



Developing an Artificial Intelligence Governance and Implementation Framework for the Caribbean Examinations Council (CXC) and Secondary Schools in Jamaica

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Abstract

Artificial intelligence (AI) is transforming education by reshaping teaching, learning, assessment, educational administration, and institutional decision-making. Although AI offers significant opportunities to enhance educational quality and efficiency, it also presents challenges related to governance, ethics, academic integrity, data privacy, cybersecurity, equity, and teacher preparedness. Despite increasing AI adoption within Caribbean education, there is no comprehensive governance framework specifically designed to guide its responsible implementation within secondary schools or the Caribbean Examinations Council (CXC). This study sought to develop an Artificial Intelligence Governance and Implementation Framework for CXC and secondary schools in Jamaica. Guided by a pragmatic research paradigm, the study employed a Design Science Research methodology supported by a systematic literature review of empirical studies on AI in education, governance, ethics, curriculum, assessment, leadership, and digital transformation. The framework was informed by the Technology Acceptance Model, Diffusion of Innovations Theory, the Technological Pedagogical Content Knowledge (TPACK) Framework, and UNESCO's Human-Centred AI Governance principles and was subsequently refined through expert validation. The resulting framework comprises eight interconnected governance domains, including leadership and policy, digital infrastructure, teacher professional development, curriculum integration, AI literacy, ethical governance, assessment and academic integrity, and continuous monitoring and evaluation. It incorporates an implementation roadmap, stakeholder responsibilities, risk management strategies, and measurable performance indicators to support sustainable AI adoption. The study contributes one of the first comprehensive AI governance models specifically developed for Caribbean secondary education, providing an evidence-informed framework to guide policymakers, educational leaders, teachers, and examination authorities in implementing AI responsibly while promoting educational quality, equity, transparency, accountability, innovation, and public confidence throughout Jamaica and the wider Caribbean.

Keywords: Artificial Intelligence; Educational Governance; Caribbean Examinations Council; Secondary Education; Jamaica; Educational Policy; Artificial Intelligence Literacy; Academic Integrity; Design Science Research.

Introduction

Background to the Study

The rapid advancement of artificial intelligence (AI) has become one of the defining technological developments of the twenty-first century, fundamentally transforming the way societies communicate, conduct business, deliver healthcare, and educate their citizens. Artificial intelligence refers to computer systems capable of performing tasks that traditionally require human intelligence, including reasoning, learning, decision-making, language processing, pattern recognition, and problem-solving (Russell & Norvig, 2021). The emergence of sophisticated AI applications, particularly generative AI systems, has significantly altered educational practices by providing learners and educators with intelligent tools capable of generating text, analysing data, supporting personalised instruction, and facilitating collaborative learning. These innovations have accelerated digital transformation within educational institutions across both developed and developing countries, prompting governments and policymakers to reconsider traditional approaches to curriculum design, assessment, teacher preparation, and educational governance (UNESCO, 2023). As educational systems continue to embrace technological innovation, artificial intelligence is increasingly viewed not merely as an instructional tool but as a strategic resource capable of improving educational quality, institutional efficiency, and lifelong learning opportunities. Nevertheless, the growing adoption of AI also raises significant concerns relating to academic integrity, ethical governance, data privacy, algorithmic bias, and equitable access to digital technologies, thereby necessitating carefully designed implementation frameworks that balance innovation with accountability (Organisation for Economic Co-operation and Development [OECD], 2023). These developments have positioned AI as both an opportunity and a challenge for educational systems worldwide, particularly those seeking to modernise while preserving fairness, inclusivity, and public confidence.

The global education sector has experienced unprecedented technological change during the past decade, driven by improvements in cloud computing, machine learning, natural language processing, and increasingly sophisticated digital learning environments. The COVID-19 pandemic accelerated educational digitalisation by compelling schools and universities to adopt remote teaching technologies at a pace previously considered unattainable, thereby exposing both the strengths and weaknesses of existing educational infrastructures (United Nations, 2022). Since that period, educational institutions have continued integrating digital technologies into routine teaching and learning activities, with AI applications becoming increasingly prominent in lesson planning, automated feedback, adaptive tutoring, language translation, assessment support, and administrative decision-making. Rather than replacing educators, contemporary evidence suggests that AI functions most effectively when it complements professional judgement, enhances instructional efficiency, and provides teachers with additional opportunities to personalise learning according to students' individual needs (Luckin, 2018; Zawacki-Richter et al., 2019). Simultaneously, concerns have emerged regarding the possibility that unrestricted AI

use may undermine independent thinking, critical reasoning, originality, and academic honesty if appropriate governance mechanisms are absent. International organisations have consistently advocated that AI should be implemented within comprehensive ethical frameworks that safeguard learners while promoting innovation, transparency, and human-centred educational development (UNESCO, 2023). These global developments demonstrate that educational institutions must move beyond ad hoc technology adoption towards systematic governance models capable of ensuring responsible and sustainable AI integration.

Artificial intelligence has also become an increasingly influential component of educational policy within many advanced economies, where governments have introduced national strategies intended to prepare schools for digital transformation. Countries including Singapore, the United Kingdom, Australia, Canada, Finland, and members of the European Union have developed policy frameworks that encourage AI literacy, strengthen teacher professional development, promote responsible innovation, and establish safeguards relating to privacy, transparency, and algorithmic accountability (European Commission, 2022; OECD, 2023). These initiatives recognise that successful AI implementation extends beyond technological infrastructure and depends equally upon institutional leadership, curriculum reform, stakeholder engagement, ethical governance, and continuous evaluation. International experience illustrates that students require opportunities to develop AI literacy alongside broader digital competencies so that they become informed users rather than passive consumers of intelligent technologies. Educational systems that invest simultaneously in infrastructure, policy development, teacher capacity, and student preparedness are generally better positioned to realise the educational benefits associated with AI while minimising associated risks. Conversely, jurisdictions lacking coherent governance structures often encounter fragmented implementation, inconsistent instructional practices, uncertainty among educators, and increased concerns regarding assessment integrity. These contrasting experiences provide valuable lessons for developing educational systems seeking to integrate AI responsibly while preserving educational quality and public trust.

Within the Caribbean, digital transformation has become an increasingly important policy priority as governments seek to improve educational quality, economic competitiveness, workforce readiness, and regional innovation. Caribbean societies are simultaneously confronted by global technological change, labour market disruption, climate vulnerability, and increasing demands for knowledge-intensive economies capable of competing internationally. Education has assumed renewed importance as a mechanism for developing the digital competencies, analytical skills, creativity, and adaptability required within contemporary labour markets (CARICOM, 2022). Although many Caribbean countries have invested in information and communication technologies within schools, AI-specific educational policies remain comparatively underdeveloped, and implementation has often occurred without comprehensive guidance concerning governance, ethics, curriculum integration, or assessment practices. The uneven distribution of technological infrastructure across urban and rural communities complicates AI adoption by creating disparities in internet connectivity, digital devices, technical support, and teacher preparedness. Such inequalities risk widening existing educational gaps if AI technologies become concentrated within better-resourced institutions while underserved schools remain excluded from emerging opportunities. Accordingly, the Caribbean requires

regionally appropriate AI implementation strategies that acknowledge local educational realities while aligning with international standards of responsible and ethical AI governance.

Jamaica has demonstrated considerable commitment to educational modernisation through national investments in digital learning, educational technology, broadband expansion, and curriculum reform designed to improve student achievement and economic competitiveness. The Ministry of Education, Skills, Youth and Information has promoted technology integration across schools through initiatives supporting digital classrooms, online learning platforms, teacher training, and expanded internet access, recognising that technological competence constitutes an essential component of twenty-first-century education (Ministry of Education, Skills, Youth and Information, 2024). Despite these achievements, significant differences remain in institutional readiness, with some secondary schools possessing advanced technological resources while others continue experiencing limitations in connectivity, equipment, funding, and professional development opportunities. These disparities influence educators' confidence in adopting emerging technologies and may affect students' opportunities to benefit from AI-supported learning environments. The rapid emergence of freely available generative AI applications has introduced new pedagogical opportunities alongside important questions concerning plagiarism, assessment authenticity, copyright, intellectual property, and responsible classroom practice. Teachers increasingly require guidance regarding appropriate instructional applications of AI, while students must develop the critical thinking skills necessary to evaluate AI-generated information responsibly. These circumstances indicate that technological investment alone is insufficient and must be accompanied by coherent governance structures capable of supporting effective implementation throughout Jamaica's secondary education system.

The Caribbean Examinations Council (CXC) occupies a uniquely influential position within the English-speaking Caribbean because it establishes curriculum standards, develops regional examinations, certifies student achievement, and influences educational policy across numerous member territories. Decisions made by CXC affect millions of students, teachers, parents, and educational institutions, making the organisation a critical stakeholder in shaping the region's response to artificial intelligence. As AI increasingly influences classroom teaching, independent study, coursework preparation, and examination practices, CXC must consider how assessment policies, curriculum frameworks, and academic integrity standards should evolve in response to technological change. International examination bodies have already begun reviewing assessment models to accommodate responsible AI use while maintaining fairness, authenticity, and rigorous academic standards, suggesting that similar discussions are necessary within the Caribbean context. , there remains limited empirical research proposing an integrated governance and implementation framework specifically designed for CXC and secondary schools operating within Jamaica's educational environment. Existing studies frequently examine AI adoption in higher education or technologically advanced countries without adequately addressing the institutional, cultural, economic, and infrastructural realities of small island developing states. There is a compelling need to develop a comprehensive framework capable of guiding responsible AI integration across Caribbean secondary education while safeguarding educational quality, equity, transparency, and academic integrity.

The present study responds directly to this identified gap by proposing a comprehensive Artificial Intelligence Governance and Implementation Framework specifically designed for the Caribbean Examinations Council and secondary schools in Jamaica. Rather than focusing exclusively upon technological adoption, the proposed framework integrates governance, educational leadership, curriculum development, teacher professional learning, student AI literacy, ethical principles, assessment reform, infrastructure readiness, cybersecurity, stakeholder collaboration, and continuous quality improvement within a single strategic model. The framework recognises that successful AI implementation requires coordinated action among policymakers, school leaders, educators, students, parents, technology providers, and examination authorities to ensure that innovation strengthens rather than compromises educational outcomes. The study seeks to provide evidence-informed recommendations that align with international best practices while remaining responsive to the educational, cultural, and developmental priorities of Jamaica and the wider Caribbean. By developing a contextually relevant governance model, the research aims to assist educational leaders in making informed decisions regarding AI policy, institutional readiness, and responsible classroom implementation. Ultimately, the proposed framework seeks to support an educational system in which artificial intelligence enhances teaching, enriches learning, strengthens assessment, promotes equity, and prepares Caribbean students for meaningful participation within an increasingly digital global society.

Statement of the Problem

Artificial intelligence (AI) has emerged as one of the most transformative technologies influencing education worldwide, reshaping teaching, learning, assessment, and educational administration. Educational systems across North America, Europe, Asia, and Australia have increasingly adopted AI-enabled technologies to enhance instructional quality, personalise learning, improve administrative efficiency, and support evidence-based decision-making (UNESCO, 2023; OECD, 2023). Although these developments have encouraged governments to establish national AI strategies that address innovation alongside ethical considerations, privacy, transparency, accountability, and academic integrity, the Caribbean has progressed more cautiously in developing comprehensive governance policies for AI implementation in secondary education. In Jamaica, teachers and students are increasingly utilising generative AI for lesson preparation, assessment, research, writing support, and examination preparation; institutional guidance remains fragmented and inconsistent. Significant concerns persist regarding plagiarism, contract cheating, overdependence on AI-generated content, diminished critical thinking, algorithmic bias, data privacy, and unequal institutional readiness arising from disparities in technological infrastructure, teacher preparedness, financial resources, and leadership (Holmes et al., 2022). Without coherent governance, these disparities risk widening educational inequalities and limiting the equitable and responsible adoption of AI across Jamaican secondary schools.

The Caribbean Examinations Council (CXC), as the region's principal curriculum and examination authority, occupies a strategic position in guiding the integration of artificial intelligence within Caribbean education. There remains limited scholarly evidence and no comprehensive AI governance framework specifically designed for CXC or the educational realities of Jamaica and other Caribbean small island developing states. Existing international frameworks largely reflect the institutional, technological, and economic contexts of developed

countries and require contextual adaptation before they can be effectively applied within the Caribbean. As a result, policymakers, school leaders, and educators currently lack empirically informed guidance regarding AI governance, curriculum integration, teacher competencies, assessment reform, cybersecurity, stakeholder responsibilities, and continuous evaluation. This policy gap constrains the ability of educational institutions to implement artificial intelligence consistently, ethically, and effectively while maintaining educational quality, academic integrity, equity, and public confidence. Accordingly, there is a pressing need to develop a comprehensive Artificial Intelligence Governance and Implementation Framework to support responsible AI implementation within CXC and Jamaican secondary schools.

Purpose of the Study

The primary purpose of this study is to develop a comprehensive Artificial Intelligence Governance and Implementation Framework for the Caribbean Examinations Council and secondary schools in Jamaica that supports the ethical, equitable, effective, and sustainable integration of artificial intelligence into teaching, learning, assessment, educational leadership, and institutional governance. The proposed framework seeks to provide educational policymakers, school administrators, curriculum developers, teachers, and examination authorities with a structured model capable of guiding responsible AI implementation while preserving academic integrity and promoting educational excellence. In addition to examining international best practices, the study seeks to identify the educational, technological, organisational, and ethical factors that influence successful AI adoption within Caribbean secondary education. Emphasis is placed upon ensuring that the framework reflects the unique social, economic, cultural, and institutional realities of Jamaica and the wider Caribbean rather than merely replicating models developed within substantially different educational environments. The study also aims to establish practical recommendations that support curriculum reform, teacher professional development, digital infrastructure enhancement, student AI literacy, cybersecurity, policy development, and continuous quality improvement. The research intends to contribute to the growing body of international scholarship concerning responsible artificial intelligence in education by proposing a contextually appropriate governance model for small island developing states. Ultimately, the study seeks to position artificial intelligence as a strategic educational resource that enhances teaching and learning while safeguarding fairness, transparency, accountability, and public trust throughout the Caribbean educational system.

Research Objectives

Overall Objective

To develop a comprehensive Artificial Intelligence Governance and Implementation Framework for the Caribbean Examinations Council (CXC) and secondary schools in Jamaica.

Specific Objectives

1. To examine the current level of artificial intelligence awareness, utilisation, and preparedness among key educational stakeholders within Jamaican secondary education.

2. To evaluate the institutional, technological, pedagogical, organisational, and ethical factors that influence the successful implementation of artificial intelligence across secondary schools and examination systems.
3. To identify the barriers that impede the responsible adoption of artificial intelligence, including infrastructural limitations, professional development needs, governance deficiencies, cybersecurity concerns, and unequal access to digital resources.
4. To examine how curriculum development, assessment practices, and teacher professional learning should be redesigned to accommodate emerging artificial intelligence technologies while maintaining academic integrity and educational quality.
5. To formulate practical policy recommendations that support the coordinated implementation and governance of artificial intelligence across the Caribbean Examinations Council member territories.
6. To develop and validate an evidence-informed Artificial Intelligence Governance and Implementation Framework for the Caribbean Examinations Council and secondary schools in Jamaica.

Research Questions

The study is guided by the following research questions:

1. What is the current level of awareness, acceptance, and utilisation of artificial intelligence among teachers, students, school leaders, and educational policymakers in Jamaica?
2. What technological, organisational, pedagogical, financial, and ethical factors influence institutional readiness for artificial intelligence implementation within secondary schools?
3. What challenges and risks are associated with integrating artificial intelligence into teaching, learning, assessment, and educational administration within the Jamaican context?
4. How should teacher professional development, curriculum design, and student artificial intelligence literacy be strengthened to support responsible and effective AI integration?
5. What governance mechanisms are necessary to ensure transparency, accountability, fairness, privacy, cybersecurity, and academic integrity within AI-enabled educational environments?
6. How can the Caribbean Examinations Council incorporate artificial intelligence into curriculum delivery and assessment while maintaining public confidence in regional qualifications?
7. What components should constitute a comprehensive Artificial Intelligence Governance and Implementation Framework capable of supporting sustainable artificial intelligence adoption across Jamaican secondary schools and the wider Caribbean?

