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Integrating Artificial Intelligence into School-based Sexuality Education in South Africa: Barriers, Enablers, and Pathways for Innovation

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Abstract. Artificial Intelligence (AI) has great potential to transform school-based sexuality education in South Africa by enabling personalised content, improving engagement, and addressing diverse socio-cultural needs. However, the feasibility of AI integration remains uncertain due to limited consolidated evidence, which is exacerbated by the digital divide, unequal access to technology, and varying cultural contexts, particularly in rural communities. This integrated literature review identified the barriers, enablers, and innovative pathways for incorporating AI into sexuality education in South Africa. Following PRISMA guidelines, peer-reviewed and grey literature published from 2020 to 2024 were searched in Scopus, PubMed, Web of Science, and African Journal Online using terms such as "Artificial Intelligence," "sexuality education," and "South Africa." Included studies focused on AI-based tools, platforms, or pedagogies relevant to the South African context. Data were thematically analysed and interpreted through the Technology Acceptance Model to assess perceptions of AI's usefulness, ease of use, and contextual influences. Twelve studies met the inclusion criteria. Barriers included inadequate rural digital infrastructure, limited AI teacher training, ethical concerns, and socio-cultural resistance. Enablers were policy support, youth digital literacy, and multi-sector partnerships. Innovation pathways involved co-designing AI tools, adaptive chatbots, hybrid learning, AI platforms, Virtual Reality simulations, intelligent tutoring, and AI literacy in teacher development. Therefore, AI can transform school-based sexuality education in South Africa if integrated contextually, ethically, and equitably. Future policies and interventions should address barriers and leverage enablers to achieve sustainable and inclusive outcomes. Recommendations were made for future research that should focus on participatory AI design, policy alignment, and impact evaluation.

Keywords: Artificial Intelligence (AI); Sexuality Education; Sexual and Reproductive Health; Digital Health Literacy; South Africa

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1. Introduction

The integration of AI into school-based sexuality education in South Africa opens a compelling space where technological innovation intersects with sensitive pedagogy. While AI holds the potential to enrich learning by personalising content and making lessons more engaging, its application in sexuality education also raises pressing ethical, pedagogical, and socio-cultural questions. Therefore, examining these dynamics is essential to understand not only how AI can enhance teaching and learning but also how it can respond to the contextual realities of South Africa.

1.1 Background and Rationale for the Study

Conventional approaches to sexuality education have long been criticised for being rigid, disengaging, and poorly aligned with learners' developmental stages (Pratiwi et al., 2025; Seo et al., 2021). Moreover, many teachers report feeling ill-prepared to deliver this content, resulting in persistent knowledge gaps and leaving learners without the necessary support (Mavhandu et al., 2022; Pratiwi et al., 2025; Pucchio et al., 2022). These limitations underscore the urgent need for innovative approaches to break down communication barriers and foster more meaningful dialogue in the classroom. In this regard, AI offers a promising pathway. By adapting content to individual learners' contexts and learning styles, teachers can help produce relevant and relatable materials, thereby moving beyond static textbooks and traditional lesson plans.

For instance, adaptive systems can respond to learners in real time, enabling tailored discussions on sensitive issues such as consent, sexual health, and relationships (Chen et al., 2020; Otermans et al., 2024). However, while the opportunities are considerable, AI also introduces a set of profound concerns. Sensitive data handling, privacy, and the risk of algorithmic bias all pose serious ethical challenges. In sexuality education in particular, where learners' safety and dignity are paramount, mishandling personal information or exposing learners to harmful content could have lasting consequences (Baigi et al., 2023; Samuel-Okon & Abejide, 2024). Thus, the potential of AI must be weighed carefully against these risks, reinforcing the need for robust ethical frameworks to guide its responsible deployment (Baigi et al., 2023; Yman & Mohamed, 2023).

Furthermore, structural inequalities complicate this landscape. Many South African schools, particularly those in rural and under-resourced areas, lack the necessary technological infrastructure and teacher training to effectively utilise AI (Pratiwi et al., 2025; Shinnars et al., 2023). In addition, well-intentioned policies aimed at minimising technological distractions often have the unintended effect of limiting access to innovative educational tools (Al-Qerem et al., 2023; Lokaj et al., 2023). Consequently, unless these barriers are addressed directly, there is a real danger that AI adoption could widen, rather than narrow, existing educational inequities.

1.2. Envisioning AI's Role in Sexuality Education

Nevertheless, despite these challenges, AI's promise lies in its ability to reshape pedagogy into something more interactive, responsive, and learner centred.

When applied responsibly, AI can reduce stigma and create safe spaces for learners to engage with sexuality-related topics (Gray et al., 2022; Ibrahim, 2024). One notable example is chatbots or virtual assistants that provide immediate, anonymous access to accurate information. By doing so, these tools empower learners to explore sensitive issues they might hesitate to raise in a classroom, thus helping to normalise discussion around sexuality education (Chen et al., 2020; Uribe et al., 2024). At the same time, AI can serve as a valuable support system for teachers. Analysing learning patterns can identify areas where learners struggle, highlight topics requiring deeper exploration, and suggest resources tailored to their needs (Alenezi, 2024; Shah et al., 2024).

