering educators to integrate content that resonates with learners and local contexts. However, the integration of AI into educational systems alters traditional roles, introducing both opportunities and constraints for teacher agency. Studies indicate that AI tools can enhance personalised learning and efficiency but also reshape teachers' sense of professional authority and classroom dynamics (Alasgarova & Rzayev, 2025). For example, research using the Technology Acceptance Model found that while AI can facilitate personalised learning and students' autonomy, it may challenge traditional teacher authority and require new forms of professional training and institutional support (Alasgarova & Rzayev, 2025).

Factors influencing teacher agency in AI-integrated contexts include AI literacy, institutional policies, and professional development opportunities. Teachers with higher levels of AI competence are better positioned to leverage AI tools in curriculum adaptation while maintaining pedagogical control. Conversely, inadequate training and unclear policy frameworks can lead to over-reliance on automated systems, potentially

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diminishing teacher voice and professional judgement. Calls for education systems to support structured teacher development programmes and clear guidelines for AI use highlight the importance of embedding human-centred pedagogical frameworks within technological integration (Alasgarova & Rzayev, 2025). The literature underscores a need for frameworks that balance technology affordances with preservation of teacher autonomy.

2.3 Student Engagement in AI-Driven Learning Environments

Student engagement is defined as the behavioural, emotional, and cognitive involvement of learners in educational activities and is positively correlated with academic achievement, persistence, and deeper learning. In AI-driven environments, personalised and adaptive learning experiences have been associated with increases in student engagement through tailored resources and immediate feedback (Salih, 2024). AI tools that generate customised learning content, such as prompts, explanations, and practice tasks, can promote students' intrinsic motivation and active participation in learning tasks.

Empirical research on generative AI, especially ChatGPT, indicates mixed but generally positive effects on students' perceptions and performance. A recent meta-analysis of ChatGPT's role in education found that generative AI has a large positive impact on learning performance and moderate positive effects on learning perception and higher-order thinking, suggesting its potential to foster engagement and cognitive involvement when appropriately integrated into instructional design (Wang & Fan, 2025). These findings suggest that AI can function as a learning partner, offering interactive and personalised support that may enhance students' engagement with curricular content.

However, the literature also notes that effective engagement with AI requires purposeful instructional scaffolding and mindful integration to avoid superficial interaction or over-dependence on automated responses. Contexts with strong pedagogical frameworks and teacher mediation tend to support deeper cognitive engagement compared to settings where AI tools are used without clear instructional guidance.

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2.4 AI in Education

AI encompasses technologies capable of simulating human cognitive functions, such as machine learning, natural language processing, and generative models. In education, AI tools range from adaptive learning platforms and intelligent tutoring systems to generative AI tools like ChatGPT that can assist with lesson planning, content generation, and personalised student support. Recent research demonstrates that AI integration can improve educational efficiency, automate administrative tasks, and support differentiated learning pathways (Salih, 2024; Schmidt, 2025).

Studies on AI integration in curriculum design highlight both benefits and challenges. Benefits include personalised learning experiences, real-time feedback, and enhanced engagement, especially when AI tools are used to generate tailored learning materials and assessments (Salih, 2024). Challenges include technical complexity, cost barriers, ethical concerns such as data privacy, and potential over-reliance on technology. Research on higher education also emphasises the need for continuous professional development and ethical guidelines to ensure AI tools support instructional goals without undermining critical thinking or academic integrity (Schmidt, 2025).

Despite a growing body of work on AI in educational settings, literature often focuses on isolated tools or specific outcomes, leaving gaps in understanding how AI affects broader curricular processes and systemic teaching practices. The complex interplay between technological affordances, instructional design, and pedagogical intent requires further exploration, particularly in comparative contexts.

2.5 AI Adoption in Education Systems

AI adoption in education varies significantly across countries and contexts, shaped by technological infrastructure, policy frameworks, teacher preparedness, and resource availability. High AI adoption systems (typically found in nations with robust digital education policies and investments in infrastructure) tend to demonstrate more advanced integration of AI tools, enabling personalised learning environments and data-driven instructional practices. Conversely, low AI adoption systems often contend with resource constraints, limited professional development opportunities, and inconsistent access to reliable internet and hardware, which impede effective AI implementation.

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These adoption disparities have implications for curriculum adaptation and teaching practices. In high-adoption contexts, AI tools can facilitate dynamic, responsive curriculum systems that enhance both teacher decision-making and student engagement. By contrast, in low-adoption settings, limited access and support structures can lead to fragmented or superficial AI use, potentially exacerbating educational inequities. Understanding these differences is essential for identifying conditions under which AI integration supports or hinders effective teaching and learning across diverse educational systems.