Significance of the Study

This study is significant because it addresses the limited availability of contextually appropriate artificial intelligence governance models for Jamaica and the wider Caribbean, where educational systems operate within diverse institutional environments, constrained resources, and varying levels of technological readiness. By developing an evidence-informed framework for the Caribbean Examinations Council and secondary schools, the research contributes original knowledge capable of guiding policy development, curriculum reform, assessment

modernisation, teacher professional development, ethical AI use, and institutional accountability. The framework may assist CXC, policymakers, school leaders, and teachers in integrating artificial intelligence responsibly while protecting academic integrity, student welfare, educational quality, and public confidence in regional qualifications. Students may benefit through strengthened AI literacy, digital citizenship, critical thinking, and responsible technological competence, while parents and wider society may gain assurance that educational innovation is being implemented transparently and ethically. The study also provides a foundation for future empirical research on AI implementation, educational governance, digital transformation, and curriculum development within small island developing states. Collectively, these contributions strengthen both the practical application and theoretical understanding of responsible artificial intelligence in Caribbean education.

Scope of the Study

This study is limited to the development of an Artificial Intelligence Governance and Implementation Framework for the Caribbean Examinations Council (CXC) and secondary schools in Jamaica. It focuses on the educational application of artificial intelligence in teaching, learning, assessment, curriculum development, educational leadership, and institutional governance rather than on the technical design, engineering, or procurement of AI systems. The framework is informed by international literature and contextualised to reflect the socio-economic, cultural, institutional, and technological realities of Jamaica while remaining adaptable to the wider English-speaking Caribbean served by CXC. The study concentrates on secondary education because it represents a critical stage for developing AI literacy, digital competencies, critical thinking, and lifelong learning skills, and because CXC curricula and assessments significantly influence educational practice across the region. It considers the roles of teachers, school leaders, curriculum specialists, examination administrators, policymakers, and students as the principal stakeholders in AI implementation, while recognising the supporting contributions of parents, higher education institutions, employers, and technology providers. The framework also addresses teacher professional development, digital infrastructure, ethical governance, cybersecurity, academic integrity, assessment reform, and continuous quality improvement as essential components of institutional readiness, while excluding detailed financial modelling, software engineering, and technical system architecture from its scope.

Delimitations of the Study

Several deliberate delimitations have been established to ensure that the study remains focused upon its central objective of developing a practical and contextually appropriate governance framework. First, the investigation is limited to secondary education and does not examine artificial intelligence implementation within early childhood, primary, tertiary, or technical and vocational educational institutions except where international literature provides useful comparative insights. Second, although the Caribbean Examinations Council operates across numerous member states, Jamaica is employed as the principal national case because of its comparatively advanced digital education initiatives, its influential role within regional education, and the accessibility of relevant policy documentation. Third, the study concentrates upon educational governance, curriculum integration, teacher preparedness, student AI literacy,

ethical implementation, and assessment practices rather than evaluating the comparative performance of individual commercial AI platforms. Technologies such as generative AI chatbots, adaptive tutoring systems, learning analytics, and automated assessment tools are discussed primarily as examples illustrating broader educational applications instead of being evaluated as individual products. The research limits its theoretical foundation to four complementary frameworks to provide conceptual coherence while avoiding unnecessary overlap among explanatory models. Finally, the study proposes an implementation framework based upon existing evidence, educational theory, policy analysis, and international best practice rather than conducting a nationwide pilot implementation within Jamaican schools. These delimitations allow the investigation to maintain depth of analysis while producing recommendations that are realistic, coherent, and directly relevant to educational decision-makers.

Limitations of the Study

As with all scholarly investigations, the present study is subject to several limitations that should be acknowledged when interpreting its findings and recommendations. Artificial intelligence represents an exceptionally dynamic field characterised by rapid technological innovation, frequent software updates, evolving regulatory frameworks, and changing educational practices, meaning that some aspects of the literature may become outdated within a relatively short period. Although every effort is made to incorporate current scholarly evidence and internationally recognised policy documents, future technological developments may require periodic revision of the proposed framework to ensure continued relevance. Another limitation concerns the comparatively limited body of empirical research examining artificial intelligence specifically within Caribbean secondary education, requiring the study to draw extensively upon international literature while carefully adapting findings to the regional context. Differences in educational funding, technological infrastructure, institutional capacity, and policy priorities among Caribbean territories may also influence the extent to which individual recommendations can be implemented uniformly across the region. The proposed framework is conceptual in nature and requires subsequent empirical validation through pilot implementation, stakeholder consultation, and longitudinal evaluation before widespread adoption can be recommended with complete confidence. Despite these limitations, the study provides a robust evidence-informed foundation for future research and policy development because it integrates established educational theory, international best practice, and Caribbean educational realities within a comprehensive governance model.

Assumptions of the Study

The study is based upon several assumptions considered necessary for the development of a meaningful and practically relevant Artificial Intelligence Governance and Implementation Framework. It is assumed that artificial intelligence will continue to influence educational systems worldwide and that its integration into teaching, learning, assessment, and educational administration will expand rather than diminish during the coming decade. The research also assumes that policymakers, educational leaders, teachers, students, and examination authorities recognise the importance of establishing governance mechanisms capable of promoting responsible innovation while protecting educational quality and academic integrity. An

assumption is that Jamaican secondary schools will continue investing in digital infrastructure, teacher professional development, and educational technologies as part of broader national development strategies. The study additionally assumes that teachers remain central to the educational process and that artificial intelligence should function as a tool supporting professional judgement rather than replacing the pedagogical expertise and ethical responsibilities of educators. It is assumed that students require explicit instruction in AI literacy, digital citizenship, information evaluation, and responsible technology use if they are to benefit fully from intelligent educational systems. Finally, the investigation assumes that collaboration among government agencies, CXC, schools, higher education institutions, private sector partners, and international organisations will be essential for successful and sustainable implementation of the proposed framework.

Operational Definitions

For this study, the following operational definitions apply:

- **Artificial Intelligence (AI):** Computer-based systems capable of performing tasks that normally require human intelligence, including learning, reasoning, language processing, decision-making, and problem-solving (Russell & Norvig, 2021).
- **Generative Artificial Intelligence (Generative AI):** A category of artificial intelligence systems capable of producing original content, including text, images, computer code, audio, and other forms of digital output, based on user prompts and learned patterns from extensive datasets.
- **Artificial Intelligence Governance:** The policies, standards, regulatory mechanisms, ethical principles, and institutional procedures established to ensure that artificial intelligence technologies are implemented responsibly, transparently, fairly, and accountably within educational environments (UNESCO, 2023).
- **Artificial Intelligence Literacy:** The knowledge, competencies, attitudes, and ethical understanding required for individuals to use artificial intelligence technologies effectively, critically, responsibly, and safely within educational and professional settings.
- **Academic Integrity:** The commitment to honesty, fairness, trust, respect, responsibility, and ethical behaviour in teaching, learning, assessment, research, and scholarly communication.
- **Digital Literacy:** The ability to locate, evaluate, create, communicate, and manage information effectively through digital technologies while demonstrating appropriate ethical, legal, and cybersecurity practices.

Literature review

Historical Evolution of Artificial Intelligence

The origins of artificial intelligence can be traced to philosophical and scientific efforts to understand human reasoning and reproduce intelligent behaviour through mechanical or computational systems. Although related ideas appeared in earlier philosophical writings, AI emerged as a modern scientific discipline during the mid-twentieth century when advances in mathematics, computing, and cognitive science created new possibilities for machine intelligence

(Russell & Norvig, 2021). The publication of Alan Turing's *Computing Machinery and Intelligence* in 1950 represented a significant milestone by introducing the question of whether machines could demonstrate behaviour indistinguishable from human intelligence and proposing what later became known as the Turing Test (Turing, 1950). The Dartmouth Summer Research Project on Artificial Intelligence subsequently established AI as an academic field and encouraged research into symbolic reasoning, machine learning, robotics, natural language processing, and problem-solving (McCarthy et al., 2006). Although early optimism was interrupted by technological limitations and periods of reduced research investment known as "AI winters," continued advances in computing power, algorithms, and data availability enabled AI to become an influential technology across education, healthcare, business, government, and scientific research.

The twenty-first century has witnessed unprecedented development in artificial intelligence through advances in machine learning, deep learning, cloud computing, and access to extensive datasets. Unlike earlier systems that relied primarily upon manually programmed rules, contemporary machine-learning models identify patterns within large datasets and improve their performance through iterative training (Goodfellow et al., 2016). Deep-learning technologies have supported progress in speech recognition, image analysis, language translation, predictive analytics, and autonomous systems, while generative AI has demonstrated the capacity to create written text, computer code, imagery, audio, and analytical summaries. These developments offer opportunities to enhance productivity and innovation but also raise concerns regarding ethics, intellectual property, misinformation, employment, privacy, and social responsibility (World Economic Forum, 2023). Educational institutions have become particularly affected because teachers and students can now access sophisticated AI applications capable of supporting academic activities that previously required substantial human effort.

Recent developments have shifted discussion from the automation of educational functions towards collaboration between human expertise and intelligent computational systems. Large language models, intelligent tutoring platforms, multimodal technologies, and adaptive learning systems can support lesson planning, curriculum development, formative assessment, personalised feedback, and educational administration (Holmes et al., 2022). Nevertheless, technological capability does not automatically produce educational improvement because implementation depends upon pedagogy, governance, professional competence, institutional leadership, and ethical safeguards. Educational policymakers must reconsider curriculum design, assessment authenticity, teacher preparation, and digital literacy while ensuring that students critically evaluate rather than uncritically accept AI-generated information. International organisations similarly emphasise that human judgement and professional responsibility must remain central to educational decision-making (UNESCO, 2023). The historical development of AI consequently demonstrates both considerable educational potential and the need for governance frameworks that align technological innovation with human values and public interests.

Artificial Intelligence in Education

Artificial intelligence has become an influential educational technology because of its potential to personalise learning, improve instructional effectiveness, support institutional decision-making, and increase administrative efficiency. Early applications concentrated upon intelligent tutoring systems within narrowly defined subject areas, whereas contemporary AI technologies support adaptive learning, automated assessment, predictive analytics, curriculum planning, language translation, accessibility services, and personalised academic assistance (Luckin, 2018). These applications allow educators to use data-informed insights when planning instruction and provide students with learning experiences responsive to their abilities, progress, and educational needs. AI has developed from a specialised instructional tool into a strategic educational resource capable of supporting institutional improvement and lifelong learning.

The educational value of AI depends upon thoughtful pedagogical integration rather than technological novelty. Poorly implemented systems may reinforce ineffective teaching practices, weaken student independence, or widen existing educational inequalities (Zawacki-Richter et al., 2019). Successful implementation requires simultaneous investment in teacher development, infrastructure, curriculum reform, ethical governance, and institutional leadership. These requirements have become increasingly important following the widespread availability of generative AI systems capable of producing sophisticated academic content with limited user input.

One of AI's principal educational benefits is its ability to facilitate personalised learning by adapting instructional activities to individual learners' needs and progress. Traditional classroom teaching often requires educators to respond to diverse learning needs within limited time and large classes. AI-powered adaptive systems may analyse student performance, recommend appropriate learning activities, provide additional support to struggling students, and present advanced tasks to learners who demonstrate higher levels of mastery (Holmes et al., 2022). These technologies may also enhance motivation through immediate feedback, visible progress monitoring, and increased learner autonomy (Chen et al., 2020). Nevertheless, personalised technologies should complement rather than replace teacher-student relationships, emotional support, social interaction, and collaborative learning. The strongest educational benefits are likely to occur when AI functions within learner-centred environments guided by professionally competent educators.

Artificial intelligence may also improve institutional administration and educational leadership. AI-supported analytics can assist leaders in monitoring attendance, identifying learners at risk of academic failure, allocating resources, evaluating programme effectiveness, and strengthening strategic planning (OECD, 2023). Automation may reduce repetitive administrative work and enable educators to devote greater attention to instruction, learner support, curriculum development, and professional collaboration. Predictive analytics may similarly facilitate earlier intervention for students experiencing academic or personal difficulties. These applications require safeguards relating to privacy, cybersecurity, transparency, accountability, and human oversight. Educational institutions must establish policies governing how student data are

collected, stored, analysed, shared, and used so that technological efficiency does not compromise individual rights or public trust (UNESCO, 2023).

Generative Artificial Intelligence in Secondary Education

Generative artificial intelligence has transformed educational practice by introducing tools capable of producing text, images, computer code, presentations, summaries, and other content in response to natural-language prompts. Unlike earlier technologies that primarily facilitated information retrieval or computer-assisted instruction, generative AI enables interactive knowledge construction, creative content development, and collaborative problem-solving through conversational interfaces (Kasneci et al., 2023). Platforms such as ChatGPT, Microsoft Copilot, Google Gemini, and Claude have accelerated AI adoption across schools and universities. Teachers use these technologies to prepare lessons, create differentiated materials, develop assessment activities, explain complex concepts, and produce formative feedback, while students employ them for research, revision, writing, language learning, programming, and examination preparation. These developments have expanded opportunities for personalised learning but have also raised concerns regarding originality, intellectual independence, authorship, and academic integrity (Holmes et al., 2022).

Within secondary education, generative AI may enhance learner engagement by providing immediate academic support and adapting explanations to students' levels of understanding. It may assist multilingual learners through translation and language practice and support students with disabilities through accessibility functions (UNESCO, 2023). Such capabilities correspond with learner-centred approaches that recognise variations in prior knowledge, ability, and learning needs. Excessive reliance upon AI-generated responses may limit critical thinking, independent reasoning, creativity, and reflective learning (Kasneci et al., 2023). Schools must ensure that AI functions as a cognitive support mechanism rather than a substitute for intellectual effort, scholarly inquiry, or meaningful interaction between educators and learners.

Generative AI also presents substantial governance and policy challenges. One major concern involves distinguishing original student work from machine-generated content, particularly when sophisticated language models produce convincing assignments that may evade conventional plagiarism-detection systems. This challenge has encouraged educators to reconsider traditional essays and coursework as primary measures of achievement and to develop more authentic assessment methods (Bearman et al., 2023). Other concerns include inaccurate information, algorithmic bias, copyright infringement, unequal technological access, privacy risks, and inappropriate dependence upon automated outputs. These issues are especially important in secondary education because adolescents are still developing information literacy, ethical judgement, and critical reasoning. Responsible implementation consequently requires AI literacy that incorporates source evaluation, digital citizenship, ethical reasoning, and informed decision-making within a comprehensive governance structure.

Artificial Intelligence Governance and Educational Policy

Artificial intelligence governance has become central to educational policy because technological innovation alone cannot ensure responsible institutional practice or improved educational

outcomes. Governance encompasses the policies, ethical principles, accountability mechanisms, organisational structures, and regulatory processes that guide the selection, deployment, monitoring, and evaluation of AI technologies (UNESCO, 2023). Effective governance ensures that AI applications remain aligned with educational objectives while protecting students, educators, and institutions from unintended harm. Core principles include transparency, fairness, privacy, accountability, inclusivity, security, and meaningful human oversight (OECD, 2023). Educational institutions require policies governing acceptable AI use, data management, procurement, professional responsibilities, student conduct, staff development, and compliance monitoring. Without such structures, implementation may become fragmented, inconsistent, and vulnerable to ethical, legal, and reputational challenges.

Governments increasingly integrate AI governance within broader national digital-transformation strategies. These strategies commonly address innovation, employment, cybersecurity, economic competitiveness, public-sector modernisation, and workforce development while recognising education's role in preparing citizens for AI-enabled societies (European Commission, 2022). Many jurisdictions have incorporated computational thinking, digital literacy, AI literacy, and ethical technology use into school curricula. Such reforms recognise that technical knowledge must be accompanied by critical evaluation, responsible decision-making, and awareness of AI's social consequences. They also emphasise lifelong learning because continued technological development requires individuals to update their professional knowledge and digital competencies throughout their careers. Effective implementation depends upon coordinated action among governments, educational institutions, examination authorities, industry, professional organisations, and civil society.