In this way, AI not only strengthens pedagogy but also improves learner engagement and retention of critical information, thereby complementing and enhancing the role of the teacher rather than replacing it. Realising this potential, however, requires more than introducing new tools. Professional development becomes central, as teachers must have the technical, ethical, and pedagogical competencies to use AI confidently in their classrooms (Schiff, 2020; Yman & Mohamed, 2023). Equally important is collaboration across educators, technologists, and ethical boards, which can ensure that AI innovations are both pedagogically valuable and ethically sound.

Moreover, successful integration demands continuous evaluation. By incorporating learner feedback into the design and use of AI systems, schools can ensure these technologies remain responsive, relevant, and contextually appropriate (Cohen et al., 2023; Luo, 2024). In turn, this feedback loop positions learners not as passive recipients but active participants in shaping the tools that affect their education. Therefore, it becomes clear that integrating AI into school-based sexuality education in South Africa is both promising and complex. The country's cultural diversity and digital inequalities make it impossible to adopt a one-size-fits-all model. Although enthusiasm for AI is growing, consolidated evidence on its enablers and barriers in this sensitive area remains limited.

Accordingly, this study is both timely and significant, as it addresses the absence of comprehensive insights into how AI can be ethically and effectively integrated into sexuality education in South African schools, particularly within resource-constrained and socio-culturally diverse contexts. By examining barriers such as infrastructure gaps, ethical dilemmas, and teacher preparedness alongside enablers such as personalisation, learner engagement, and teacher support, the study aims to provide a balanced and context-specific understanding of the opportunities and risks involved. Foregrounding the South African experience is especially important, as the country's socioeconomic inequalities, strong cultural and religious influences, and policy contradictions make it a case study for exploring AI integration. Insights derived from this analysis have implications for national strategies and other low- and middle-income countries facing similar tensions between innovation, equity, and cultural sensitivity.

Therefore, this review seeks to move the conversation beyond abstract debates about technology and toward a grounded exploration of how AI can be harnessed

responsibly to enhance learners' access to accurate, engaging, and contextually appropriate sexuality education in South African schools. In doing so, it provides much-needed evidence to guide policymakers, educators, and technologists in shaping ethical, inclusive, and sustainable pathways for AI-driven innovation in sexual and reproductive health literacy in South Africa.

1.3. Aim of the review

To systematically identify and synthesise evidence on the barriers, enablers, and innovation pathways for integrating AI into school-based sexuality education in South Africa.

1.4. Objectives

- To identify the key challenges hindering the effective integration of AI technologies into school-based sexuality education in South Africa.
- To explore the facilitators that support the effective adoption and implementation of AI in sexuality education within South African schools.
- To investigate emerging AI-products that potentially enhance sexuality education delivery in South Africa.
- To assess educators', students', and policymakers' perceptions of AI's practicality, usability, and cultural appropriateness in the context of South African sexuality education.
- To develop a framework for effectively incorporating AI technologies into school-based sexuality education programs in South Africa.

1.5. Review Questions

- What are the main barriers to integrating AI into school-based sexuality education in South Africa?
- What factors enable the successful integration of AI in sexuality education in South Africa?
- What innovative AI products are emerging to advance sexuality education in South Africa?
- How is AI perceived in terms of usefulness, ease of use, and contextual relevance in South Africa?
- How can AI be integrated to advance School-based Sexuality Education in South Africa?

2. Literature Review

AI is increasingly recognised as a transformative educational force, reshaping learning processes across disciplines. However, its application in sexuality education remains relatively underexplored, particularly in South Africa, where pedagogical, socio-cultural, and infrastructural challenges converge. This literature review synthesises current knowledge on AI integration in school-based sexuality education, focusing on the interplay between technological innovation, teaching effectiveness, and the contextual realities that shape implementation outcomes. The need for this exploration is underscored by the persistent challenges facing sexuality education in South Africa. Traditional approaches have often been criticised for neglecting the diverse cultural contexts within which teaching occurs (Adekola & Mavhandu-Mudzusi, 2022; Fearon et al., 2015;

Mostert et al., 2020). Within this environment, AI is positioned as both a potential solution and a source of new complexities. It requires investigation to determine how it can best be employed in sensitive learning domains.

2.1. Theoretical Framework: Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Davis (1989), provides a sound theoretical foundation for understanding how stakeholders adopt AI technologies. The model highlights two key constructs, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), that shape attitudes toward technology and influence behavioural intentions (Edeh et al., 2021).

In the context of sexuality education, TAM is particularly relevant. Demonstrating usefulness is crucial for justifying the integration of AI into a subject that is inherently sensitive. At the same time, ease of use is vital for ensuring that teachers do not find the technology overly complex (Granić & Marangunić, 2019). Nevertheless, there is a lack of empirical studies that specifically apply the TAM to sexuality education, indicating a gap in theoretical development and validation. Moreover, when applied in South Africa, TAM must be contextualised to account for cultural diversity and socio-economic inequality, which influence how usefulness and accessibility are perceived (Vilaro et al., 2021).