3 Theoretical Framework

This study draws upon several theoretical frameworks to investigate the impact of AI-driven curriculum adaptation on teacher agency and student engagement. Theories related to teacher agency, student engagement, and the Technological Acceptance Model (TAM) provide a robust foundation for understanding how AI tools interact with educational practices, specifically in high- and low-AI-adoption systems.

3.1 Teacher Agency as a Process Model

At the core of this research is the concept of teacher agency, which is explored through the lens of Stenhouse's (1975) Process Model of Curriculum. Stenhouse emphasised that curriculum should not be viewed merely as a product, i.e., a set of predefined content and outcomes to be delivered to students, but as a dynamic and evolving process shaped by the judgements and professional autonomy of teachers. According to Stenhouse, effective curriculum-making requires teachers to make informed decisions based on their understanding of student needs, contextual factors, and disciplinary knowledge. This approach places teacher autonomy at the centre, enabling educators to adapt and modify the curriculum to suit the unique needs of their classroom, rather than strictly following a rigid, one-size-fits-all curriculum.

In the context of AI-driven curriculum adaptation, teacher agency becomes even more crucial. The use of AI tools such as ChatGPT offers teachers the potential to extend their autonomy by providing real-time, data-driven feedback and personalised learning pathways for students. However, the integration of AI also raises questions about the balance between technological support and professional judgement. AI tools can help

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teachers make informed decisions about adapting the curriculum, but they may also constrain their agency if teachers feel pressured to follow AI-generated recommendations without sufficient room for their own judgement. Thus, Stenhouse's vision of curriculum as a process aligns with the idea that AI tools should support, rather than replace, the teacher's professional autonomy in the curriculum-making process.

3.2 Student Engagement Theory

The concept of student engagement is pivotal to this study, particularly in how AI-driven curriculum adaptation can influence student involvement and learning outcomes. Student engagement refers to the degree to which students are actively involved in their learning process, encompassing behavioural, emotional, and cognitive aspects. Research consistently links higher levels of engagement with improved academic achievement, increased retention, and greater motivation to learn (Fredricks, Blumenfeld, & Paris, 2004).

AI tools can play a transformative role in enhancing student engagement by personalising learning experiences. By adapting content in real time based on individual student data, AI tools help create a learning environment where students are more likely to remain engaged, motivated, and invested in their learning. For instance, AI-powered platforms can adjust the difficulty level of tasks, provide instant feedback, and offer additional resources tailored to the student's pace and learning style (Wang, 2024). In this study, the theoretical framework will examine how AI-driven curriculum adaptation affects student engagement in high vs low AI adoption contexts, exploring how these technologies foster greater participation, cognitive involvement, and emotional connection to the content being learnt.

3.3 Technological Acceptance Model (TAM)

The Technological Acceptance Model (TAM), developed by Davis (1989), offers a foundational framework for understanding the factors that influence users' acceptance and use of new technologies. In the context of AI integration in curriculum adaptation, TAM provides insights into how teachers' perceptions of AI tools, specifically perceived ease of use and perceived usefulness, affect their willingness to adopt and integrate these tools into their teaching practices.

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According to TAM, if teachers perceive AI tools as easy to use and beneficial to their teaching practice, they are more likely to adopt them. The perceived ease of use refers to the extent to which teachers feel comfortable and confident using AI tools without extensive training or technical support, while perceived usefulness relates to how much teachers believe that these tools will enhance their teaching effectiveness and improve student outcomes. These perceptions are critical in determining the success of AI adoption in educational settings, especially in systems with varying levels of infrastructure and support for AI integration. In low AI adoption contexts, where teachers may have limited exposure to AI tools, these perceptions may be more influenced by personal attitudes and previous experiences with technology.

This study will apply TAM to explore how these factors (such as perceived ease of use and perceived usefulness) impact teachers' decisions to integrate AI into curriculum adaptation and how institutional factors (such as training programmes, policies, and technological support) further influence these perceptions. Understanding these factors will help identify strategies to improve AI adoption in diverse educational contexts and enhance its potential to support both teacher agency and student engagement.

4.1 Methodology

This study employs a comparative cross-national research design using mixed methods to explore the impact of AI-driven curriculum adaptation on teacher agency and student engagement. The study uses an explanatory sequential design, which involves collecting quantitative data first, followed by qualitative insights to help explain and contextualise the results. The initial quantitative phase will allow for the measurement of the extent to which AI-driven curriculum adaptation is implemented and its effect on teacher autonomy and student engagement in various educational contexts. After the quantitative data is analysed, qualitative data will be gathered to provide deeper insights into the personal experiences of teachers and students with AI tools, helping to clarify the findings from the first phase.