For the Caribbean, AI governance represents both an opportunity and a policy challenge because educational systems must modernise while managing infrastructural inequalities, limited resources, and varying levels of institutional readiness. The Caribbean Examinations Council occupies an influential position because its curricula, examinations, and certification standards shape educational practice throughout member territories. A regional governance framework could provide consistent guidance regarding curriculum integration, assessment, academic integrity, teacher competence, student AI literacy, privacy, and institutional accountability. Such a framework could support harmonisation while allowing member states to adapt implementation to national economic, technological, and cultural conditions. Governance should be understood not as a restriction upon innovation but as a mechanism for enabling innovation to occur responsibly, transparently, and equitably.

UNESCO and OECD Guidelines for Responsible Artificial Intelligence in Education

International organisations have contributed significantly to global AI governance through policies intended to assist governments and educational institutions in managing the opportunities and risks associated with artificial intelligence. UNESCO's *Guidance for Generative AI in Education and Research* and the OECD's work on trustworthy AI emphasise that technological innovation should remain grounded in human rights, ethical principles, and educational values. Both organisations maintain that AI should enhance rather than replace human decision-making and that educators must retain responsibility for teaching, assessment,

and learner welfare. Their guidance identifies transparency, fairness, accountability, inclusivity, privacy, security, and human oversight as essential throughout procurement, implementation, and evaluation (OECD, 2023; UNESCO, 2023).

UNESCO additionally encourages governments to invest in AI literacy for teachers and students, recognising that responsible use depends upon knowledge and critical understanding rather than prohibition. It also warns that unequal infrastructure and digital access may intensify existing educational inequalities. This concern is particularly relevant to Jamaica and the wider Caribbean, where school funding, broadband access, digital devices, and teacher capacity differ across institutions and communities. UNESCO's human-centred approach consequently prioritises learner wellbeing, cultural diversity, accessibility, and equity alongside innovation.

The OECD similarly recommends that AI systems be secure, robust, transparent, and subject to human supervision so that automated processes do not produce discriminatory or unfair outcomes. Both organisations promote continuous monitoring, stakeholder consultation, risk assessment, and policy revision because AI technologies change rapidly. Implementation should be considered an ongoing process of institutional learning rather than a single technological intervention. These principles provide an appropriate international foundation for a Caribbean-specific governance framework, although regional adaptation remains necessary to address local institutional, economic, cultural, and educational realities.

Artificial Intelligence Ethics and Responsible Innovation

The expansion of artificial intelligence in education has intensified ethical concerns because educational technologies influence students' personal information, academic development, learning opportunities, and prospects. Ethical AI involves designing, selecting, implementing, and governing technologies in ways that respect human rights, preserve autonomy, promote fairness, ensure transparency, and protect privacy (UNESCO, 2023). Within education, ethical considerations include not only technical performance but also the social, cultural, psychological, and pedagogical consequences of AI adoption. Educational institutions possess a responsibility to ensure that AI promotes learner wellbeing, democratic values, inclusion, and equitable access to quality education (Floridi & Cowls, 2019).

Algorithmic bias represents a major ethical concern because AI systems may reproduce inequalities found within historical or unrepresentative training data. Such systems may generate recommendations that disadvantage learners according to gender, socio-economic status, disability, language, ethnicity, or geographical location (Holmes et al., 2022). These consequences are particularly serious when AI influences assessment, academic support, placement, or educational opportunity. Institutions should evaluate systems before deployment and continuously monitor outcomes for potential discrimination. Transparency concerning data sources, decision processes, limitations, and error rates is also necessary so that teachers, learners, and administrators can evaluate automated recommendations critically. Human oversight remains indispensable, and final responsibility for consequential educational decisions should remain with qualified professionals.

Privacy and data protection are similarly important because AI applications frequently depend upon extensive collections of learner information. Educational datasets may include attendance, assessment results, learning preferences, demographic characteristics, behavioural information, and digital activity (OECD, 2023). Inappropriate collection, disclosure, or commercial use of such information may expose students to discrimination, identity theft, reputational damage, or exploitation. Educational authorities consequently require policies specifying how data are collected, processed, stored, shared, retained, and destroyed. Students and parents should understand how personal information is used, and informed consent should be obtained where appropriate. Cybersecurity measures, regular audits, professional training, and clearly assigned responsibilities are essential components of ethical AI governance.

Teacher Readiness for Artificial Intelligence Integration

Teacher readiness is a major determinant of successful AI implementation because educators remain responsible for curriculum delivery, classroom management, learner engagement, and assessment. Although AI can automate routine functions and provide instructional assistance, it cannot replace the professional judgement, empathy, ethical reasoning, contextual understanding, and interpersonal relationships associated with effective teaching (Luckin, 2018). The educational benefits of AI consequently depend upon teachers' ability to integrate technology within pedagogically appropriate learning environments.

Educators with stronger digital competencies, confidence in educational technology, and positive attitudes towards innovation are generally more likely to adopt AI effectively than teachers who receive limited professional preparation (Trust et al., 2023). Readiness extends beyond technical knowledge to include curriculum planning, assessment design, ethical awareness, information evaluation, and the capacity to guide responsible student use. Professional learning should present AI as an instructional resource that supports rather than replaces teacher expertise. These competencies are especially important in secondary schools, where teachers influence students' ethical conduct, critical thinking, and preparation for digitally mediated societies.

Professional development must also extend beyond one-time workshops. Effective programmes should provide sustained, practical, curriculum-aligned opportunities for teachers to explore AI applications, evaluate resources, collaborate with colleagues, and reflect upon classroom experiences (European Commission, 2022). Mentoring, professional learning communities, peer observation, and action research may strengthen competence and encourage responsible experimentation. School leaders contribute by developing supportive cultures, supplying technical assistance, allocating resources, and communicating clear institutional expectations. Inadequate professional learning, by contrast, may produce resistance, uncertainty, inconsistent practice, and underutilisation of institutional investments.

The Technology Acceptance Model provides an additional explanation for teacher adoption by proposing that willingness to use technology is influenced by perceived usefulness and ease of use (Davis, 1989). Teachers are more likely to integrate AI when they believe that it strengthens instruction, reduces administrative work, supports curriculum delivery, and improves learner engagement without unnecessary complexity. Acceptance may decline where educators remain

uncertain about data privacy, ethical responsibilities, assessment integrity, or institutional policy. Teacher readiness is shaped by the interaction of individual competence, technological usability, organisational culture, leadership, professional support, and policy clarity.

Student Artificial Intelligence Literacy

Artificial intelligence literacy has become an essential competency because students encounter AI within education, employment, social media, financial services, healthcare, and everyday digital environments. AI literacy extends beyond operating technological tools and includes understanding how systems function, recognising their limitations, evaluating generated information, identifying bias, and applying ethical principles (Long & Magerko, 2020). It should be regarded as an extension of digital literacy that enables learners to engage critically with automated systems rather than becoming passive recipients of machine-generated information.

Students who understand AI's capabilities and limitations are better positioned to identify inaccuracies, question algorithmic outputs, recognise potential bias, and exercise independent judgement. These skills support critical thinking, creativity, information literacy, and responsible digital citizenship. AI literacy should consequently be integrated systematically into secondary curricula rather than treated as an optional or isolated subject. Instruction should develop progressively and connect technological understanding with mathematics, science, language, communication, social studies, and ethical reasoning.

Students should also examine how AI affects fairness, privacy, misinformation, intellectual property, employment, democracy, and social relationships (UNESCO, 2023). Relevant activities may include analysing AI-generated responses, comparing automated outputs with authoritative sources, evaluating bias, verifying factual claims, and discussing appropriate uses of AI-assisted learning. Teachers must model transparent and responsible use while explaining that AI should complement rather than replace intellectual effort. Educational systems that neglect these competencies risk producing students who are familiar with AI applications but lack the judgement required to use them safely, ethically, and effectively.

Digital Infrastructure and Institutional Readiness

Digital infrastructure is a prerequisite for AI integration because intelligent technologies depend upon reliable internet connectivity, appropriate hardware, cloud services, software, cybersecurity, and technical support (OECD, 2023). Schools lacking these resources are unlikely to realise AI's educational benefits regardless of teacher or student enthusiasm. Digital transformation should be understood as a systemic process involving technology, human capacity, governance, financing, leadership, and organisational culture rather than merely the acquisition of devices (Selwyn, 2016).

Institutional readiness includes infrastructure as well as strategic planning, leadership commitment, policy development, financial sustainability, stakeholder participation, and technical competence. Schools possessing clear implementation strategies are more likely to integrate AI effectively than institutions adopting tools without defined educational objectives or

governance procedures. Infrastructure development and organisational preparedness should consequently be treated as mutually reinforcing components of implementation.

Jamaica has expanded educational technology through initiatives supporting broadband connectivity, digital devices, teacher development, and technology-enhanced classrooms. Nevertheless, disparities remain in internet reliability, equipment, maintenance, and technical support, particularly between urban and rural schools (Ministry of Education, Skills, Youth and Information, 2024). These inequalities may discourage teachers from experimenting with AI and restrict students' opportunities to develop digital and AI competencies. Technological inequality may become educational inequality unless implementation deliberately prioritises underserved institutions. Investment in infrastructure should be regarded as an educational equity strategy rather than simply a modernisation initiative (UNESCO, 2023).

Institutional readiness depends upon leadership, strategic vision, and continuous quality improvement. School leaders must explain the educational purpose of AI adoption and ensure that policies correspond with curricula, ethical principles, and national priorities (Fullan, 2016). Supportive leadership encourages innovation, professional collaboration, and strategic resource allocation. Institutions should also evaluate implementation through indicators relating to teacher competence, student learning, infrastructure performance, ethical compliance, academic integrity, and stakeholder satisfaction. Continuous evaluation enables leaders to identify barriers, revise strategies, and ensure that AI remains a means of advancing educational goals rather than an end.

Artificial Intelligence and Educational Assessment

Artificial intelligence has challenged conventional approaches to assessment because generative technologies can produce sophisticated written and digital content with limited independent student effort. Traditional assessments commonly rely upon essays, coursework, examinations, and practical activities to evaluate knowledge and application. Generative AI complicates this model by enabling students to produce apparently original responses that may not accurately represent their knowledge, reasoning, or writing ability (Bearman et al., 2023). Educational institutions and examination authorities must reconsider the purpose, design, and authenticity of assessment.

Rather than treating AI exclusively as a threat, scholars recommend assessments that evaluate higher-order reasoning, creativity, reflection, collaboration, and application within authentic contexts (Luckin, 2018). Oral examinations, project-based assignments, portfolios, practical demonstrations, personalised tasks, and staged submissions can provide stronger evidence of student learning. These approaches reduce inappropriate dependence upon generated content while promoting deeper engagement and intellectual development.

AI can also strengthen assessment by improving efficiency and formative feedback. Automated systems may assist teachers in identifying misconceptions, analysing performance patterns, completing routine marking, and generating personalised feedback (Holmes et al., 2022). Learning analytics may provide institutional insights into curriculum effectiveness, student progression, and areas requiring intervention. Nevertheless, automated assessment should support rather than replace professional judgement because teachers can interpret reasoning,

context, creativity, communication, and learner development in ways that current systems cannot fully reproduce. Human oversight should remain central to consequential assessment decisions.

For CXC, AI presents strategic challenges and opportunities. As the principal regional examining authority, CXC must ensure that assessment continues to represent authentic student achievement while responding to changing educational practices. Alternative methods, including oral presentations, portfolios, collaborative investigations, performance tasks, and supervised project work, may complement conventional examinations (OECD, 2023). CXC also requires policies defining acceptable and unacceptable uses of AI during coursework, examination preparation, and assessment. Such guidance should distinguish legitimate assistance that enhances understanding from undisclosed AI-generated submissions that undermine validity and public confidence.

Academic Integrity in the Era of Artificial Intelligence

Academic integrity refers to honesty, trust, fairness, respect, responsibility, and ethical conduct throughout teaching, learning, assessment, and scholarly work (International Centre for Academic Integrity, 2021). Generative AI has complicated established ideas of authorship, originality, plagiarism, and appropriate academic assistance because students can produce written assignments, computer code, presentations, and summaries through conversational systems. Educational institutions must consequently distinguish responsible educational support from practices that misrepresent students' independent achievement (Bearman et al., 2023).

AI may be used appropriately to brainstorm ideas, clarify concepts, improve grammar, generate practice questions, or obtain formative explanations. These applications may strengthen learning when they support rather than replace critical reasoning and intellectual effort (Kasneci et al., 2023). Ethical concerns arise when students submit machine-generated work as their own, conceal AI use, or rely upon outputs without independent evaluation. Such practices weaken assessment validity and may restrict the development of problem-solving, creativity, writing, and reflective thinking. Institutions need explicit policies addressing acceptable use, disclosure, attribution, citation, verification, and consequences for misconduct.

Preserving academic integrity requires assessment reform rather than exclusive dependence upon AI-detection technologies. Detection systems may produce false results, classify authentic student work incorrectly, and perform inconsistently across writing contexts (Perkins et al., 2024). Excessive dependence upon detection may also create adversarial relationships between students and educators. Authentic assessment methods, including oral defence, reflective writing, practical demonstration, project-based learning, and documented drafting, offer more reliable evidence of student engagement (Bearman et al., 2023). Academic integrity should consequently be understood as a shared educational responsibility involving students, teachers, school leaders, parents, policymakers, and examination authorities.

The Caribbean Educational Context and Digital Transformation

Caribbean governments increasingly recognise technological competence, digital literacy, and innovation as important drivers of educational quality, economic competitiveness, and

sustainable development. Regional efforts have emphasised educational technology, curriculum modernisation, teacher development, and digital infrastructure (CARICOM, 2022). These initiatives respond to aspirations for knowledge-based economies while addressing challenges associated with climate vulnerability, limited resources, and dependence upon traditional industries. Schools are expected not only to transmit academic knowledge but also to develop creativity, critical thinking, technological competence, adaptability, and lifelong learning.

Digital transformation has progressed unevenly because Caribbean territories differ in financial resources, technological infrastructure, and institutional capacity. Some systems have expanded broadband access, online learning platforms, and technology-supported instruction more rapidly than others. These differences affect schools' readiness for AI and demonstrate the need for implementation models that acknowledge national circumstances while supporting common regional standards.

Jamaica has pursued educational modernisation through investments in digital platforms, technology infrastructure, online learning, and teacher capacity. Rural and economically disadvantaged schools continue to experience limitations in connectivity, equipment, maintenance, and technical support (Ministry of Education, Skills, Youth and Information, 2024). These conditions affect opportunities for AI-supported learning and reinforce the connection among technology, leadership, equity, policy, and professional development. Jamaica provides an appropriate context for developing a governance framework with both national relevance and wider regional applicability.

CXC possesses a strategic role because its curricula, assessments, and certification standards influence teaching and learning across the English-speaking Caribbean. As AI becomes embedded within educational practice, CXC will shape how schools define acceptable use, redesign assessment, develop curriculum competencies, and safeguard the credibility of regional qualifications. A coordinated regional approach could establish shared principles for governance, AI literacy, teacher preparation, academic integrity, and learner outcomes while permitting national adaptation. Such leadership would reduce policy fragmentation and support more equitable implementation across member territories.

Empirical Literature Review

Empirical research on AI in education has expanded rapidly as schools, universities, and educational authorities adopt intelligent technologies. Systematic reviews generally indicate that AI can support personalised learning, learner engagement, formative assessment, educational administration, and early identification of students needing assistance when implemented within appropriate pedagogical and ethical structures (Chen et al., 2020; Holmes et al., 2022; Zawacki-Richter et al., 2019). AI-assisted systems may increase motivation through immediate feedback, adapted content, and learner autonomy. Outcomes vary according to teacher competence, institutional leadership, infrastructure, curriculum alignment, and implementation quality. AI should be understood as one component of wider educational reform rather than an independent solution to persistent educational challenges (Luckin, 2018).