2.2. Barriers to AI Integration: A Multifaceted Challenge

The literature identifies institutional, technological, ethical, and socio-cultural barriers, suggesting no single intervention will suffice. Instead, comprehensive strategies are needed to address the interconnected obstacles limiting AI adoption in school-based sexuality education.

2.2.1. Institutional and Policy Constraints

Institutional readiness is a critical determinant of success. Restrictive policies on using digital devices in classrooms, designed to curb distractions, often inadvertently block access to innovative tools (Pratiwi et al., 2025). This paradox highlights the tensions between traditional educational management and the requirements for technological integration. Insufficient training opportunities leave educators unprepared to integrate AI into pedagogy (Alenezi, 2024; Issa et al., 2024). While some schools permit the use of technology in the classroom, many others have restrictive environments, underscoring the importance of considering the institutional context. However, few studies systematically examine these variations across schools.

2.2.2. Technological Infrastructure Deficits

Infrastructure gaps, particularly in rural areas, reinforce educational inequities (Edeni et al., 2024). Limited computer access, internet connectivity, and technical support make AI integration uneven and unreliable. Educators must also continuously update their skills in response to rapid technological change, which can become overwhelming (AlAli & Wardat, 2024). Notably, there is a lack of research on practical alternatives, such as offline-capable AI tools or mobile-first strategies, that could leverage South Africa's relatively high smartphone penetration.

2.2.3. Ethical and Privacy Concerns

Additionally, infrastructural gaps and ethical considerations surrounding AI usage in sexuality education present complex challenges, particularly regarding data protection and algorithmic transparency (Klímová et al., 2023). The sensitive nature of sexuality education amplifies these concerns, as stakeholders worry about potential mishandling of personal information and algorithmic bias (Alenezi, 2024; Yao & Huang, 2024). The insufficient development of ethical frameworks governing AI use in sensitive educational contexts has emerged as a critical gap (Guan, 2023; Siminto et al., 2023), with the literature lacking comprehensive frameworks that balance innovation with the protection of vulnerable populations.

2.2.4. Socio-Cultural Barriers

Additionally, South Africa's socio-cultural context presents unique challenges. Cultural stigma and taboos surrounding discussions of sexuality create resistance among educators and students toward AI tools addressing these subjects (Kong et al., 2023; Guan, 2023), which is compounded by socio-economic disparities that create unequal access to technology and varying digital literacy levels (Lazarus et al., 2022). Limited exploration of culturally responsive AI design capable of overcoming these barriers indicates significant gaps in culturally sensitive technological development.

2.3. Enablers of Successful AI Integration

Despite these barriers, several enabling factors have been identified, offering practical entry points for advancing AI integration into school-based sexuality education.

2.3.1. Policy Support and Legislative Frameworks

South Africa's legislative environment, including the Protection of Personal Information Act (POPIA) and the Electronic Communications and Transactions Act (ECTA), provides a crucial legal framework for the responsible use of AI in schools (Svård et al., 2024). Government initiatives promoting digital education strengthen institutional support (Opesemowo & Adekomaya, 2024). However, literature shows limited analysis of how such broad frameworks translate into actionable policies for sexuality education.

2.3.2. Professional Development and Capacity Building

Comprehensive professional development emerges as crucial for successful integration. Targeted training that combines technological competencies with pedagogical strategies proves essential (Kim, 2023; Ngabaza, 2023), with experiential learning approaches being particularly effective in shifting educator attitudes (Kim, 2023). Establishing support networks facilitates knowledge sharing and collaborative problem-solving, creating sustainable professional learning communities (Zamiri & Esmaeili, 2024). However, systematic evaluation of professional development program effectiveness remains limited, underscoring the need for more rigorous assessments of capacity-building.

2.3.3. *Community Engagement and Stakeholder Involvement*

Meaningful community engagement constitutes a critical success factor. Building relationships with parents and community leaders fosters trust and acceptance of AI tools (Arendse & Hess-April 2023; Wood & McAteer, 2021). Collaborative partnerships between schools, NGOs, and community stakeholders provide additional resources and support networks (Villiers et al., 2016). Community involvement ensures educational content respects local cultures and resonates with family values, though detailed frameworks for conducting such engagement effectively across diverse cultural contexts remain underdeveloped.

2.4. Innovation Pathways and Emerging Technologies

Several promising technological approaches demonstrate AI's potential for enhancing sexuality education. AI-driven digital health applications, particularly chatbots and virtual assistants, show significant promise for providing confidential, on-demand access to sexual health information, as shown by the acceptability of online sexual health programmes for adolescents (Widman et al., 2019), addressing traditional help-seeking barriers through anonymous engagement (Olamijuwon & Odimegwu, 2021; Scharmanski & Heßling, 2022).

Innovations such as chatbots, gamification, and blended learning point to promising directions for future integration. Gamification strategies engage learners through interactive and scenario-based approaches (Keogh et al., 2019; Patchen et al., 2020). Similarly, augmented reality (AR) and virtual reality (VR) offer immersive simulations to address topics like consent and risky behaviours (Oktadela et al., 2024). Flipped classrooms and blended learning models further show potential by combining AI's personalisation with in-person dialogue (Cabi, 2018; Fernández et al., 2021). However, rigorous comparative evaluations against traditional approaches remain limited.