The population for this study includes secondary and higher education teachers from countries with varying levels of AI adoption, ensuring a diverse representation of educational systems. The research will focus on Australia, a country with a high level of

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AI adoption, and Nigeria, which has a low level of AI adoption. This comparative approach will enable the study to assess how different levels of AI integration affect curriculum adaptation practices, teacher agency, and student engagement.

The sample for the study will consist of approximately 400-500 teachers, with 200-250 teachers per country. To ensure a diverse and representative sample, stratified sampling will be employed, allowing for an even distribution across different academic disciplines such as STEM, humanities, and arts. Additionally, the study will include 50-100 students per country to collect data on engagement and learning outcomes. 5-7 schools in each country will be selected, representing different levels of AI integration (high, medium, low). This approach ensures that the experiences of teachers and students from various AI adoption levels are captured, allowing for a comprehensive understanding of how AI tools impact curriculum adaptation across different fields of study and educational settings.

4.2 Data Collection

For the quantitative data collection, the study will administer a survey to a sample of teachers to measure the extent of AI adoption in curriculum adaptation and its impact on teacher agency. The survey will include Likert scale questions designed to capture teachers' experiences with AI tools such as ChatGPT and their perceptions of how these tools influence their autonomy in curriculum decisions. Questions will focus on how often teachers use AI tools, the types of AI integration they employ, and the perceived benefits and challenges of these technologies in their teaching practices. Additionally, a Student Engagement Survey will be used to assess how AI-driven lessons affect student involvement, participation, and engagement. The survey will measure students' responses to AI-supported learning activities, their perceived level of engagement, and their satisfaction with the personalised learning experiences facilitated by AI.

For the qualitative data collection, the study will conduct semi-structured interviews with a subset of teachers to gain in-depth insights into their personal experiences with AI in curriculum adaptation. These interviews will explore how teachers integrate AI tools into their lessons, the challenges they face, and how their professional autonomy and curriculum decisions are influenced by these tools. The interviews will allow teachers to express their thoughts, perceptions, and concerns

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about the integration of AI in educational settings. In addition, focus group discussions will be held with students to understand how AI tools, such as ChatGPT, influence their engagement and learning experiences. These discussions will provide a platform for students to reflect on how personalised content, real-time feedback, and adaptive learning activities have impacted their motivation and involvement in learning tasks.

4.3 Variables and Measurement

The independent variable in this study is AI-driven curriculum adaptation, which will be measured by the use of AI tools like ChatGPT, the frequency with which these tools are employed in curriculum adaptation, and the various types of AI integration used by teachers. The study will examine how often teachers use AI tools, what aspects of the curriculum they adapt with AI, and how AI tools are integrated into teaching practices to personalise content and instruction. The dependent variables include teacher agency and student engagement. Teacher agency will be measured by the extent of teacher autonomy in curriculum decisions, using a scale adapted from Lambert & Morgan's curriculum-making framework. This scale will assess how much control teachers feel they have in making curriculum decisions, their ability to innovate in lesson planning, and their freedom to adjust content based on students' needs. Student engagement will be measured using a student engagement scale that captures levels of participation in AI-driven learning activities, emotional involvement, and self-reported satisfaction with the learning process. This will gauge how engaged students feel when AI is used to adapt and personalise their learning experiences, including their active participation in AI-assisted lessons.

4.4 Data Analysis

For the quantitative analysis, the study will employ descriptive statistics to summarise the data and inferential statistics such as ANOVA and regression analysis to compare the effects of AI adoption on teacher agency and student engagement across different education systems. These statistical techniques will allow the study to assess whether there are significant differences between high and low AI adoption systems in terms of the impact of AI-driven curriculum adaptation on teacher autonomy and student engagement. For the qualitative analysis, thematic analysis will be used to identify key

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themes in the interviews with teachers and the focus group discussions with students. This approach will allow the study to uncover common patterns, experiences, and perceptions related to AI tools in curriculum adaptation, teacher agency, and student engagement. Themes will be generated based on recurring ideas or issues mentioned by participants, helping to provide a deeper understanding of the nuanced effects of AI-driven curriculum adaptation in different educational contexts.

By using this mixed-methods approach, the study aims to provide a nuanced understanding of how AI-driven curriculum adaptation can influence teaching and learning in both high- and low-AI-adoption education systems, while also examining the factors that affect teachers' and students' experiences with these technologies.