Research concerning teacher perceptions consistently identifies professional competence and institutional support as important predictors of adoption. Educators generally recognise AI's potential to improve lesson preparation, differentiation, assessment, and administration but report uncertainty regarding privacy, ethics, assessment integrity, and appropriate classroom use (Trust et al., 2023). Studies across Europe, Asia, and North America similarly demonstrate demand for practical and sustained professional development (European Commission, 2022). Teachers with stronger technological confidence are more likely to experiment with AI, while supportive leadership and collaborative cultures facilitate innovation (Fullan, 2016). Professional development should consequently address pedagogy, ethics, curriculum, and assessment rather than concentrating exclusively upon technical operation.

Studies of learners identify both educational benefits and significant concerns. AI-supported environments may improve engagement, conceptual understanding, writing, and self-directed learning when students receive appropriate guidance (Kasneci et al., 2023). Students may become excessively dependent upon generated content and may possess limited understanding of bias, inaccuracies, privacy, or ethical implications (Long & Magerko, 2020). Structured instruction in AI literacy, academic integrity, source verification, and digital citizenship can strengthen responsible use. Technological familiarity should not be assumed to produce critical or ethical competence automatically.

Comparatively little empirical research has examined AI governance within Caribbean secondary education. Regional studies have generally concentrated upon ICT adoption, digital transformation, online learning, or educational technology rather than generative AI governance and CXC's institutional responsibilities. Much of the available evidence is descriptive and offers limited guidance concerning policy, implementation, risk management, stakeholder accountability, or long-term governance. This shortage requires Caribbean educational leaders to draw heavily upon international findings that may not fully reflect the economic, cultural, and organisational conditions of small island developing states. Research is required that synthesises international evidence while producing implementation models adapted to Caribbean realities.

Research Gap

The literature reveals several gaps that justify the present study. First, although many investigations examine AI in higher education, fewer focus specifically upon secondary education, where students develop critical reasoning, ethical judgement, digital competence, and habits that influence lifelong learning. Second, much of the evidence originates from technologically advanced countries, resulting in limited understanding of implementation within developing systems and small island states. Third, existing studies often examine isolated issues, such as teacher attitudes, student perceptions, technical performance, or academic integrity, without integrating governance, infrastructure, curriculum, professional development, ethics, assessment, and leadership within a unified model.

Fourth, CXC has received little scholarly attention despite its regional influence over curriculum, examinations, certification, and educational quality. Policymakers and educational leaders lack a comprehensive framework for addressing the distinctive governance challenges associated with

AI across Caribbean secondary education. International models developed by UNESCO, the OECD, and the European Commission provide valuable principles but are intentionally broad and require contextual adaptation (European Commission, 2022; OECD, 2023; UNESCO, 2023).

Caribbean education systems possess distinctive characteristics, including regional examinations, constrained resources, infrastructural inequalities, diverse national policies, and varying institutional capacities. Directly transferring models developed for wealthier jurisdictions may overlook important contextual factors and reduce implementation effectiveness. The present study addresses this gap by developing an Artificial Intelligence Governance and Implementation Framework for CXC and Jamaican secondary schools that remains adaptable to the wider Caribbean. By integrating international scholarship, educational theory, governance principles, and regional realities, the investigation contributes original knowledge and offers practical guidance for policymakers, educational leaders, teachers, and examination authorities.

Theoretical Framework

The theoretical framework provides the intellectual foundation upon which the proposed Artificial Intelligence Governance and Implementation Framework is constructed by explaining the relationships among technological innovation, educational practice, organisational change, and responsible governance. A theoretically grounded framework enables researchers to interpret empirical findings systematically while ensuring that recommendations are supported by established scholarly perspectives rather than isolated observations. Because artificial intelligence implementation involves technological, pedagogical, organisational, and ethical dimensions, no single theory adequately explains the complexity of AI adoption within educational institutions. This study adopts four complementary theoretical perspectives: the Technology Acceptance Model, the Diffusion of Innovations Theory, the Technological Pedagogical Content Knowledge (TPACK) Framework, and UNESCO's Human-Centred Artificial Intelligence Governance principles. Collectively, these perspectives explain how educators and institutions adopt emerging technologies, how professional competence influences classroom implementation, and how governance mechanisms promote responsible innovation. The integration of these theories provides a comprehensive explanation of the factors influencing successful AI implementation within the Caribbean Examinations Council (CXC) and Jamaican secondary schools. Accordingly, the theoretical framework offers an interdisciplinary lens through which the proposed governance model may be understood, evaluated, and applied.

Technology Acceptance Model

The Technology Acceptance Model (TAM), originally developed by Davis (1989), remains one of the most influential theories for explaining individuals' willingness to adopt emerging technologies within organisational environments. The model proposes that technology acceptance is primarily determined by two interrelated constructs: perceived usefulness and perceived ease of use. Perceived usefulness refers to the extent to which individuals believe that a particular technology will improve their performance, whereas perceived ease of use concerns the degree to which technology is considered understandable, accessible, and uncomplicated to operate (Davis, 1989). Numerous empirical investigations have confirmed the explanatory power

of TAM across educational settings, demonstrating that teachers who perceive digital technologies as beneficial and manageable are significantly more likely to integrate them into classroom practice (Venkatesh & Davis, 2000). Within the context of artificial intelligence, perceived usefulness may include improvements in lesson planning, differentiated instruction, formative assessment, learner engagement, and administrative efficiency, while perceived ease of use encompasses intuitive interfaces, reliable technical support, and adequate professional development. The theory provides an appropriate foundation for understanding educators' attitudes towards AI implementation within Jamaican secondary schools and offers insight into factors that may encourage or impede widespread adoption.

The Technology Acceptance Model is particularly relevant to the present study because teacher acceptance represents one of the principal determinants of successful AI implementation. Regardless of the sophistication of available technologies, artificial intelligence is unlikely to improve educational outcomes if teachers perceive AI as unreliable, ethically problematic, excessively complex, or inconsistent with curriculum objectives. Conversely, educators who recognise the pedagogical value of AI and possess sufficient confidence to utilise these technologies responsibly are more likely to integrate them effectively into teaching and learning activities. Institutional leadership, professional learning opportunities, policy clarity, and technical assistance may all influence teachers' perceptions of usefulness and ease of use, thereby affecting implementation outcomes. The model supports the argument that AI adoption should be accompanied by continuous professional development rather than assuming that technological availability alone will produce educational transformation. Within the proposed governance framework, TAM explains the behavioural dimension of AI adoption by illustrating how individual attitudes influence institutional implementation. The model provides valuable guidance for designing professional learning initiatives that strengthen teacher confidence and promote responsible AI integration.

Diffusion of Innovations Theory

The Diffusion of Innovations Theory developed by Rogers (2003) provides a broader organisational perspective by explaining how new ideas, technologies, and practices spread throughout social systems over time. Rogers proposed that innovation adoption occurs through a process involving knowledge, persuasion, decision, implementation, and confirmation, with individuals adopting innovations at different rates according to their perceptions and organisational circumstances. The theory classifies adopters into innovators, early adopters, early majority, late majority, and laggards, thereby recognising that technological change rarely occurs simultaneously across institutions. Within educational environments, diffusion is influenced by leadership support, organisational culture, communication networks, professional collaboration, and observable evidence of educational benefit. Innovations perceived as compatible with existing values, relatively simple to implement, demonstrably advantageous, and capable of limited experimentation are generally adopted more rapidly than those lacking these characteristics (Rogers, 2003). These principles have been widely applied to studies examining educational technology integration, curriculum reform, and organisational change because they acknowledge the complex social processes through which innovation becomes institutionalised. The theory provides an appropriate framework for understanding how artificial intelligence may

gradually become embedded within Jamaican secondary schools and the wider Caribbean educational system.

Within the context of this investigation, Diffusion of Innovations Theory emphasises that successful AI implementation depends upon collaborative leadership, effective communication, stakeholder engagement, and institutional learning rather than technological acquisition alone. School leaders function as change agents by communicating the educational rationale for AI adoption, encouraging innovation, allocating resources, and supporting teachers throughout the implementation process. Early adopters may similarly influence colleagues by demonstrating effective classroom applications, sharing successful practices, and reducing uncertainty associated with new technologies. The theory also highlights the importance of pilot implementation, ongoing evaluation, and continuous refinement before large-scale institutional adoption occurs. Such an approach is particularly relevant for CXC because regional implementation requires coordination across multiple educational jurisdictions characterised by differing levels of technological readiness and institutional capacity. By recognising that innovation occurs progressively rather than instantaneously, the theory supports the phased implementation strategy proposed within this study. Diffusion of Innovations Theory strengthens the governance framework by explaining how organisational change can be managed systematically while promoting sustainability and stakeholder confidence.

Technological Pedagogical Content Knowledge Framework

The Technological Pedagogical Content Knowledge (TPACK) Framework developed by Mishra and Koehler (2006) extends earlier conceptions of teacher knowledge by emphasising the dynamic interaction among technological knowledge, pedagogical knowledge, and subject content knowledge. According to the framework, effective technology integration occurs when educators understand not only the operation of digital tools but also how these tools support appropriate pedagogical strategies and subject-specific learning objectives. Teachers require more than technical competence because successful educational innovation depends upon integrating technology meaningfully within curriculum delivery and instructional practice. The framework has become particularly influential within educational technology research because it recognises that technology should enhance rather than dominate teaching and learning processes. Artificial intelligence provides an excellent illustration of this principle because AI applications must be aligned carefully with learning outcomes, assessment practices, learner characteristics, and disciplinary expectations if they are to improve educational quality. TPACK provides a practical explanation of why professional development should address curriculum integration, instructional design, ethical reasoning, and learner engagement in addition to technological skills. This multidimensional perspective aligns closely with the objectives of the present study, which seeks to develop a governance framework supporting responsible and pedagogically sound AI implementation.

The relevance of TPACK to Jamaican secondary education is particularly evident because teachers operate within diverse classroom environments characterised by varying levels of technological infrastructure, learner preparedness, and curriculum demands. Artificial intelligence should be introduced as an instructional resource that enhances pedagogical

effectiveness while respecting teachers' professional expertise and the educational requirements established by CXC. Professional development programmes based upon the TPACK framework would encourage educators to evaluate AI critically, determine appropriate classroom applications, and design learning experiences that promote analytical reasoning, collaboration, creativity, and ethical decision-making. Such preparation would also assist teachers in distinguishing between educationally valuable AI applications and uses that may undermine academic integrity or learner independence. The framework supports interdisciplinary collaboration because AI technologies increasingly influence multiple subject areas rather than remaining confined to computer science education alone. Integrating TPACK within the proposed governance model strengthens its pedagogical foundation by ensuring that technology implementation remains firmly centred upon effective teaching and meaningful student learning. The framework provides an essential bridge between technological innovation and educational practice.

UNESCO's Human-Centred Artificial Intelligence Governance Principles

The fourth theoretical perspective underpinning this study derives from UNESCO's Human-Centred Artificial Intelligence Governance principles, which emphasise that AI should always advance human wellbeing, educational equity, ethical responsibility, and sustainable development (UNESCO, 2023). Unlike traditional technology adoption theories that focus primarily upon individual behaviour or organisational change, UNESCO's framework introduces a normative perspective by identifying the ethical values that should guide AI implementation within education. These principles include transparency, accountability, fairness, privacy, inclusivity, human oversight, cultural diversity, and respect for fundamental human rights. UNESCO argues that educational institutions must ensure that AI strengthens rather than diminishes human agency and that automated systems should never replace professional educational judgement in matters affecting learners' development and welfare. This perspective is particularly important because educational decisions possess profound personal and social consequences extending beyond technical efficiency or organisational productivity. Governance frameworks should incorporate ethical review processes, stakeholder participation, continuous monitoring, and mechanisms for addressing unintended consequences associated with AI implementation. The emphasis upon responsible innovation makes UNESCO's framework especially relevant for educational systems seeking to balance technological advancement with public trust and social responsibility.

Within the Caribbean context, UNESCO's human-centred approach provides an appropriate ethical foundation for the proposed governance framework because it recognises the importance of cultural diversity, educational inclusion, and equitable access to technological innovation. Jamaica and other Caribbean territories must address variations in digital infrastructure, institutional capacity, and socio-economic conditions while ensuring that AI implementation benefits all learners rather than exacerbating existing educational inequalities. The governance principles complement the Technology Acceptance Model, Diffusion of Innovations Theory, and the TPACK framework by introducing ethical accountability as an essential dimension of educational transformation. The resulting theoretical integration enables the proposed framework to explain not only how AI is adopted and implemented but also why implementation should

remain consistent with educational values, democratic principles, and human-centred development. UNESCO's framework encourages continuous policy review because technological innovation evolves rapidly and governance mechanisms must remain sufficiently adaptable to respond to emerging opportunities and challenges. This perspective reinforces the argument that successful AI implementation requires sustained collaboration among governments, educational authorities, schools, teachers, learners, and wider society. Accordingly, UNESCO's principles provide the ethical cornerstone of the proposed Artificial Intelligence Governance and Implementation Framework.

Evidence Mapping Table

Table 1: Evidence Mapping of the Systematic Literature Review to Framework Components

Evidence Theme Identified from Literature	Key Supporting Literature	Main Findings	Implication for Framework Development
Educational leadership and AI governance	UNESCO (2023); OECD (2023); European Commission (2022)	Effective AI implementation requires institutional leadership, strategic planning, governance structures, and policy oversight.	Leadership and Policy became the first governance domain.
Teacher readiness and professional competence	Davis (1989); Mishra & Koehler (2006); Trust et al. (2023); Holmes et al. (2022)	Teachers require AI literacy, pedagogical competence, confidence, and continuous professional learning.	Teacher Professional Development became a core framework component.
Digital infrastructure	OECD (2023); Selwyn (2016); Ministry of Education (2024)	Reliable infrastructure, cybersecurity, internet connectivity, and technical support determine implementation success.	Digital Infrastructure established as a governance pillar.
Curriculum redesign	UNESCO (2023); Luckin (2018); Zawacki-Richter et al. (2019)	AI should be integrated across the curriculum rather than treated as an isolated subject.	Curriculum Integration incorporated into the framework.
Student AI literacy	Long & Magerko (2020); UNESCO (2023)	Students require AI literacy, critical thinking, digital citizenship, and ethical awareness.	AI Literacy developed as a distinct governance domain.
Ethical AI	UNESCO (2023); Floridi & Cowls (2019); OECD (2023)	Responsible AI requires transparency, fairness, accountability, privacy, and human oversight.	Ethical Governance incorporated throughout the framework.

Assessment reform	Bearman et al. (2023); Perkins et al. (2024)	Traditional assessment requires redesign in response to generative AI.	Assessment and Academic Integrity became a dedicated domain.
Continuous improvement	Fullan (2016); OECD (2023)	AI implementation should be monitored continuously using measurable indicators.	Monitoring and Evaluation established as the final governance domain.

Domain Development Matrix

Table 2: Development of the Artificial Intelligence Governance Framework

Framework Domain	Evidence from Literature	Supporting Theory	Practical Purpose
Leadership and Policy	Educational leadership studies; UNESCO; OECD	Diffusion of Innovations	Provides strategic leadership and institutional governance.
Digital Infrastructure	Institutional readiness literature	Diffusion of Innovations	Supports technological implementation and equitable access.
Teacher Professional Development	Teacher readiness studies	TPACK; TAM	Builds teacher competence and AI integration capacity.
Curriculum Integration	AI in education literature	TPACK	Embeds AI into teaching and learning.
AI Literacy	Student competency literature	TAM	Develops responsible AI users and critical thinkers.
Ethical Governance	AI ethics literature	UNESCO Human-Centred AI	Ensures responsible, transparent, and equitable AI use.
Assessment and Academic Integrity	Assessment literature	TPACK	Maintains authenticity and educational quality.
Monitoring and Evaluation	Educational leadership literature	Diffusion of Innovations	Facilitates continuous improvement and framework sustainability.