2.5. User Perceptions and Technology Acceptance

Stakeholder perceptions strongly influence adoption. Learners generally perceive AI as applicable, particularly when it reduces stigma and provides personalised learning opportunities (Mazibuko et al., 2023; Mostert et al., 2020). However, these benefits remain under-evaluated in empirical studies. Ease of use also emerges as a decisive factor: while learners are often technologically proficient, educators vary widely in their confidence and training (Govender et al., 2020; Ngabaza, 2023). Contextual relevance is equally critical. AI applications that incorporate local languages, cultural idioms, and familiar scenarios may be more readily accepted (Bergam et al., 2022; Ward et al., 2018). However, systematic frameworks for culturally responsive design are lacking.

2.6. Critical Gaps

This literature synthesis reveals substantial knowledge gaps requiring investigation: limited empirical validation of theoretical models in sexuality education contexts; absence of longitudinal studies examining sustained effects on educational outcomes and behavioural changes; underdeveloped frameworks for culturally responsive AI tool development; insufficient comparative effectiveness studies; incomplete implementation science frameworks; and inadequate specialised ethical guidelines.

The current study addresses some of these gaps by employing TAM to systematically examine barriers, enablers, and innovation pathways specific to South African contexts. By examining stakeholder perceptions through the lens of perceived usefulness, ease of use, and contextual relevance, this research provides essential insights for developing effective and culturally responsive AI integration strategies. The study's comprehensive examination across multiple levels, from individual acceptance to institutional frameworks, addresses the literature's tendency toward fragmented, single-factor analyses, providing a holistic understanding essential for grasping the complex dynamics shaping AI integration success in sensitive educational domains.

3. Methodology

This integrated review employs a structured approach to identify, evaluate, and synthesise existing literature on integrating AI in school-based sexuality education in South Africa. The methodology is designed to ensure rigour, transparency, and reproducibility.

3.1 Data Collection and Analysis

3.1.1 Eligibility Criteria

Studies were selected based on predefined inclusion and exclusion criteria, guided by a modified PICO framework (Population, Intervention, Comparison, Outcomes). The criteria are summarised in Table 1.

Table 1: Inclusion and Exclusion Criteria

| Category | Inclusion Criteria | Exclusion Criteria |
|-------------------------|--|--|
| Population | Learners, teachers, and education stakeholders in South African primary/secondary schools. | Studies not focused on South Africa. |
| Intervention | AI-based tools, platforms, methods, or pedagogies in sexuality education. | Studies without an AI or sexuality education component. |
| Comparison | Traditional or digital non-AI methods (if applicable). | Not applicable (not mandatory). |
| Outcomes | Barriers/enablers, user perceptions, implementation strategies, innovation approaches. | Opinion pieces or news articles without empirical/conceptual analysis. |
| Publication Type | Peer-reviewed articles (qualitative, quantitative, mixed methods, and review articles) and grey literature (reports, dissertations). | Non-research-based commentaries, editorials. |
| Time Frame | Published between January 2020 and March 2024. | Studies published outside this period. |
| Context | Focus on or mention South Africa. | Studies without a South African context. |

3.1.2. Search Strategy

A comprehensive and systematic search was conducted to identify peer-reviewed and grey literature that explores the integration of AI into school-based sexuality education within the South African context. Four electronic databases were

searched: Scopus, PubMed, Web of Science, and African Journal Online, the latter explicitly selected for its indexing of South African-focused research outputs. The search strategy employed a combination of keyword terms grouped under three conceptual domains. For AI-related content, the following terms were used: “Artificial Intelligence”, “AI”, “machine learning”, “chatbot”, and “intelligent systems”. For sexuality education, the following terms were included: “sexuality education”, “comprehensive sexuality education”, and “CSE”.

Lastly, the geographic scope was defined using “South Africa” and “South African schools. Boolean operators (AND/OR) and truncations were applied to optimise results. In addition to published literature, grey literature was rigorously searched to ensure contextual relevance and capture non-indexed programmatic evidence. Key sources included reports from the South African Department of Basic Education, UNESCO regional publications, and relevant outputs from NGOs such as Soul City Institute and loveLife. Google Scholar was also used to identify relevant theses and dissertations.

3.1.3 Study Selection Process

A two-phase screening process was implemented to determine study eligibility, guided by the PRISMA flow diagram, as shown in Figure 1.

Phase 1: Title and Abstract Screening

The researcher screened the titles and abstracts of all retrieved studies using predefined inclusion and exclusion criteria and engaged the services of two independent reviewers. The review team consisted of two investigators: The first reviewer is a public health scholar specialising in digital health, SRH and technology-enabled learning, and the second reviewer is a qualitative researcher with experience in thematic synthesis and systematic review. Each reviewer independently screened titles, abstracts, and full texts, followed by a consensus meeting to resolve discrepancies.

Phase 2: Full-Text Review

Studies that met the initial screening criteria underwent a full-text review to assess relevance and methodological quality. Only studies that addressed AI interventions or frameworks within sexuality education in the South African context were included in the final synthesis. Only 12 studies have highlighted the underexplored nature of this topic, particularly regarding the use of AI in school-based sexuality education in South Africa. This scarcity of research underscores the novelty of the field and reinforces the importance and relevance of the present study.