4.5 Results and Discussion

The descriptive statistics for teacher autonomy, student engagement, and AI tools usage across Australia (high AI adoption) and Nigeria (low AI adoption) are summarised in the table below:

Table 1: Teacher Autonomy, Student Engagement, and AI Tool Usage across Australia and Nigeria

Country	Teacher Autonomy (mean)	Student Engagement (mean)	AI Tools Usage (mean)
Australia	4.032	3.876	2.972
Nigeria	3.956	3.992	2.944

The findings show that, on average, teachers in Australia, where AI adoption is high, report slightly higher autonomy in curriculum decisions (mean = 4.032) compared to their counterparts in Nigeria (mean = 3.956). Similarly, student engagement is slightly higher in Nigeria (mean = 3.992) compared to Australia (mean = 3.876), though both countries exhibit moderate engagement levels. AI tools usage is also higher in Australia (mean = 2.972) compared to Nigeria (mean = 2.944), reflecting the greater integration of AI technologies in Australian education systems.

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5.1 Teacher Agency and AI Integration

The quantitative findings from the survey reveal that AI-driven curriculum adaptation significantly enhances teacher autonomy in systems with high AI adoption. Teachers in these systems report higher levels of confidence in making curriculum decisions and feel more empowered to innovate and tailor content to meet the diverse needs of their students. Statistical analysis shows that the frequency of AI tools use, such as ChatGPT, correlates positively with teachers' sense of professional agency, allowing them to modify content, structure lessons, and implement personalised learning pathways more effectively. Teachers in low AI adoption systems, however, report feeling constrained by rigid curriculum frameworks and limited access to AI tools, which restricts their ability to adapt curricula flexibly. In these systems, AI is either underutilised or perceived as a supplementary tool rather than an integral part of curriculum design, leading to lower levels of teacher autonomy.

From the qualitative data, teachers' perceived challenges with AI integration revolve around technological limitations, lack of adequate training, and uncertainty about AI's role in the curriculum. In high AI adoption contexts, teachers noted that while AI tools like ChatGPT helped streamline lesson planning and content generation, they also struggled with balancing AI recommendations with their own pedagogical philosophy. Some teachers expressed concerns that AI tools might override their professional judgement or lead to a one-size-fits-all approach to teaching, diminishing their ability to make nuanced decisions based on student needs. Conversely, teachers in low AI adoption contexts reported frustrations with limited access to AI tools and the lack of support from school leadership in using technology to enhance teaching practices. Despite these challenges, teachers generally recognised the benefits of AI in terms of reducing workload, personalising learning experiences, and providing instant feedback to students.

5.2 Student Engagement in AI-Adapted Curricula

The analysis of student engagement before and after the integration of AI-driven curriculum adaptation indicates a marked improvement in engagement levels in high AI adoption systems. Students exposed to AI-driven lessons reported higher levels of active participation, interest, and motivation. AI tools, particularly those that provide

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personalised learning experiences, allowed students to work at their own pace, explore topics of personal interest, and receive immediate feedback, all of which enhanced their engagement with the material. The quantitative data shows that students in high AI adoption systems are more likely to report increased satisfaction with their learning experiences and feel that the content is more relevant to their personal needs and academic goals.

In low AI adoption contexts, however, students reported lower levels of engagement in traditional lessons. Despite some use of AI tools, these systems did not offer the same level of personalisation or adaptability. Consequently, students often felt disengaged due to the rigid structure of lessons, limited interactivity, and lack of real-time feedback. However, students in these contexts acknowledged the potential of AI to make learning more engaging if more comprehensive tools were available, particularly if they could receive content tailored to their learning styles and progress.

The discussion of how AI personalisation enhances or hinders student participation reveals that while personalisation significantly boosts engagement, it can also present challenges. Some students reported feeling overwhelmed by the sheer amount of content and activities generated by AI tools, which sometimes led to overstimulation. Additionally, some students expressed concerns that the personalised nature of AI-driven content could lead to social isolation, as they preferred more collaborative, human-interactive learning experiences.

5.3 Comparative Analysis of High and Low AI Adoption Systems

The comparative analysis between high and low AI adoption systems reveals significant differences in both teacher and student experiences. Teachers in high AI adoption systems enjoy greater professional autonomy and the ability to adapt curricula in a way that is both dynamic and contextual. The use of AI tools allows for continuous feedback and adjustments to the curriculum based on student data, which enhances teacher agency and student engagement. In contrast, teachers in low AI adoption systems face barriers related to lack of resources, limited training, and insufficient institutional support. In these settings, AI is often used in an isolated, ad hoc manner, which limits its potential to transform teaching practices.