Justification for Each Governance Domain

Table 3: Justification for the Governance Domains

Governance Domain	Justification
Leadership and Policy	Successful AI implementation requires institutional leadership, governance structures, strategic planning, and policy direction. Leadership establishes organisational vision and accountability.
Digital Infrastructure	AI cannot function effectively without reliable digital infrastructure, cybersecurity, internet connectivity, cloud services, and technical support.
Teacher Professional Development	Teachers remain central to AI implementation. Continuous professional learning enhances confidence, pedagogical competence, ethical awareness, and classroom integration.
Curriculum Integration	AI literacy should be embedded across subject areas and aligned with curriculum outcomes rather than taught as a standalone topic.
AI Literacy	Students require knowledge of AI capabilities, limitations, ethics, critical thinking, and digital citizenship to become responsible users of intelligent technologies.
Ethical Governance	Responsible AI requires fairness, transparency, accountability, privacy protection, human oversight, and compliance with international ethical standards.
Assessment and Academic Integrity	AI changes traditional assessment. Policies are needed to preserve authenticity, originality, fairness, and public confidence in qualifications.
Monitoring and Evaluation	Continuous monitoring ensures that implementation remains effective, responsive, equitable, and aligned with institutional objectives.

Traceability Matrix

This is the most important table because it demonstrates the **chain of evidence** from the literature to the framework.

Table 4. Traceability Matrix Linking Evidence to Framework Components

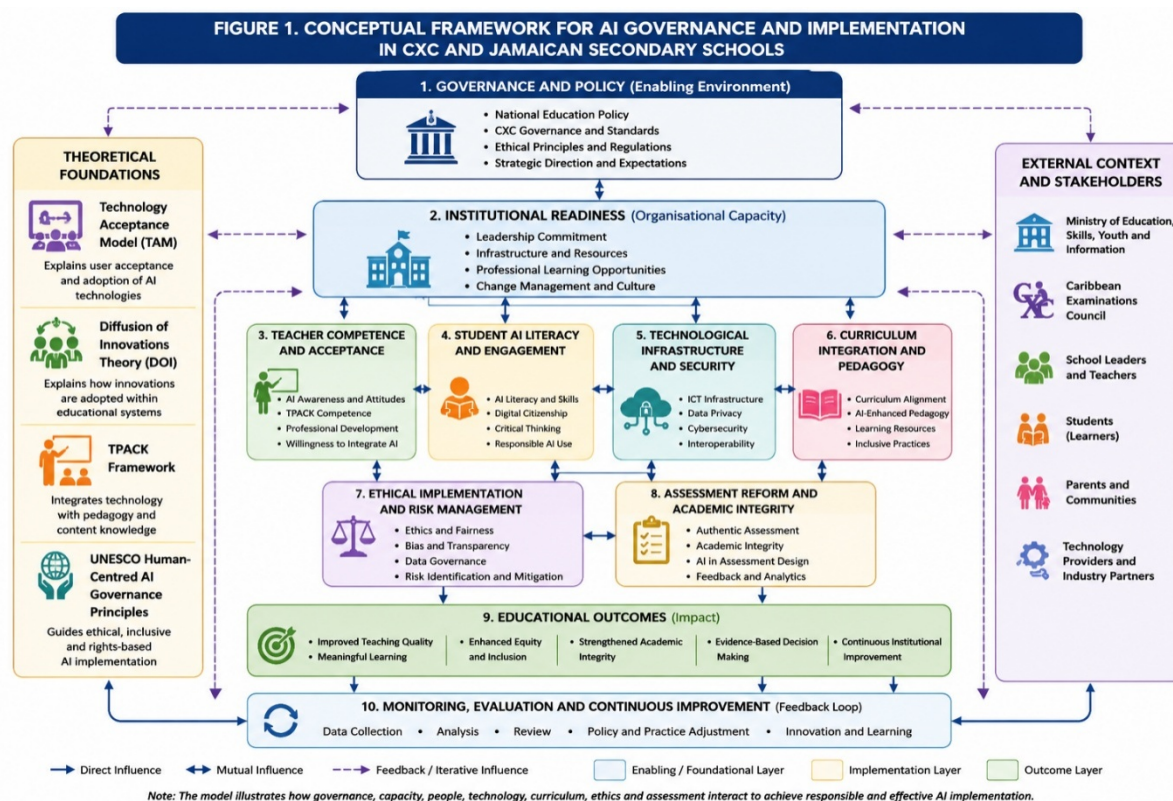
Research Evidence	Design Requirement	Framework Component
AI implementation requires institutional leadership.	Governance structure	Leadership and Policy
Teacher competence predicts AI adoption.	Professional learning system	Teacher Professional Development
Infrastructure determines institutional readiness.	Technology management	Digital Infrastructure
AI should support curriculum rather than replace it	Curriculum redesign	Curriculum Integration
Students require AI competencies.	Student capacity building	AI Literacy

Ethical concerns include privacy, bias, and accountability	Ethical safeguards	Ethical Governance
AI challenges conventional assessment.	Assessment redesign	Assessment and Academic Integrity
AI implementation requires continuous review.	Performance	

Conceptual Framework

The conceptual framework synthesises the four theoretical perspectives into a unified explanatory model illustrating the relationships among educational governance, institutional readiness, teacher competence, student AI literacy, technological infrastructure, curriculum integration, ethical implementation, assessment reform, and educational outcomes. The framework proposes that responsible AI implementation begins with national educational policy and CXC governance, which establish strategic direction, ethical standards, and institutional expectations for schools. These governance structures influence organisational readiness by shaping leadership commitment, infrastructure development, professional learning opportunities, and resource allocation. Institutional readiness subsequently affects teachers' willingness and capacity to integrate artificial intelligence into classroom practice, consistent with the Technology Acceptance Model and the TPACK framework. Simultaneously, students develop AI literacy, digital citizenship, and critical thinking through curriculum experiences that encourage responsible engagement with intelligent technologies. Effective interaction among these components results in improved teaching, meaningful learning, authentic assessment, enhanced educational equity, strengthened academic integrity, and continuous institutional improvement. The conceptual framework provides the structural foundation upon which the Artificial Intelligence Governance and Implementation Framework presented in Study Four is developed.

Figure 1 presented in Study Four illustrates this conceptual relationship by positioning governance as the central coordinating mechanism linking technological innovation with pedagogical practice and educational accountability. The model assumes that governance influences infrastructure, professional development, curriculum reform, assessment policy, cybersecurity, and stakeholder engagement, all of which collectively determine the quality and sustainability of AI implementation. Feedback mechanisms incorporated within the framework allow educational institutions to evaluate implementation continuously, identify emerging challenges, and revise policies in response to technological and educational developments. Such an iterative process reflects the dynamic nature of artificial intelligence and recognises that educational innovation requires continuous adaptation rather than static policy development. The conceptual framework integrates behavioural, organisational, pedagogical, and ethical perspectives into a comprehensive explanatory model capable of guiding responsible AI implementation within CXC and Jamaican secondary schools. This integrated approach distinguishes the present study from previous investigations that have examined isolated aspects of artificial intelligence without providing a comprehensive governance perspective.



Methods and Materials

Research Paradigm

The present study is situated within the pragmatic research paradigm because pragmatism recognises that research methods should be selected according to their ability to address the research problem rather than adherence to a single philosophical tradition (Creswell & Creswell, 2023). Pragmatism is particularly appropriate for investigations that seek to generate practical solutions to complex organisational and educational challenges through the integration of multiple sources of evidence. Artificial intelligence governance represents a multifaceted phenomenon involving educational policy, technological innovation, ethics, organisational leadership, curriculum development, assessment, and institutional management. Understanding this phenomenon requires drawing upon diverse forms of scholarly evidence rather than relying exclusively upon either quantitative or qualitative traditions. The pragmatic paradigm permits the integration of systematic literature synthesis, theoretical analysis, policy evaluation, and expert validation to develop a comprehensive governance framework. This philosophical position is consistent with contemporary educational technology research, where complex implementation challenges frequently require interdisciplinary and practice-oriented solutions. Accordingly, pragmatism provides the philosophical foundation supporting the development of an implementation framework intended to improve educational practice within CXC and Jamaican secondary schools.

Pragmatism recognises that educational policy and governance should ultimately contribute to improved decision-making and institutional effectiveness rather than remaining purely theoretical constructs. The proposed framework is intended to assist policymakers, school leaders, teachers,

and examination authorities in implementing artificial intelligence responsibly while safeguarding educational quality, equity, and academic integrity. Rather than attempting to establish universal laws governing AI implementation, the study acknowledges that educational systems operate within distinctive cultural, organisational, and socio-economic contexts requiring context-sensitive policy responses. This perspective is especially relevant for Jamaica and the wider Caribbean, where educational priorities, technological infrastructure, and institutional capacities differ from those characterising many highly industrialised countries. The pragmatic paradigm consequently supports adaptation of international best practices to regional educational realities while maintaining scholarly rigour and methodological transparency. Pragmatism encourages continuous refinement of governance frameworks as new evidence emerges, reflecting the rapidly evolving nature of artificial intelligence technologies. For these reasons, pragmatism provides the most appropriate philosophical orientation for the present investigation.

Research Design

This investigation employed a Design Science Research (DSR) methodology because the principal objective was to develop and validate an innovative governance framework capable of addressing an identified educational problem. Design Science Research is widely recognised as an appropriate methodological approach for studies seeking to create practical artefacts, models, frameworks, or systems that improve organisational performance while contributing to scholarly knowledge (Peppers et al., 2007). Unlike explanatory research designs that focus primarily upon testing hypotheses, Design Science Research emphasises problem identification, artefact development, iterative refinement, and practical evaluation. Within educational research, this methodology has increasingly been adopted to guide the development of policy frameworks, digital learning systems, educational technologies, and institutional governance models. The present study adopts Design Science Research because it aligns directly with constructing a comprehensive Artificial Intelligence Governance and Implementation Framework for CXC and Jamaican secondary schools. The framework constitutes the primary research artefact, informed by international evidence, educational theory, governance principles, and expert judgement. Design Science Research provides a systematic and transparent process through which scholarly evidence can be translated into practical educational guidance.

The Design Science Research process followed six interconnected stages adapted from Peppers et al. (2007). The first stage involved identifying the educational problem by examining the rapid emergence of artificial intelligence technologies and the absence of comprehensive governance guidance for Caribbean secondary education. The second stage established the objectives of the proposed solution by defining the essential characteristics required of an effective governance framework, including ethical accountability, institutional feasibility, educational relevance, adaptability, and sustainability. The third stage consisted of systematically reviewing the international literature relating to artificial intelligence, educational governance, teacher readiness, assessment, ethics, digital transformation, and policy development. During the fourth stage, these findings were synthesised into a preliminary governance framework incorporating governance principles, implementation processes, stakeholder responsibilities, monitoring mechanisms, and evaluation indicators. The fifth stage focused upon expert validation to determine the relevance, clarity, completeness, and practical applicability of the proposed

framework. Finally, the validated framework was refined and presented as the principal contribution of the study, providing a contextually appropriate model for responsible AI implementation within Caribbean education.

Systematic Literature Review Procedures

The systematic literature review constituted the principal evidence base informing the development of the proposed governance framework. A systematic review was selected because it provides a transparent, reproducible, and comprehensive method for identifying, evaluating, and synthesising existing scholarly evidence while reducing the potential for selection bias (Page et al., 2021). Unlike traditional narrative reviews, systematic reviews employ clearly defined search strategies, eligibility criteria, quality appraisal procedures, and evidence synthesis methods to ensure methodological rigour. Given the rapidly expanding body of literature concerning artificial intelligence in education, systematic review methods were particularly appropriate for identifying international best practices and governance principles relevant to Caribbean educational contexts. The review focused upon peer-reviewed journal articles, policy reports, international organisational publications, and selected scholarly books addressing artificial intelligence, educational technology, governance, ethics, curriculum, assessment, and institutional leadership. Collectively, these sources provided the empirical and theoretical foundation upon which the governance framework was constructed. The systematic review also ensured that the framework reflected contemporary international scholarship while remaining adaptable to Jamaican and Caribbean educational realities.

Electronic database searches were conducted using internationally recognised academic databases, including Scopus, Web of Science, ERIC, IEEE Xplore, ScienceDirect, SpringerLink, Taylor & Francis Online, and Google Scholar. Search terms included combinations of phrases such as "artificial intelligence in education", "generative AI", "AI governance", "educational governance", "secondary education", "teacher readiness", "AI ethics", "digital transformation", "academic integrity", "educational assessment", and "artificial intelligence policy". Boolean operators, truncation symbols, and database-specific search filters were applied to maximise retrieval of relevant publications while reducing irrelevant results. Reference lists of key publications were also examined manually to identify additional studies not retrieved through electronic database searches. Only studies published in English and judged directly relevant to the research objectives were included in the review. Preference was given to recent publications, particularly those published from 2018 onwards, although seminal theoretical works were retained where necessary to establish conceptual foundations. These procedures enhanced the comprehensiveness, transparency, and reproducibility of the literature review that informed the development of the proposed framework.

Eligibility Criteria

Clearly defined eligibility criteria were established before commencing the systematic literature review to ensure methodological transparency, consistency, and reproducibility throughout the evidence selection process. Establishing explicit inclusion and exclusion criteria reduced the potential for selection bias and ensured that all studies were evaluated against the same

predetermined standards, consistent with internationally accepted systematic review methodology (Page et al., 2021). Because the primary objective of the present investigation was to develop an Artificial Intelligence Governance and Implementation Framework, the review focused exclusively upon **primary empirical research studies** rather than systematic reviews or meta-analyses. Restricting the evidence base to primary studies minimised duplication of evidence and prevented the possibility that the same empirical investigations would be represented multiple times through secondary syntheses. This approach also enabled the study to examine original findings directly, thereby strengthening the validity of the evidence underpinning the proposed governance framework. The review provides a coherent synthesis of primary research while avoiding methodological overlap commonly associated with combining multiple levels of evidence within a single systematic review.

Studies were included if they satisfied the following eligibility criteria. First, the investigation had to constitute an original empirical study employing quantitative, qualitative, or mixed-methods research designs. Second, the study had to examine artificial intelligence, generative artificial intelligence, machine learning, intelligent tutoring systems, learning analytics, or closely related AI applications within formal educational settings. Third, the research had to address at least one aspect of educational governance, policy, leadership, ethics, curriculum implementation, teacher readiness, student learning, assessment, institutional management, digital transformation, or educational technology adoption. Fourth, the publication had to appear in a peer-reviewed academic journal or an internationally recognised institutional research report demonstrating rigorous methodological standards. Fifth, publications were required to be available in English to ensure accurate interpretation and synthesis. Finally, emphasis was placed upon studies published between 2018 and 2026 because this period captures the rapid evolution of contemporary artificial intelligence, particularly the emergence and widespread educational adoption of generative AI technologies, while seminal theoretical publications published before this period were retained where necessary to support conceptual development.

Studies were excluded if they did not satisfy the predetermined eligibility criteria. Publications describing artificial intelligence exclusively within healthcare, finance, manufacturing, engineering, military applications, or other non-educational sectors were excluded because they did not address the objectives of the present investigation. Editorials, opinion pieces, conference abstracts lacking full methodological descriptions, dissertations without peer review, newspaper articles, magazine publications, and commercial reports were similarly excluded to maintain academic quality. Studies focusing solely upon higher education without presenting findings transferable to secondary education were carefully assessed for relevance, with only those contributing directly to governance, ethics, or implementation retained for conceptual purposes. Duplicate publications identified across multiple databases were removed before screening to avoid repeated inclusion of identical evidence. Articles for which complete texts could not be accessed despite reasonable efforts were also excluded because methodological quality could not be adequately evaluated. These eligibility criteria ensured that the evidence informing the governance framework remained relevant, methodologically rigorous, and directly applicable to the educational context under investigation.