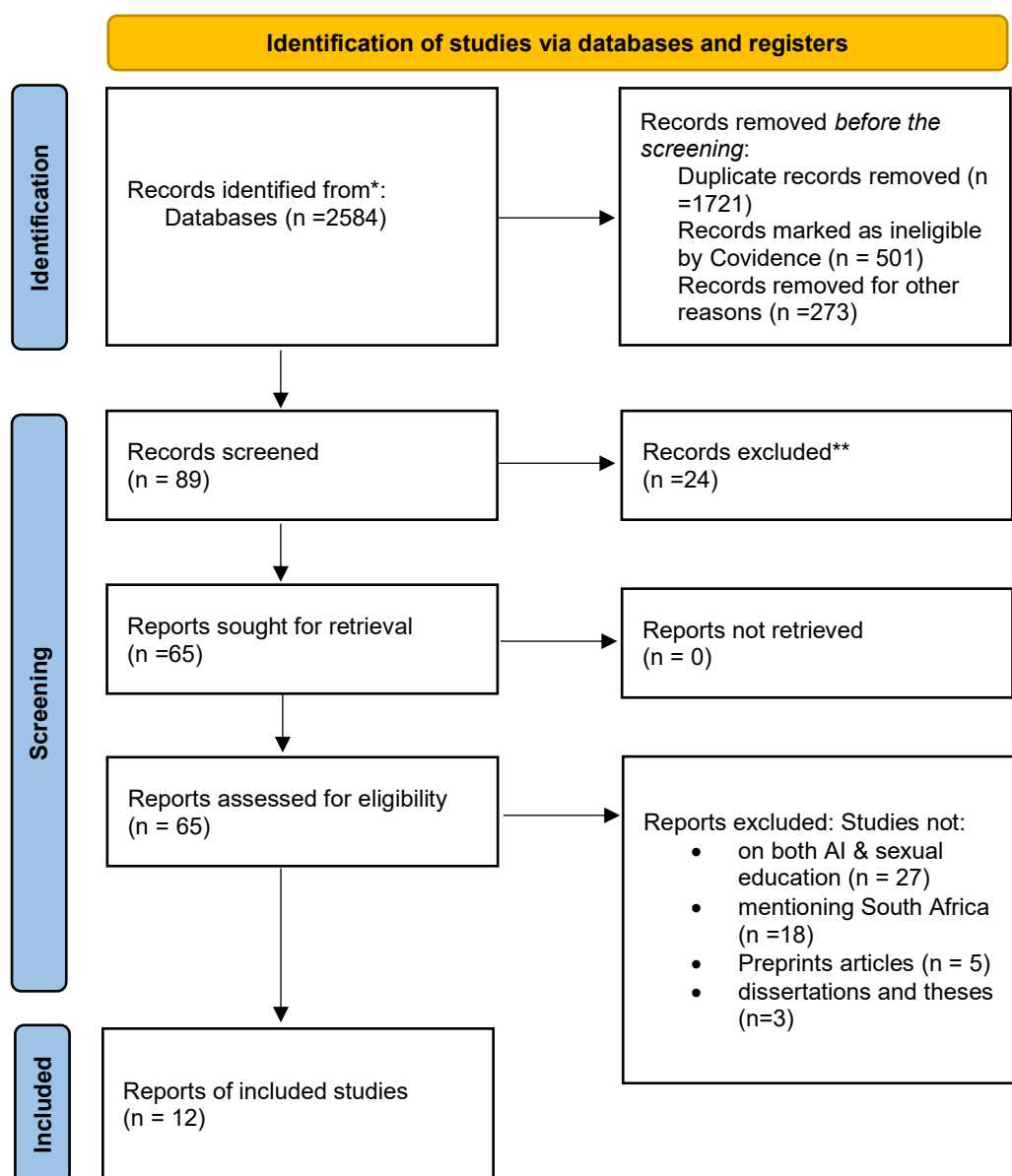


Figure 1: Article Selection Process Guided by PRISMA

3.1.4. Data Extraction

Data were systematically extracted using a structured data extraction form. The following fields were captured for each included study, as shown in Table 2:

- Author(s), year of publication, and study location
- Study aim, design, and target population
- Type and description of the AI intervention
- Role of AI in sexuality education
- Reported barriers and enablers.
- User perceptions, aligned with the TAM
- Recommendations and policy relevance

3.1.5. Quality Appraisal

To ensure methodological rigour, included studies were appraised using appropriate tools based on study type. The Mixed Methods Appraisal Tool (MMAT) assessed peer-reviewed studies of diverse designs. Grey literature, including reports and theses, was evaluated using the AACODS Checklist, which examines Authority, Accuracy, Coverage, Objectivity, Date, and Significance.