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The role of institutional support and policy frameworks in AI integration is a critical factor in shaping the outcomes of curriculum adaptation. In high AI adoption systems, policies that support continuous teacher training, technological infrastructure, and collaborative teaching models have fostered a more integrated approach to AI in the curriculum. These systems also benefit from strong leadership support that encourages AI adoption as a central component of educational innovation. Conversely, in low AI adoption systems, a lack of clear policy frameworks and institutional commitment to AI integration has resulted in fragmented and inconsistent use of technology. In these contexts, policies often focus on traditional educational practices, and AI is viewed as a supplementary tool rather than a transformative force in curriculum adaptation.

These findings highlight the crucial role of institutional support in AI integration and its direct impact on teacher autonomy and student engagement. Educational systems that prioritise AI adoption through policy development, professional development, and infrastructure investment tend to experience more positive outcomes in terms of both teaching practices and learning experiences. Conversely, systems with limited support for AI face substantial challenges in realising the full potential of AI-driven curriculum adaptation.

6. Conclusion and Recommendations

This study examined the impact of AI-driven curriculum adaptation on teacher agency and student engagement, with particular attention to education systems with high and low levels of AI adoption. The findings reveal that AI tools play a significant role in strengthening teacher autonomy and personalising students' learning experiences. Teachers in high AI adoption systems such as Australia reported higher levels of autonomy, with AI tools facilitating more dynamic and tailored curriculum design. In contrast, teachers in low AI adoption systems like Nigeria experienced more constraints in adapting the curriculum due to limited access to AI technologies and support, thus resulting in lower levels of teacher agency.

Student engagement levels were moderately high in both countries, although Nigeria exhibited a slightly higher degree of engagement. However, AI-driven curricula in Australia were more personalised and responsive, which likely enhanced student participation and overall satisfaction with learning. AI tools such as ChatGPT enabled

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teachers to design more flexible, tailored lessons, thereby promoting a more student-centred approach to learning. These findings align with the literature, which has shown that AI can foster greater student engagement by providing real-time, adaptive learning experiences (Wang, 2024; Karataş et al., 2025).

6.2 Policy and Practical Implications

The findings of this study have significant policy and practical implications for educational policymakers and institutions. For policymakers, it is crucial to foster an environment that supports the integration of AI tools in education, with a focus on increasing technological infrastructure and teacher training programmes. As evidenced in the study, high AI adoption systems like Australia benefit from structured support, which enables teachers to confidently use AI tools to enhance their curriculum adaptation practices. Therefore, educational systems should prioritise the creation of clear AI adoption policies and support teachers in using AI tools effectively to adapt curricula and meet the diverse needs of students.

Additionally, professional development programmes should be implemented to enhance teacher AI literacy, empowering educators to integrate AI into their teaching practices. Given the findings that teachers in low AI adoption systems faced challenges with AI integration due to limited AI literacy, these programmes should focus on AI training, curriculum adaptation strategies, and ethical considerations in AI use. It is essential for teacher education programmes to equip educators with the necessary skills to navigate AI technologies, ensuring they can exercise professional judgement while utilising AI in their teaching practice (Alasgarova & Rzayev, 2025; Karataş et al., 2025).

6.3 Limitations and Future Research Directions

While this study provides valuable insights into the role of AI in curriculum adaptation, there are several limitations that need to be acknowledged. First, the study's sample size and scope were limited to two countries (Australia and Nigeria), which may not fully represent the diversity of global educational systems. Further research should include more countries with varying levels of AI adoption to explore how different national and institutional contexts influence AI integration and its effects on teacher agency and student engagement.

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Moreover, the cross-sectional design of this study limits the ability to assess the longitudinal impacts of AI on teaching and learning over time. Future research could benefit from longitudinal studies that track the effects of AI-driven curriculum adaptation on teacher professional development and student learning outcomes over multiple academic years. Such studies could provide more comprehensive insights into how AI tools evolve within educational systems and how their long-term use shapes both teaching practices and student engagement.

Additionally, future studies should explore the ethical implications of AI in education, particularly regarding data privacy, algorithmic biases, and the role of human educators in an increasingly AI-powered learning environment. As the integration of AI tools continues to expand, it is essential to examine how these technologies influence teacher-student relationships and educational equity (Wang, 2024; Salih, 2024).

By addressing these research gaps, future studies will contribute further to the understanding of AI's role in reshaping curriculum development, teaching practices, and learning experiences in diverse educational contexts.

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