Study Selection Process

The study selection process followed internationally recognised systematic review procedures consistent with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Statement (Page et al., 2021). Electronic database searches initially identified a substantial number of potentially relevant publications through the predefined search strategy. Retrieved references were exported into reference management software, where duplicate records were identified and removed before screening commenced. The remaining records were screened initially by title and abstract to determine their potential relevance to the research objectives and eligibility criteria. Publications considered potentially eligible proceeded to full-text review, during which each article was examined comprehensively against the predetermined inclusion and exclusion criteria. Studies failing to satisfy the eligibility requirements at any stage of the review process were excluded, and the principal reason for exclusion was documented to enhance methodological transparency. This structured selection process strengthened the credibility of the systematic review by ensuring that study inclusion resulted from explicit methodological criteria rather than subjective judgement.

The PRISMA framework additionally promotes transparency by documenting the number of records identified, screened, excluded, assessed for eligibility, and ultimately included within the final synthesis. Accordingly, the present study includes a PRISMA flow diagram (Appendix A) illustrating each stage of the literature identification and selection process. Maintaining detailed records throughout screening facilitates reproducibility by enabling future researchers to understand how the evidence base was established and to replicate the search strategy if necessary. Systematic documentation assists readers in evaluating the comprehensiveness of the review and identifying potential sources of bias. The transparent application of PRISMA principles enhances both the methodological rigour and credibility of the present investigation. These procedures collectively ensured that the final body of evidence represented the most relevant and methodologically robust empirical literature available at the time of the review.

Quality Appraisal of Included Studies

Following study selection, each eligible publication underwent methodological quality appraisal to evaluate its scientific rigour, credibility, and contribution to the development of the proposed governance framework. Quality appraisal is an essential component of systematic reviews because inclusion alone does not guarantee methodological excellence or the reliability of reported findings (Aromataris & Munn, 2020). Each empirical investigation was evaluated according to criteria appropriate to its research methodology, including clarity of research objectives, appropriateness of study design, sampling procedures, data collection methods, analytical techniques, ethical considerations, transparency of reporting, and consistency between findings and conclusions. Assessing methodological quality enabled the review to distinguish between stronger and weaker evidence while ensuring that recommendations were informed primarily by high-quality research. Studies demonstrating substantial methodological limitations were interpreted cautiously during evidence synthesis, thereby reducing the likelihood that weak evidence would disproportionately influence framework development. This appraisal process

strengthened both the validity and trustworthiness of the governance framework proposed by the present study.

To promote consistency throughout the appraisal process, a structured critical appraisal checklist adapted from the Joanna Briggs Institute (JBI) Critical Appraisal Tools was employed according to the design of each included study (Aromataris & Munn, 2020). Quantitative studies were assessed with respect to sampling adequacy, measurement validity, statistical analysis, management of confounding variables, and internal validity. Qualitative investigations were evaluated according to credibility, transferability, reflexivity, methodological congruence, and the trustworthiness of thematic interpretation. Mixed-methods studies were appraised based upon the quality of both qualitative and quantitative components together with the effectiveness of methodological integration. Rather than assigning numerical scores alone, the appraisal process considered the overall methodological robustness and relevance of each study to the research objectives. This balanced approach recognised that studies employing different methodological traditions may each contribute valuable evidence when conducted rigorously. The quality appraisal ensured that the evidence underpinning the proposed Artificial Intelligence Governance and Implementation Framework was both scientifically credible and educationally relevant.

Data Extraction

Data extraction was conducted using a standardised extraction matrix developed specifically for the present investigation to ensure consistency across all included studies. Standardised extraction procedures reduce the possibility of selective reporting and facilitate systematic comparison among studies addressing related research questions (Page et al., 2021). For each eligible publication, information was extracted concerning author, year of publication, country of study, educational setting, research objectives, study design, participant characteristics, sample size, artificial intelligence application, governance dimensions examined, principal findings, methodological strengths, identified limitations, and implications for educational policy or practice. Additional information relating to ethical considerations, implementation barriers, teacher readiness, student outcomes, leadership practices, infrastructure requirements, and governance recommendations was also recorded where available. Collecting these variables enabled comprehensive comparison across studies despite differences in research design and geographical context. The completed extraction matrix subsequently formed the basis for thematic synthesis and framework development. This structured process enhanced transparency and ensured that all relevant evidence was considered systematically throughout the review.

Data Synthesis

Because the included studies employed diverse research methodologies, educational contexts, and outcome measures, a narrative thematic synthesis was undertaken rather than a statistical meta-analysis. Narrative synthesis is widely recommended when heterogeneity among studies prevents meaningful quantitative pooling of results while still permitting rigorous integration of empirical findings (Popay et al., 2006). Initially, extracted findings were organised into preliminary thematic categories corresponding to the objectives of the present investigation, including governance, ethics, institutional leadership, teacher readiness, curriculum integration, student AI literacy, assessment, digital infrastructure, academic integrity, and implementation

strategies. Relationships among these themes were subsequently examined to identify recurring patterns, common recommendations, contextual differences, and emerging conceptual relationships. Areas of convergence across multiple studies were interpreted as representing stronger evidence supporting framework development, whereas contradictory findings were examined carefully to identify possible contextual explanations. This iterative analytical process enabled empirical findings from diverse educational systems to be integrated into a coherent body of knowledge while recognising differences in institutional context and implementation conditions. The resulting thematic synthesis directly informed the construction of the Artificial Intelligence Governance and Implementation Framework presented in Study Four.

Framework Development Process

The development of the Artificial Intelligence Governance and Implementation Framework followed a structured, iterative process consistent with Design Science Research principles and evidence-informed policy development. Framework development commenced following completion of the systematic literature review and thematic synthesis described in the preceding sections. Rather than constructing the framework from theoretical assumptions alone, each component was derived from recurring themes identified across the empirical literature, supported by established educational theories and internationally recognised artificial intelligence governance principles. This evidence-informed approach ensured that the proposed framework reflected both scholarly knowledge and practical implementation considerations relevant to educational institutions. The framework was intentionally designed to accommodate the unique educational, cultural, technological, and administrative characteristics of Jamaica while remaining sufficiently adaptable for implementation across other Caribbean jurisdictions served by the Caribbean Examinations Council (CXC). The proposed framework represents the synthesis of empirical evidence, theoretical perspectives, educational policy principles, and governance best practices rather than the application of a single predetermined model.

Framework construction proceeded through five sequential phases. The first phase involved identifying the principal governance domains emerging consistently throughout the literature review, including leadership and governance, institutional policy, teacher professional development, curriculum integration, learner preparedness, ethical accountability, digital infrastructure, cybersecurity, assessment reform, stakeholder engagement, and continuous evaluation. During the second phase, these domains were organised into an integrated governance structure illustrating the relationships among institutional leadership, educational policy, implementation processes, and anticipated educational outcomes. The third phase focused upon defining stakeholder responsibilities, recognising that effective artificial intelligence implementation requires coordinated participation from governments, educational authorities, school leaders, teachers, learners, parents, and technology providers. The fourth phase incorporated implementation mechanisms addressing institutional planning, resource allocation, professional learning, monitoring, risk management, and continuous quality improvement. Finally, the preliminary framework underwent expert review and refinement before presentation as the final governance model. This systematic development process strengthened the conceptual coherence and practical applicability of the proposed framework while ensuring that every

component remained directly supported by the evidence synthesised during the systematic literature review.

The completed framework consists of several interdependent governance dimensions designed to function collectively rather than independently. Governance and policy provide strategic direction through legislation, institutional regulations, ethical standards, and accountability mechanisms. Organisational readiness encompasses leadership commitment, financial investment, technological infrastructure, and institutional planning necessary to support sustainable implementation. Professional capacity addresses continuous teacher development, leadership training, and technical support to ensure that educators possess the competencies required to integrate artificial intelligence responsibly into teaching and learning. Curriculum and assessment reforms promote the ethical use of artificial intelligence while preserving authentic learning, critical thinking, creativity, and academic integrity. Continuous monitoring and evaluation provide evidence regarding implementation effectiveness, educational outcomes, stakeholder satisfaction, and areas requiring policy revision. Collectively, these interconnected dimensions provide a comprehensive governance architecture capable of supporting responsible artificial intelligence implementation throughout secondary education.

Expert Validation Procedures

Following development of the preliminary framework, expert validation was undertaken to evaluate its relevance, clarity, completeness, feasibility, and practical usefulness. Validation represents an essential component of Design Science Research because newly developed artefacts should be evaluated by individuals possessing relevant professional expertise before implementation recommendations are finalised (Peppers et al., 2007). Expert review also strengthens the credibility of governance frameworks by incorporating professional perspectives beyond those represented within the published literature. Accordingly, the validation process sought to determine whether the proposed framework adequately addressed the practical realities confronting educational institutions implementing artificial intelligence. Particular attention was devoted to assessing the appropriateness of governance principles, stakeholder responsibilities, implementation procedures, ethical safeguards, and evaluation mechanisms. Feedback obtained through the validation process informed refinement of the framework before presentation as the final research artefact. Expert review enhanced both the scholarly quality and practical relevance of the proposed governance model.

The expert panel was selected purposively because participants were required to possess substantial professional knowledge relevant to artificial intelligence, educational leadership, curriculum development, educational technology, educational policy, or governance. Potential participants included senior officials within ministries of education, representatives of the Caribbean Examinations Council, secondary school principals, educational technology specialists, teacher educators, curriculum officers, information technology professionals, and academic researchers specialising in artificial intelligence or educational innovation. Purposeful sampling ensured that feedback originated from individuals capable of evaluating the framework from multiple professional perspectives while recognising the realities of Caribbean educational systems. Diversity of expertise also strengthened the validation process by incorporating policy,

administrative, technological, pedagogical, and ethical considerations simultaneously. Experts were provided with the preliminary framework together with structured evaluation instruments requesting comments regarding clarity, relevance, comprehensiveness, practicality, implementation feasibility, and recommendations for improvement. Responses were analysed thematically, and suggested revisions supported by multiple experts were incorporated into the final version of the framework. This iterative refinement process increased confidence that the proposed governance framework possesses practical value for educational decision-makers.

Trustworthiness and Rigour

Ensuring methodological rigour constituted a central objective throughout every stage of the present investigation because the credibility of the proposed governance framework depends upon the quality of the evidence informing its development. Multiple strategies were implemented to strengthen the trustworthiness of the research process. Transparency was maintained through comprehensive documentation of the search strategy, eligibility criteria, quality appraisal procedures, data extraction methods, and thematic synthesis processes employed during the systematic literature review. Adherence to internationally recognised methodological guidance, including the PRISMA 2020 Statement and Design Science Research principles, enhanced procedural consistency and reproducibility (Page et al., 2021; Peffers et al., 2007). The integration of multiple theoretical perspectives reduced dependence upon any single conceptual framework and strengthened the explanatory depth of the study. Expert validation provided an additional mechanism for evaluating the practical relevance and conceptual completeness of the proposed governance model. Collectively, these methodological safeguards contribute to the scientific credibility and educational usefulness of the study's findings.

Credibility was strengthened through the inclusion of high-quality empirical evidence obtained from internationally recognised scholarly databases and evaluated using structured quality appraisal procedures. Dependability was promoted by maintaining a clearly documented methodological protocol capable of being replicated by future researchers investigating similar educational governance issues. Confirmability was enhanced by ensuring that framework components emerged from systematic evidence synthesis rather than opinion or unsupported assumptions. Transferability was addressed by providing sufficiently detailed descriptions of the Caribbean educational context to enable policymakers and researchers to determine the applicability of the framework to other educational settings with similar institutional characteristics. Reflexivity was maintained throughout the study by recognising that educational governance is influenced by evolving technological, cultural, organisational, and policy environments requiring continual adaptation. The study does not claim that the proposed framework represents a permanent solution but rather an evidence-informed model capable of evolving alongside future technological developments and educational priorities. These quality assurance procedures collectively strengthen the trustworthiness and scholarly contribution of the investigation.

Ethical Considerations

Although the present investigation primarily synthesised published literature and developed a governance framework rather than collecting sensitive personal information from human

participants, ethical principles remained integral throughout the research process. Ethical research requires honesty, transparency, respect for intellectual property, responsible reporting, and adherence to internationally recognised standards of academic integrity (Resnik, 2020). All published sources included within the systematic review were acknowledged appropriately through APA Seventh Edition referencing to ensure that original authors received proper scholarly attribution. Care was also taken to represent published findings accurately without selective quotation, distortion, or misinterpretation that might mislead readers or misrepresent existing evidence. The literature review was conducted objectively, with inclusion decisions determined exclusively by the predefined eligibility criteria rather than researcher preferences or anticipated findings. The development of the governance framework reflects a balanced synthesis of available evidence rather than advocacy for predetermined policy positions. These practices ensured that the study maintained the ethical standards expected of scholarly research.

Should expert validation involve human participants, ethical approval would be obtained from the appropriate institutional research ethics committee before data collection commenced. Participation would be entirely voluntary, with all participants receiving comprehensive information regarding the purpose of the study, procedures involved, anticipated benefits, and their right to withdraw without penalty at any stage of the investigation. Written informed consent would be obtained before participation, and confidentiality would be maintained through anonymisation of responses during data analysis and reporting. Information collected during the validation process would be stored securely using password-protected electronic systems accessible only to the research team. Findings would be reported collectively rather than attributing individual comments to identifiable participants unless explicit permission had been granted. These procedures are consistent with internationally accepted principles of research ethics, including respect for persons, beneficence, justice, confidentiality, and responsible data management. Adherence to these ethical principles strengthens both the integrity of the research process and the credibility of the resulting governance framework.

Limitations of the Methodology

Despite the methodological strengths of the present investigation, several limitations should be acknowledged. First, the systematic review included only publications available in the English language, thereby potentially excluding relevant evidence published in other languages. Second, because artificial intelligence continues to evolve rapidly, new empirical evidence may emerge following completion of the review that could influence future revisions of the governance framework. Third, the relative scarcity of Caribbean-specific empirical studies required the integration of international evidence that, although carefully contextualised, may not fully capture every regional educational reality. Fourth, the proposed framework is intended to provide strategic governance guidance rather than detailed operational procedures for every individual educational institution. Finally, although expert validation strengthens the practical relevance of the framework, future implementation studies will be necessary to evaluate its effectiveness within real educational settings. Recognising these limitations enhances the transparency of the investigation and provides direction for future research designed to refine and extend the proposed governance model.

Results

Guiding Principles of the Framework

The Artificial Intelligence Governance and Implementation Framework is underpinned by a set of guiding principles that establish the philosophical and operational foundation for all implementation activities. These principles were synthesised from the empirical literature, UNESCO's human-centred approach to artificial intelligence, OECD recommendations for trustworthy AI, and established educational leadership research. The first principle is **human-centred education**, recognising that artificial intelligence should strengthen rather than replace the professional judgement of teachers or diminish meaningful human interaction within educational environments. The second principle is **ethical responsibility**, requiring that all AI applications operate transparently, fairly, accountably, and in accordance with recognised standards relating to privacy, equity, and learner protection. The third principle is **educational quality**, ensuring that AI contributes directly to improved learning outcomes, curriculum delivery, assessment quality, and institutional effectiveness. Collectively, these principles establish the ethical and educational boundaries within which artificial intelligence should operate throughout secondary education.

A fourth guiding principle is **equity and inclusion**, acknowledging that all learners should have fair opportunities to benefit from artificial intelligence regardless of geographical location, socio-economic status, disability, or school resources. Artificial intelligence implementation should reduce rather than reinforce educational inequalities by promoting equitable access to digital infrastructure, assistive technologies, and high-quality learning opportunities. The fifth principle is **continuous professional learning**, recognising that teachers, school leaders, curriculum officers, and examination personnel require ongoing professional development to maintain competence within an evolving technological environment. The sixth principle is **evidence-informed decision-making**, whereby policy development, institutional planning, and implementation strategies are guided by empirical evidence rather than technological enthusiasm alone. Finally, the framework adopts the principle of **continuous improvement**, recognising that governance mechanisms should be reviewed regularly to respond effectively to technological innovation, educational research, legislative developments, and stakeholder feedback. These principles collectively provide the normative foundation supporting every component of the proposed governance framework.