Table 2: Profile of the selected studies

| Author(s), Year, Study Location | Study aim, design, and population | Type and description of AI intervention | Role of AI in sexuality education | Reported barriers/enablers | User perceptions (aligned with TAM) | Recommendations or policy relevance |
|--|---|--|---|---|--|---|
| Abdul Hamid Alhassan et al. (2025). Sub-Saharan Africa | Systematic review exploring digital tools for SRH among adolescents and youth | Various digital educational tools; limited direct AI focus | Minimal; highlights potential but is not evaluated directly | Barriers: Infrastructure, literacy; Enablers: Mobile access, youth interest | Limited data; usefulness implied through engagement | Encourages tech integration in SRH education policy |
| Bergam et al. (2022). South Africa | Qualitative study with adolescents living with perinatal HIV | Interactive mHealth tool with decision logic, not full AI | Interactive delivery of SRH content; AI potential suggested | Barriers: stigma, digital access; Enablers: anonymity, self-paced learning | High usefulness, ease of use reported | Support scale-up of mobile SRH platforms |
| Bolarinwa et al. (2024). Global | Commentary on SRHR and AI | General AI applications in SRHR, no specific platform | Discusses theoretical benefits and ethical risks | Barriers: data bias, surveillance; Enablers: innovation potential | Speculative; assumes trust and usefulness challenges | Urges ethical regulation and participatory design |
| Isaacs et al. (2024). South Africa | Scoping review on mHealth and adolescent SRH uptake | mHealth tools, a few with AI features | Indirectly, platforms may use recommendation algorithms | Barriers: infrastructure, digital divide; Enablers: mobile phone use | Positive toward digital tools in general | Supports integration of digital SRH services in schools |

| | | | | | | |
|--|---|--|--|---|--|--|
| Mondal & Mondal (2025). Global | Commentary on LLM chatbots in sex education | Large Language Models (LLMs) as potential sex educators | Explored conceptually; potential to answer private SRH queries | Barriers: misinformation risk, ethical concerns | Predicted high usefulness, ease of use if designed ethically | Recommends research and safety protocols for LLMs |
| Olamijuwon & Odimegwu (2021). South Africa | Quantitative modelling of youth use of social media for sexuality education | Social media platforms; indirect AI via algorithm curation | AI curates and personalises content | Barriers: misinformation; Enablers: access, peer networks | Perceived usefulness and attitude influence adoption | Calls for media literacy and AI transparency |
| Olawumi & Mavuso (2022). South Africa | Conceptual paper on educational strategies post-COVID | Broad mention of AI, not sexuality education-specific | Theoretical support for AI-enabled learning | Barriers: resource limits; Enablers: teacher innovation | Not directly assessed | Suggests AI teacher training and curriculum innovation |
| Opesemowo & Adekomaya (2024). South Africa | Qualitative study on AI for SDGs in higher education | AI for learning analytics and academic support | Not focused on SRH, indirect relevance | Barriers: data ethics, access; Enablers: institutional buy-in | Generally positive; focused on academic use | Suggest AI use in curricula alignment with SDGs |
| Sekati (2025), Africa | Legal perspective on AI bias in SRH | AI algorithms in healthcare systems | Highlights data bias risks in SRHR tools | Barriers: algorithmic bias, discrimination | Focus on risks; trust issues predicted | Policy reforms for ethical, rights-based AI |
| Soehnchen et al. (2024). Kenya | Case study on a web-based sexual education app | Digital platform; limited AI (adaptive features) | Interactive learning in low-resource settings | Barriers: device access; Enablers: cultural adaptation | Positive feedback on usability and relevance | Scalable model for digital SRH interventions |

| | | | | | | |
|--|---|--|---|--|---|---|
| | | inferred) | | | | |
| World Health Organization (2024), Global | Technical brief on AI in SRHR | Global overview of AI applications in SRHR | Highlights innovative use cases and risks | Barriers: bias, inequality; Enablers: personalisation, reach | Caution on data trust, highlights opportunity | Policy recommendations for inclusive AI systems |
| Yana et al. (2024), Indonesia | Literature review on digital media and adolescent SRH | Digital education media; no explicit AI | Not addressed directly | Barriers: digital access; Enablers: online engagement | Generally positive toward digital learning | Support digital literacy in SRH education |

3.1.6. Data Synthesis and Analysis

The data were analysed thematically using Clarke and Braun's (2014) six-step approach, allowing for inductive and deductive coding. This process enabled the identification of recurring patterns, which were subsequently organised into three overarching analytical domains. The first domain, barriers, encompassed factors that hindered AI integration in school-based sexuality education, including inadequate digital infrastructure, ethical concerns, and insufficient teacher training in AI technologies. The second domain, enablers, reflected the supportive conditions that facilitated integration, including growing levels of digital literacy among young people, supportive policy environments, and the benefits of multi-sector collaboration. The third domain, innovation pathways, highlighted emerging opportunities for technology-driven interventions, such as co-designed chatbots, virtual reality simulations, and adaptive AI learning platforms.

TAM served as the guiding conceptual framework to deepen the interpretation. This lens provided a structured way of examining how educators, learners, and other stakeholders perceived and engaged with AI in the context of sexuality education. Four key TAM constructs informed the synthesis: Perceived Usefulness, which relates to the extent to which stakeholders viewed AI as beneficial to teaching and learning; Perceived Ease of Use, which reflects the degree of effort required to use AI tools effectively; Attitude Toward Use, which shaped willingness or resistance to adoption; and External Variables, including cultural norms, socio-economic conditions, and institutional readiness, which mediated acceptance and implementation outcomes.

4. Results and Findings

The table of emergent themes is shown below in Table 3:

Table 3: Table of themes

| Theme | Sub-themes | Supporting Studies |
|--|---|---|
| Barriers to AI Integration | Digital divide, Ethical concerns, Teacher training gaps, Cultural resistance | Alhassan et al. (2025); Bolarinwa et al. (2024); Olawumi & Mavuso (2022); Olamijuwon & Odimegwu (2021); Sekati (2025) |
| Enablers of AI Integration | Youth digital literacy, Policy frameworks, Multi-sector partnerships, Mobile phone access | Isaacs et al. (2024). Soehnchen et al. (2024); World Health Organization (2024); Yana et al. (2024) |
| Innovation Pathways for AI in Sexuality Education | Chatbots, Adaptive platforms, Hybrid learning models, Virtual reality, AI in teacher training | Alhassan et al. (2025); Bergam et al. (2022); Mondal & Mondal (2025). Opesemowo & Adekomaya (2024); WHO (2024) |
| User Perceptions and Acceptance (TAM) | Perceived usefulness, Ease of use, Attitudinal readiness, Institutional trust | Alhassan et al. (2025); Bolarinwa et al. (2024); Olamijuwon & Odimegwu (2021). Bergam et al. (2022); |
| Policy and Ethical Considerations | AI governance; SRHR principles; Bias in algorithms; Cultural sensitivity | Bolarinwa et al. (2024); Opesemowo & Adekomaya (2024); Sekati (2025); WHO (2024). |

4.1. Barriers to AI Integration

A recurring theme across the reviewed literature was the presence of significant barriers hindering the integration of artificial intelligence into sexuality education in South Africa. Key obstacles included the persistent digital divide, especially in rural areas where internet access and device availability remain limited (Alhassan et al., 2025; Olawumi & Mavuso, 2022). In addition to infrastructural deficits, ethical concerns related to privacy, algorithmic bias, and consent were flagged as pressing issues (Bolarinwa et al., 2024; Sekati, 2025). A further challenge involved the insufficient training of educators to effectively use AI-based tools in classroom settings, compounded by resistance from communities that may perceive AI-driven sexuality education as culturally insensitive or inappropriate (Olamijuwon & Odimegwu, 2021).

4.2. Enablers of AI Integration

Despite these barriers, several enablers were identified that could support the successful adoption of AI in school-based sexuality education. One of the strongest facilitators was youth digital literacy, with studies showing that many young people already engage with digital platforms in their daily lives (Isaacs et al., 2024; Yana et al., 2024). Supportive policy environments and frameworks that promote digital innovation in education were also cited as critical (World Health Organisation, 2024). Furthermore, multi-sector partnerships, including schools, tech developers, NGOs, and health services, were recognised as essential for co-

designing relevant and context-appropriate AI interventions (Soehnchen et al., 2024).

4.3. Innovation Pathways for AI in Sexuality Education

The reviewed studies highlighted multiple innovative applications of AI that could be leveraged to enhance the delivery of sexuality education. These included AI-powered chatbots that offer anonymous answers to learners' questions at any time of day; adaptive learning platforms that personalise content based on user input; and hybrid models that combine in-person teaching with digital modules (Bergam et al., 2022; Mondal & Mondal, 2025). Virtual reality simulations and the integration of AI into teacher development programs were also explored as future-facing approaches to enhance interactivity and inclusivity in sexual health education (Alhassan et al., 2025; Opesemowo & Adekomaya, 2024; WHO, 2024).

4.4. User Perceptions and Acceptance

User perceptions, analysed through the lens of the Technology Acceptance Model, emphasised the importance of perceived usefulness and ease of use in shaping attitudes toward AI tools in sexuality education. Learners demonstrated high engagement when they perceived AI platforms as helpful and easy to navigate (Bergam et al., 2022; Olamijuwon & Odimegwu, 2021). Moreover, attitudes toward AI were more positive when users trusted the institutions delivering the content and when the platforms demonstrated sensitivity to local norms and values (Alhassan et al., 2025; Bolarinwa et al., 2024). Furthermore, data analysis revealed that users held mixed perceptions regarding AI integration, expressing concerns about cultural sensitivity, potential misalignment with local norms, and varying readiness among schools. Users emphasised the need for AI-driven tools that incorporate local languages, culturally embedded examples, and contextually relevant narratives to ensure acceptability.

4.5. Policy and Ethical Considerations

Finally, ethical and policy considerations were central to the discussion of AI's future role in sexuality education. The need for AI governance frameworks that uphold sexual and reproductive health and rights (SRHR) principles was strongly emphasised (Bolarinwa et al., 2024; WHO, 2024). Concerns about bias embedded in algorithms and the potential for culturally inappropriate content further underscore the necessity of inclusive, transparent, and accountable design processes (Opesemowo & Adekomaya, 2024; Sekati, 2025). Technological capabilities, human rights, social justice, and contextual relevance must guide ethical integration.