Governance Architecture

The governance architecture consists of four interconnected levels that collectively support responsible artificial intelligence implementation throughout the education system. The first level comprises **national and regional governance**, including the Ministry of Education, Skills, Youth and Information, the Caribbean Examinations Council, relevant government agencies, and legislative authorities responsible for educational policy, data protection, cybersecurity, and national digital transformation. These organisations establish strategic priorities, regulatory requirements, funding mechanisms, curriculum expectations, and accountability standards that guide implementation across all secondary schools. The second level consists of **institutional**

governance, whereby school boards, principals, senior leadership teams, and departmental leaders translate national policy into institutional implementation strategies appropriate to their individual schools. Leadership at this level is responsible for developing local AI policies, allocating resources, coordinating professional development, monitoring implementation, and ensuring compliance with ethical and regulatory standards. Effective collaboration between national and institutional governance creates consistency while permitting sufficient flexibility to accommodate local educational needs. This multilevel governance structure promotes coherent implementation while respecting institutional autonomy and contextual diversity.

The third level of governance focuses upon **instructional implementation**, where teachers integrate artificial intelligence into curriculum delivery, assessment, learner support, and classroom management in accordance with institutional policies and professional standards. Teachers function as the principal educational decision-makers because they determine how AI technologies are incorporated into learning experiences while maintaining pedagogical quality and safeguarding student wellbeing. The fourth level comprises **learner participation and stakeholder engagement**, recognising that students, parents, technology providers, and community partners contribute significantly to responsible implementation. Learners should receive structured opportunities to develop AI literacy, ethical reasoning, digital citizenship, and critical evaluation skills, enabling them to engage responsibly with intelligent technologies throughout their educational and professional lives. Parents similarly require appropriate information regarding school AI policies, learner privacy, acceptable technology use, and mechanisms for addressing concerns. This inclusive governance approach strengthens transparency, accountability, and public confidence while promoting shared responsibility for ethical artificial intelligence implementation across the education sector.

Strategic Governance Domains

The framework is organised around eight strategic governance domains that collectively support sustainable implementation. The first domain addresses **leadership and policy**, emphasising strategic planning, institutional vision, governance committees, regulatory compliance, and organisational accountability. The second domain focuses on **digital infrastructure and cybersecurity**, ensuring that schools possess reliable connectivity, appropriate hardware and software, secure digital environments, and effective mechanisms for protecting educational data from unauthorised access or cyber threats. The third domain concerns **teacher professional development**, requiring systematic training in artificial intelligence literacy, curriculum integration, ethical decision-making, assessment redesign, and instructional innovation. The fourth domain addresses **curriculum integration**, ensuring that AI supports rather than displaces established learning objectives while encouraging creativity, analytical reasoning, collaboration, and responsible technology use. Together, these domains establish the organisational and pedagogical foundations necessary for successful implementation.

The remaining governance domains focus upon learner development, ethical accountability, assessment reform, and continuous improvement. **Student AI literacy** constitutes the fifth domain and promotes learners' understanding of artificial intelligence, algorithmic bias, digital citizenship, information evaluation, responsible technology use, and lifelong learning

competencies. The sixth domain concerns **ethical governance**, including transparency, accountability, fairness, privacy, inclusivity, human oversight, and respect for fundamental rights. The seventh domain addresses **assessment and academic integrity**, encouraging authentic assessment approaches that preserve educational credibility while recognising the realities of AI-assisted learning. The final domain emphasises **monitoring, evaluation, and quality improvement**, requiring educational authorities and schools to collect evidence concerning implementation effectiveness, learner outcomes, stakeholder satisfaction, and emerging risks. Because these domains are mutually reinforcing, improvements within one area strengthen implementation across the broader educational system. Collectively, they provide a comprehensive governance structure capable of supporting responsible and sustainable artificial intelligence integration throughout secondary education.

Implementation Roadmap

Successful implementation of the Artificial Intelligence Governance and Implementation Framework requires a carefully sequenced roadmap that recognises institutional readiness, resource availability, stakeholder engagement, and the evolving nature of artificial intelligence technologies. Immediate, system-wide implementation across all secondary schools is neither realistic nor desirable because educational institutions differ considerably in technological infrastructure, human resource capacity, financial resources, and organisational preparedness. The proposed framework adopts a phased implementation strategy that enables educational authorities and schools to introduce artificial intelligence progressively while continuously evaluating outcomes and refining implementation procedures. This staged approach reduces organisational disruption, promotes stakeholder confidence, and provides opportunities to identify and address emerging challenges before broader implementation occurs. It also allows educational policymakers to align artificial intelligence initiatives with existing national education reforms, digital transformation strategies, and curriculum development programmes. By integrating continuous learning and iterative policy refinement, the implementation roadmap enhances both institutional sustainability and long-term educational effectiveness. The roadmap serves as a practical guide for translating governance principles into measurable educational practice.

The first phase focuses upon **strategic preparation and policy development**. During this stage, the Ministry of Education, Skills, Youth and Information, in collaboration with the Caribbean Examinations Council and other relevant agencies, should establish a national artificial intelligence steering committee responsible for coordinating policy development, stakeholder consultation, legislative review, and strategic planning. Institutional AI governance committees should similarly be established within secondary schools to oversee local implementation activities, identify resource requirements, and coordinate professional learning initiatives. Comprehensive baseline assessments should be conducted to evaluate technological infrastructure, teacher digital competencies, existing educational technology policies, cybersecurity capacity, and institutional readiness. Findings from these assessments should inform school-specific implementation plans that reflect local needs while remaining consistent with national governance standards. Simultaneously, public awareness campaigns should communicate the educational objectives, anticipated benefits, ethical safeguards, and

implementation timeline associated with artificial intelligence adoption. These preparatory activities establish the organisational foundation upon which subsequent implementation phases depend.

The second phase emphasises **capacity building and pilot implementation**. Teacher professional development programmes should be introduced systematically, addressing artificial intelligence literacy, curriculum integration, ethical decision-making, assessment redesign, digital citizenship, and classroom management within AI-supported learning environments. School leaders should receive specialised training focusing on strategic leadership, organisational change management, policy implementation, cybersecurity governance, and educational innovation. Selected pilot schools representing urban, rural, high-performing, and resource-constrained contexts should implement carefully monitored AI initiatives to evaluate practical feasibility under diverse educational conditions. Continuous monitoring throughout pilot implementation should collect quantitative and qualitative evidence relating to teacher experiences, learner engagement, assessment outcomes, technological performance, stakeholder perceptions, and implementation challenges. Lessons learned from pilot schools should subsequently inform revisions to institutional policies, professional learning programmes, technical support systems, and implementation guidelines before wider expansion occurs. This evidence-informed pilot approach reduces implementation risks while strengthening confidence in the governance framework.

The third phase involves **system-wide implementation and continuous improvement**. Following successful evaluation of pilot initiatives, artificial intelligence integration should be progressively expanded across all secondary schools, supported by sustained professional learning, technical assistance, infrastructure investment, and ongoing policy refinement. CXC should simultaneously review curriculum specifications and assessment policies to ensure consistency with responsible artificial intelligence use while preserving academic integrity and assessment validity. National monitoring systems should be established to evaluate implementation progress through regularly collected performance indicators addressing learner achievement, teacher competence, infrastructure reliability, ethical compliance, stakeholder satisfaction, and institutional effectiveness. Annual review processes should examine implementation evidence, identify emerging technological developments, and revise governance policies accordingly to maintain educational relevance. Periodic independent external evaluations should complement internal monitoring to strengthen accountability and public confidence in the implementation process. Through continuous evaluation and adaptive governance, the framework remains responsive to changing technological, educational, and societal conditions rather than becoming static or obsolete.

Roles and Responsibilities of Key Stakeholders

The effectiveness of the proposed governance framework depends upon clearly defined stakeholder responsibilities because artificial intelligence implementation represents a shared educational responsibility rather than the obligation of any single institution. At the regional level, the Caribbean Examinations Council should provide strategic leadership by developing regional policy guidance, reviewing curriculum frameworks, modernising assessment systems,

establishing standards relating to ethical AI use, and facilitating collaboration among member territories. CXC should also coordinate regional research initiatives, disseminate best practices, and encourage continuous professional dialogue regarding emerging developments in artificial intelligence and educational assessment. By performing these functions, the Council strengthens consistency across member states while permitting contextual adaptation according to national educational priorities. Regional leadership also reduces duplication of effort by enabling territories to benefit collectively from shared expertise, research, and policy development. CXC occupies a pivotal position within the governance framework as the principal regional coordinating institution for educational artificial intelligence.

The Ministry of Education, Skills, Youth and Information bears primary responsibility for establishing national policy, legislative alignment, funding priorities, infrastructure development, professional development programmes, and institutional accountability mechanisms supporting artificial intelligence implementation. The Ministry should collaborate closely with CXC, teacher education institutions, technology providers, and national regulatory agencies to ensure policy coherence across the education system. National leadership should ensure equitable distribution of technological resources so that schools located within economically disadvantaged or rural communities possess opportunities comparable to those available within more affluent educational settings. Government investment should prioritise broadband connectivity, secure digital infrastructure, educational software, cybersecurity capacity, technical support, and sustainable funding models. Continuous national monitoring should evaluate implementation progress while informing future policy revisions based upon empirical evidence and stakeholder feedback. Through these responsibilities, the Ministry establishes the enabling environment within which responsible artificial intelligence implementation can occur throughout Jamaican secondary education.

School leaders function as the principal organisational leaders responsible for translating national policy into effective institutional practice. Principals and senior leadership teams should develop school-specific artificial intelligence policies aligned with national governance standards while reflecting local educational circumstances and resource availability. Leadership responsibilities include coordinating professional development, allocating financial and technological resources, establishing institutional AI governance committees, monitoring classroom implementation, managing organisational change, and fostering collaborative professional cultures supportive of educational innovation. School leaders must also ensure that ethical principles relating to privacy, equity, transparency, academic integrity, and learner wellbeing remain central throughout implementation activities. Regular communication with teachers, students, parents, and governing boards strengthens transparency and encourages stakeholder participation in institutional decision-making. Effective instructional leadership constitutes one of the strongest determinants of sustainable and responsible artificial intelligence implementation within secondary schools.

Teachers occupy the central operational role within the governance framework because they determine how artificial intelligence influences daily teaching, learning, assessment, and learner development. Professional responsibilities include integrating AI into curriculum delivery where educationally appropriate, modelling responsible technology use, maintaining assessment

integrity, protecting learner privacy, and encouraging critical evaluation of AI-generated information. Teachers should employ artificial intelligence as a pedagogical support tool that enhances learning while preserving opportunities for independent reasoning, creativity, collaboration, and authentic problem-solving. Continuous professional learning is essential because rapidly evolving technologies require educators to update their knowledge regularly concerning emerging applications, ethical issues, curriculum innovations, and instructional strategies. Teachers should also contribute actively to institutional policy evaluation by identifying implementation challenges, sharing successful practices, and participating in professional learning communities. Their professional expertise remains indispensable despite increasing technological sophistication because meaningful education ultimately depends upon informed human judgement and effective pedagogical relationships.

Students similarly possess important responsibilities within the governance framework because responsible artificial intelligence implementation depends upon ethical learner participation rather than institutional regulation alone. Learners should receive structured instruction regarding artificial intelligence literacy, digital citizenship, responsible online behaviour, information evaluation, algorithmic bias, privacy protection, and academic integrity. Students are expected to utilise artificial intelligence transparently, comply with institutional policies governing acceptable AI use, acknowledge AI assistance where appropriate, and continue developing independent analytical and creative abilities. Parents and guardians likewise contribute by supporting responsible technology use within home environments, encouraging ethical behaviour, engaging with school policies, and participating in educational discussions concerning artificial intelligence. Technology providers should support educational institutions through transparent product design, robust cybersecurity standards, accessible technical support, responsible data management, and ongoing collaboration with educators during implementation. This shared responsibility model recognises that sustainable governance depends upon constructive partnerships among all stakeholders rather than isolated institutional action.

Risk Management

Artificial intelligence implementation inevitably introduces organisational, educational, ethical, legal, and technological risks that require proactive management through structured governance mechanisms. One of the most significant risks concerns the inappropriate use of AI-generated content during assessment, potentially undermining academic integrity, qualification credibility, and public confidence in educational standards. Additional risks include algorithmic bias, learner privacy violations, cybersecurity threats, unequal access to technological resources, excessive dependence upon automated systems, and inadequate teacher preparedness. Failure to address these issues systematically may compromise both educational quality and public trust in artificial intelligence initiatives. Risk management should be embedded throughout every stage of implementation rather than treated as an isolated administrative activity. Effective governance requires continuous identification, assessment, mitigation, monitoring, and review of emerging implementation risks. This proactive approach enables educational institutions to respond rapidly to technological developments while safeguarding learners and maintaining educational integrity.

Risk mitigation strategies should include comprehensive institutional policies governing acceptable AI use, mandatory cybersecurity protocols, routine privacy impact assessments, continuous professional development, ethical review procedures, and regular technological audits. Schools should establish clear reporting mechanisms enabling teachers, students, parents, and staff to raise concerns regarding inappropriate AI use or emerging ethical issues without fear of adverse consequences. Incident response procedures should similarly define responsibilities for investigating potential breaches involving academic misconduct, cybersecurity incidents, data privacy violations, or technology failures. Continuous collaboration among educational authorities, legal experts, technology providers, and cybersecurity specialists will strengthen institutional resilience as artificial intelligence technologies evolve. Periodic policy reviews should ensure that governance arrangements remain aligned with changing legislation, technological capabilities, educational priorities, and international best practices. Through systematic risk management, educational institutions can maximise the benefits of artificial intelligence while minimising potential harm to learners, educators, and wider society.

Monitoring and Evaluation Framework

Continuous monitoring and evaluation constitute essential components of the Artificial Intelligence Governance and Implementation Framework because effective governance depends upon systematic evidence demonstrating whether implementation is achieving its intended educational objectives. Artificial intelligence technologies evolve rapidly, and educational institutions must establish mechanisms capable of identifying emerging opportunities, implementation challenges, unintended consequences, and areas requiring policy refinement. Monitoring should not be viewed solely as an accountability exercise but rather as a continuous organisational learning process that supports evidence-informed decision-making and institutional improvement. Educational authorities should adopt a balanced monitoring system that evaluates governance processes, implementation quality, stakeholder engagement, educational outcomes, ethical compliance, and technological performance simultaneously. Such a multidimensional approach enables policymakers and school leaders to identify implementation strengths while responding proactively to emerging concerns before they compromise educational quality or public confidence. Continuous evaluation strengthens organisational adaptability by ensuring that governance arrangements remain aligned with technological innovation, educational research, and evolving national priorities. Accordingly, monitoring and evaluation function as the feedback mechanism through which the governance framework remains dynamic, responsive, and sustainable.

Evaluation activities should occur at institutional, national, and regional levels to ensure coherence throughout the education system. Individual schools should conduct annual self-assessments examining teacher preparedness, learner engagement, curriculum implementation, infrastructure reliability, assessment practices, cybersecurity performance, and stakeholder satisfaction. These institutional findings should be submitted to the Ministry of Education to facilitate national analysis of implementation progress, resource allocation requirements, policy effectiveness, and regional disparities requiring targeted intervention. At the regional level, the Caribbean Examinations Council should periodically review implementation evidence across member territories to identify common challenges, disseminate successful practices, and

strengthen harmonisation of regional educational standards relating to artificial intelligence. Independent external evaluations conducted every three to five years should complement internal monitoring by providing objective assessments of governance effectiveness, educational impact, ethical compliance, and policy implementation. Findings from these evaluations should inform continuous policy revision and future strategic planning. This integrated monitoring structure supports accountability while promoting continuous organisational learning throughout the Caribbean education system.

Key Performance Indicators

To facilitate objective evaluation of implementation progress, the governance framework proposes a comprehensive set of Key Performance Indicators (KPIs) aligned with each strategic governance domain. Leadership and governance indicators should include the proportion of schools possessing approved artificial intelligence policies, the establishment of institutional AI governance committees, policy compliance rates, and stakeholder participation in governance activities. Infrastructure indicators should assess internet reliability, device availability, cybersecurity preparedness, technical support responsiveness, and utilisation of approved educational AI platforms. Teacher development indicators should evaluate participation in professional learning programmes, demonstrated AI competencies, confidence in classroom implementation, and integration of AI-supported instructional strategies across subject areas. Curriculum indicators should examine the extent to which artificial intelligence literacy, digital citizenship, ethical reasoning, and responsible technology use have been incorporated into classroom instruction and assessment activities. Collectively, these indicators provide measurable evidence concerning institutional readiness and implementation quality. They also enable educational authorities to compare progress across schools and identify institutions requiring additional support or intervention.

Learner-centred indicators should evaluate student AI literacy, digital citizenship competencies, critical thinking skills, ethical awareness, academic integrity, learner engagement, and perceptions of AI-supported learning. Assessment indicators should monitor the adoption of authentic assessment practices, incidence of academic misconduct associated with artificial intelligence, teacher satisfaction with assessment reforms, and student perceptions of fairness and transparency. Ethical governance indicators should assess privacy compliance, cybersecurity incidents, algorithmic bias reporting, accessibility of AI technologies, and stakeholder confidence in institutional governance arrangements. Continuous improvement indicators should evaluate policy review frequency, implementation of evaluation recommendations, stakeholder participation in governance review processes, and institutional responsiveness to emerging technological developments. Financial indicators should similarly monitor investment in digital infrastructure, professional development, maintenance, and technological sustainability to ensure efficient utilisation of educational resources. Together, these indicators provide a comprehensive evidence base for evaluating both implementation effectiveness and long-term educational impact. Their systematic collection enables evidence-informed decision-making while strengthening accountability at institutional, national, and regional levels.

Proposed Governance Model

The proposed Artificial Intelligence Governance and Implementation Framework adopt a cyclical governance model that emphasises continuous interaction among policy development, institutional implementation, monitoring, evaluation, and policy refinement. The model begins with national and regional educational governance, where strategic priorities, legislative requirements, ethical principles, curriculum expectations, and funding mechanisms are established by the Ministry of Education and the Caribbean Examinations Council. These strategic directives subsequently guide institutional governance, during which school leaders develop implementation plans, establish governance committees, allocate resources, coordinate professional development, and formulate school-specific AI policies. Teachers then operationalise these policies through responsible curriculum integration, learner support, assessment redesign, and ethical classroom practice, while students engage actively in developing artificial intelligence literacy, digital citizenship, and responsible technology use. Continuous monitoring generates evidence regarding implementation effectiveness, educational outcomes, stakeholder experiences, and emerging risks. Evaluation findings subsequently inform policy revision, institutional learning, and strategic planning, thereby completing the governance cycle. This iterative process enables artificial intelligence governance to evolve continuously in response to educational evidence and technological innovation.

The governance model additionally recognises that successful implementation depends upon continuous communication and collaboration among all stakeholders rather than hierarchical decision-making alone. Information should flow bidirectionally between policymakers, school leaders, teachers, learners, parents, technology providers, and external regulatory agencies. Stakeholder feedback obtained through surveys, focus groups, professional learning communities, institutional reviews, and independent evaluations should inform periodic revisions to governance policies and implementation procedures. Such collaborative governance strengthens transparency, enhances stakeholder ownership, and increases the likelihood that implementation strategies remain relevant to classroom realities. The model encourages interdisciplinary collaboration because artificial intelligence influences virtually every aspect of educational practice rather than functioning as an isolated technological initiative. By integrating governance, pedagogy, ethics, technology, leadership, and continuous quality improvement within a single conceptual structure, the framework provides a comprehensive model capable of guiding sustainable artificial intelligence implementation across Caribbean secondary education. Figure 4.1 illustrates this governance architecture by demonstrating the dynamic relationships among governance, implementation, evaluation, and continuous improvement.

Policy Implications

The proposed governance framework has significant implications for educational policy throughout Jamaica and the wider Caribbean because it provides a structured approach for integrating artificial intelligence into secondary education while maintaining educational quality and public confidence. National educational authorities should recognise artificial intelligence governance as a strategic policy priority comparable to curriculum reform, teacher professional development, and digital transformation. Policy development should extend beyond technical

guidance to include legislative alignment, ethical standards, institutional accountability, funding mechanisms, cybersecurity requirements, and long-term workforce planning. Ministries of Education should collaborate with universities, teacher education institutions, technology providers, professional associations, and international organisations to establish comprehensive national AI education strategies consistent with broader educational development objectives. Such collaboration will strengthen policy coherence while reducing duplication of effort and ensuring efficient utilisation of limited educational resources. Coordinated regional leadership through CXC provides opportunities for harmonising standards while respecting national educational priorities and contextual diversity. The governance framework offers policymakers a practical blueprint capable of informing future educational legislation and strategic planning throughout the Caribbean.

The framework also highlights the necessity of sustained investment in human capital alongside technological infrastructure. Artificial intelligence should not be viewed merely as a technological procurement initiative but rather as an educational transformation requiring continuous professional learning, curriculum redesign, organisational leadership, and stakeholder engagement. Teacher education programmes should incorporate artificial intelligence literacy, ethical reasoning, educational technology integration, assessment innovation, and digital pedagogy into both pre-service and in-service professional preparation. Educational policymakers should likewise ensure that artificial intelligence initiatives promote educational equity by prioritising schools and communities facing greater technological disadvantage. Sustainable implementation requires long-term financial planning supporting infrastructure maintenance, software licensing, cybersecurity enhancement, technical assistance, and ongoing evaluation. Through these policy commitments, governments can maximise the educational benefits of artificial intelligence while minimising the risks associated with rapid technological change. The governance framework provides not only an implementation model but also a strategic policy agenda supporting the future development of Caribbean education.

Discussion the Study

The systematic review demonstrated that artificial intelligence is no longer an emerging educational technology but has become an increasingly influential component of contemporary teaching, learning, assessment, and educational administration. International evidence consistently indicates that AI possesses considerable capacity to personalise learning, improve administrative efficiency, enhance formative assessment, strengthen learner engagement, and support educational decision-making when implemented within clearly defined governance structures. The literature also revealed that these potential benefits are accompanied by significant ethical, organisational, legal, and pedagogical challenges relating to privacy, algorithmic bias, cybersecurity, academic integrity, teacher preparedness, and equitable access. Technological innovation alone cannot guarantee educational improvement because implementation quality depends upon governance, leadership, institutional capacity, and professional competence. These findings reinforce the central proposition of the present investigation that artificial intelligence implementation should be viewed primarily as an educational governance challenge rather than solely as a technological initiative. The proposed

framework addresses this complexity by integrating technological, pedagogical, organisational, and ethical dimensions within a unified governance model appropriate for Caribbean education.

The findings demonstrated that teacher preparedness represents one of the most influential determinants of successful artificial intelligence implementation. Across diverse educational contexts, teachers consistently expressed willingness to utilise AI where technologies supported curriculum delivery and enhanced learner outcomes, yet many simultaneously identified uncertainties regarding ethical responsibilities, classroom integration, assessment practices, and institutional expectations. This observation aligns with the Technology Acceptance Model, which proposes that technology adoption depends largely upon perceived usefulness and perceived ease of use. The findings additionally support the Technological Pedagogical Content Knowledge framework by demonstrating that effective implementation requires considerably more than technical competence because teachers must integrate artificial intelligence appropriately within subject content and sound pedagogical practice. Accordingly, the governance framework positions professional learning as a central implementation strategy rather than a supplementary activity undertaken after technological adoption. This emphasis recognises that sustainable educational innovation depends fundamentally upon knowledgeable and confident educators.

An important finding concerns the strategic leadership role of the Caribbean Examinations Council and the Ministry of Education in coordinating artificial intelligence implementation throughout the education system. The literature consistently emphasised that educational innovation is more effective where institutional leadership provides strategic direction, policy coherence, stakeholder engagement, and continuous evaluation. Within the Caribbean, the regional influence exercised by CXC creates an important opportunity to harmonise curriculum expectations, assessment standards, and governance principles while respecting national educational priorities. The proposed framework assigns substantial responsibility to regional and national educational authorities for establishing ethical standards, implementation guidance, professional development priorities, and quality assurance mechanisms. Such coordinated leadership reduces policy fragmentation while promoting consistency across schools and member territories. The governance model recognises that successful implementation depends upon collaboration across multiple levels of educational governance rather than isolated institutional initiatives.

Contribution to Theory

The present study contributes to educational theory by integrating four complementary theoretical perspectives into a comprehensive framework explaining responsible artificial intelligence implementation within secondary education. The Technology Acceptance Model explains behavioural factors influencing teacher adoption of AI technologies, while the Diffusion of Innovations Theory illustrates how educational innovation spreads through institutions over time. The Technological Pedagogical Content Knowledge framework provides the pedagogical foundation necessary for meaningful curriculum integration, whereas UNESCO's human-centred governance principles establish the ethical values underpinning responsible educational innovation. Although each theoretical perspective has been applied previously within educational technology research, comparatively few studies have integrated them into a single governance

framework specifically designed for artificial intelligence implementation. The present investigation advances theoretical understanding by demonstrating how behavioural, organisational, pedagogical, and ethical theories complement one another in explaining educational transformation. This interdisciplinary integration provides a more comprehensive explanation of artificial intelligence implementation than would be achieved through reliance upon any single theoretical perspective alone.

The study also contributes conceptually by positioning governance rather than technology as the central organising principle of artificial intelligence implementation. Much existing scholarship has concentrated upon technological capabilities, classroom applications, or learner outcomes without adequately examining the institutional governance arrangements necessary to support sustainable implementation. By contrast, the proposed framework conceptualises governance as the coordinating mechanism linking leadership, infrastructure, curriculum, professional development, assessment, ethics, and continuous quality improvement. This governance-centred perspective extends existing educational technology literature by emphasising that technological effectiveness depends upon institutional capacity and organisational leadership. The study offers a conceptual model capable of informing future investigations examining educational innovation within technologically evolving environments. The framework represents both a practical implementation model and a theoretical contribution to the emerging field of artificial intelligence governance in education.

Implications for Educational Policy and Practice

The proposed governance framework has important implications for educational policy because it demonstrates that responsible artificial intelligence implementation requires comprehensive policy development extending beyond the acquisition of digital technologies. National education strategies should incorporate governance principles addressing ethics, privacy, transparency, accountability, curriculum reform, assessment, teacher professional learning, cybersecurity, and educational equity. Artificial intelligence should be embedded within broader educational reform initiatives rather than implemented through isolated technology projects. Educational policies should establish mechanisms for continuous monitoring, stakeholder engagement, and evidence-informed revision to ensure that governance arrangements remain responsive to technological innovation. Such an approach enables policymakers to balance educational innovation with public accountability while protecting learner wellbeing and maintaining confidence in national education systems. Accordingly, the study provides policymakers with a structured governance model capable of informing future legislation, strategic planning, and institutional regulation.

From an institutional perspective, the framework highlights the importance of distributed leadership, collaborative organisational cultures, and sustained professional learning. School leaders should establish governance structures that encourage teacher participation, interdisciplinary collaboration, and continuous reflection regarding artificial intelligence implementation. Professional development should move beyond technical training to include ethical reasoning, curriculum integration, assessment innovation, learner protection, and responsible decision-making. Schools should likewise establish transparent communication with parents and wider communities concerning institutional AI policies, acceptable technology use,

learner privacy, and academic integrity expectations. These organisational practices strengthen stakeholder confidence while promoting responsible educational innovation. The governance framework offers school leaders a practical roadmap for managing organisational change within increasingly digital learning environments. Adoption of these recommendations is likely to strengthen institutional resilience while supporting high-quality teaching and learning.

Recommendations

Based upon the findings of this study, several recommendations are proposed. First, the Ministry of Education, Skills, Youth and Information should develop a comprehensive National Artificial Intelligence in Education Policy that establishes clear governance standards for all educational institutions. Second, the Caribbean Examinations Council should formulate regional guidelines governing acceptable educational uses of artificial intelligence, assessment integrity, curriculum integration, and ethical implementation. Third, teacher education institutions should incorporate artificial intelligence literacy, educational ethics, digital pedagogy, and AI-supported assessment into both pre-service and in-service professional development programmes. Fourth, all secondary schools should establish institutional AI governance committees responsible for local policy implementation, stakeholder engagement, monitoring, and continuous evaluation. Fifth, governments should prioritise equitable investment in digital infrastructure and cybersecurity to reduce technological disparities among schools. Finally, educational authorities should establish permanent monitoring systems capable of evaluating implementation outcomes and informing continuous policy refinement as artificial intelligence technologies continue to evolve.

Limitations of the Study

Several limitations should be acknowledged when interpreting the findings of this investigation. The study was based primarily upon a systematic review of published empirical literature and depended upon the quality, scope, and geographical distribution of existing research. Although every effort was made to contextualise international evidence appropriately, comparatively few empirical studies have examined artificial intelligence governance specifically within Caribbean secondary education. Some recommendations inevitably reflect adaptation of international evidence to regional educational conditions. Because artificial intelligence continues to develop rapidly, future technological advances may require revision of certain governance recommendations. Finally, although expert validation strengthened the practical relevance of the framework, implementation studies evaluating its effectiveness within operational school environments remain necessary. Recognition of these limitations provides appropriate context for interpreting the study while identifying opportunities for continued scholarly investigation.

Recommendations for Future Research

Future research should evaluate the implementation of the proposed governance framework within Jamaican secondary schools through longitudinal case studies examining organisational change, educational outcomes, and stakeholder experiences over time. Comparative investigations across Caribbean member territories would determine the framework's adaptability within diverse educational systems while identifying contextual factors influencing implementation success. Additional research should also examine the effectiveness of artificial

intelligence professional development programmes, learner AI literacy initiatives, assessment redesign strategies, and institutional governance mechanisms in improving educational quality. Scholars should investigate emerging issues including algorithmic fairness, explainable artificial intelligence, learner wellbeing, cybersecurity resilience, and the ethical implications of increasingly autonomous educational technologies. Quantitative investigations examining relationships among leadership, teacher competence, institutional readiness, and implementation outcomes would complement the conceptual contributions of the present investigation. Such research will strengthen the evidence base supporting responsible artificial intelligence governance while informing future educational policy throughout the Caribbean. Continued scholarly attention remains essential because educational governance must evolve alongside technological innovation to ensure that artificial intelligence consistently serves the best interests of learners and society.

Conclusion

Artificial intelligence represents one of the most significant educational developments of the twenty-first century, offering unprecedented opportunities to enhance teaching, learning, assessment, and institutional effectiveness while simultaneously presenting complex ethical, organisational, and governance challenges. This study responded to the absence of a comprehensive Caribbean-focused governance model by developing an Artificial Intelligence Governance and Implementation Framework specifically designed for the Caribbean Examinations Council and secondary schools in Jamaica. Drawing upon systematic evidence synthesis, established theoretical perspectives, Design Science Research methodology, and internationally recognised governance principles, the study produced a framework that integrates leadership, policy, infrastructure, professional development, curriculum, assessment, ethics, stakeholder engagement, and continuous evaluation within a unified governance architecture. The framework recognises that successful artificial intelligence implementation depends fundamentally upon responsible governance, informed educational leadership, and sustained professional capacity rather than technological innovation alone. It provides educational policymakers, school leaders, teachers, and regional examination authorities with an evidence-informed roadmap for implementing artificial intelligence responsibly while maintaining educational quality, equity, academic integrity, and public trust. As Caribbean education continues its digital transformation, the framework offers a practical and adaptable foundation capable of supporting sustainable educational innovation while ensuring that artificial intelligence remains firmly aligned with human-centred educational values and the long-term development priorities of the region.

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