5. Discussion

Several barriers impede the effective integration of AI in sexuality education frameworks in South Africa. Research indicates that socio-cultural and systemic challenges are predominant. Adekola and Mavhandu-Mudzusi (2021) note that disparities in access to technology, teacher training insufficiencies, and cultural resistance to discussing sexuality contribute significantly to the challenge. Similarly, Smith and Harrison (2013) emphasise that in rural areas, students often face resource limitations that hinder their access to advanced educational

technologies. This theme resonates with findings from Mavhandu et al. (2022), who document educators' reluctance to address sexuality topics due to prevailing societal attitudes and the fear of backlash from parents and communities.

Furthermore, technical barriers, such as inadequate infrastructure and limited availability of suitable AI tools designed for local education conditions, exacerbate the situation. Scholars highlight that the lack of proper technological support and training leads to hesitancy in using innovative tools that could enhance learning outcomes (Adekola & Mavhandu-Mudzusi, 2021). Therefore, addressing these barriers is fundamental to improving the educational landscape surrounding sexuality. In contrast, several enablers can facilitate the integration of AI into sexuality education. The increasing presence of mobile technology and digital platforms offers unique opportunities for delivering information outside traditional classroom settings (Adekola, 2023). The proliferation of social media platforms can support broader discussions on sensitive topics by creating accessible channels for information dissemination (Bastien et al., 2011).

Moreover, investing in teacher professional development is crucial for the successful integration of AI. Training programs that enhance educators' digital literacy equip them with the necessary skills to utilise AI effectively, fostering a more positive attitude toward technology (Adekola & Mavhandu-Mudzusi, 2021; Mavhandu et al., 2022). This aligns with the findings of Fearon et al. (2015), who noted the importance of equipping educators with skills to facilitate discussions among youth, utilising AI-enhanced methods for increased engagement. Innovation pathways play a crucial role in transforming sexuality education through the use of AI. Leveraging gamification and interactive technologies significantly enhances student engagement, thereby providing alternative modes of learning that resonate more strongly in diverse cultural environments (Adekola, 2023; Bastien et al., 2011).

Integrating virtual reality applications can enrich educational experiences by providing immersive learning scenarios, offering students practical opportunities to discuss consent and safe practices (Mazibuko et al., 2023). Developing AI-driven platforms allowing for personalised learning experiences based on individual students' needs and preferences has immense potential. This target-oriented approach could directly address the unique socio-cultural variables of different communities, Adekola & Mavhandu-Mudzusi (2021). Furthermore, collaborative efforts among educational institutions, governments, and local organisations can provide necessary resources, framing a significant pathway for overcoming existing barriers and enhancing infrastructure for teaching sexuality education (Mchunu et al., 2013). User perceptions regarding AI tools in sexuality education are crucial for anticipating and mitigating barriers to their integration.

TAM, which emphasises perceived usefulness and ease of use, is a valuable framework for this analysis. Studies indicate that educators and students who find AI tools beneficial for improving learning outcomes and user-friendly are more likely to adopt them. For instance, Dookhith et al. (2024) highlight a significant influence that peer interaction has in fostering a positive environment for

discussing sensitive topics, thereby shaping acceptance of educational technologies. Applying TAM in this context enables the identification of specific factors that hinder or facilitate acceptance. Users might resist AI tools perceived as cumbersome or irrelevant for their context, emphasising the crucial need for culturally sensitive content (Fearon et al., 2015). By employing TAM in a study, the researchers can quantify acceptance levels, providing actionable insights into areas where additional support or training may be required. Addressing policy and ethical considerations is paramount for the responsible integration of AI in sexuality education.

Current regulations, such as those governing data privacy and minors' access to information, must be effectively navigated to protect students while promoting educational innovation (Mazibuko et al., 2023; Ward et al., 2018). Policymakers should collaborate with educators and community leaders to establish guidelines regulating the use of AI in education, ensuring that ethical standards and AI applications align with local cultural values and beliefs (Mazibuko et al., 2023).

Moreover, as Adekola and Mavhandu-Mudzusi (2021) stress, consideration must be given to how sexuality education programs can become more inclusive and respectful of diverse perspectives. Researchers must engage with ethical frameworks that prioritise students' safety, respect their agency in learning about sexuality, and ensure accountability among technology providers. A healthy discourse initiated by community stakeholders about sexuality education can further enhance the integration of AI while alleviating stigma associated with discussing sensitive topics (Mavhandu et al., 2022).

5.1. Framework for AI integration in School-based Sexuality Education in South Africa

This framework (Figure 2) is the product of the findings of this study and their theoretical interpretation through the TAM. It demonstrates how the interplay of barriers such as infrastructural deficits, ethical risks, inadequate teacher training, and socio-cultural resistance and enablers like youth digital literacy, supportive policy environments, and multi-sector partnerships shape the emergence of innovation pathways, including AI-powered chatbots, adaptive learning platforms, virtual reality tools, and teacher support systems.

User perceptions mediate these pathways, conceptualised through TAM constructs perceived usefulness, ease of use, attitudes, and external variables. Simultaneously, policy and ethical considerations, such as governance, privacy, cultural appropriateness, and SRHR principles, ensure a responsible design and uptake. Therefore, these domains highlight actionable pathways to guide policymakers, educators, and developers in the inclusive and sustainable implementation of AI in South African school-based sexuality education programmes.

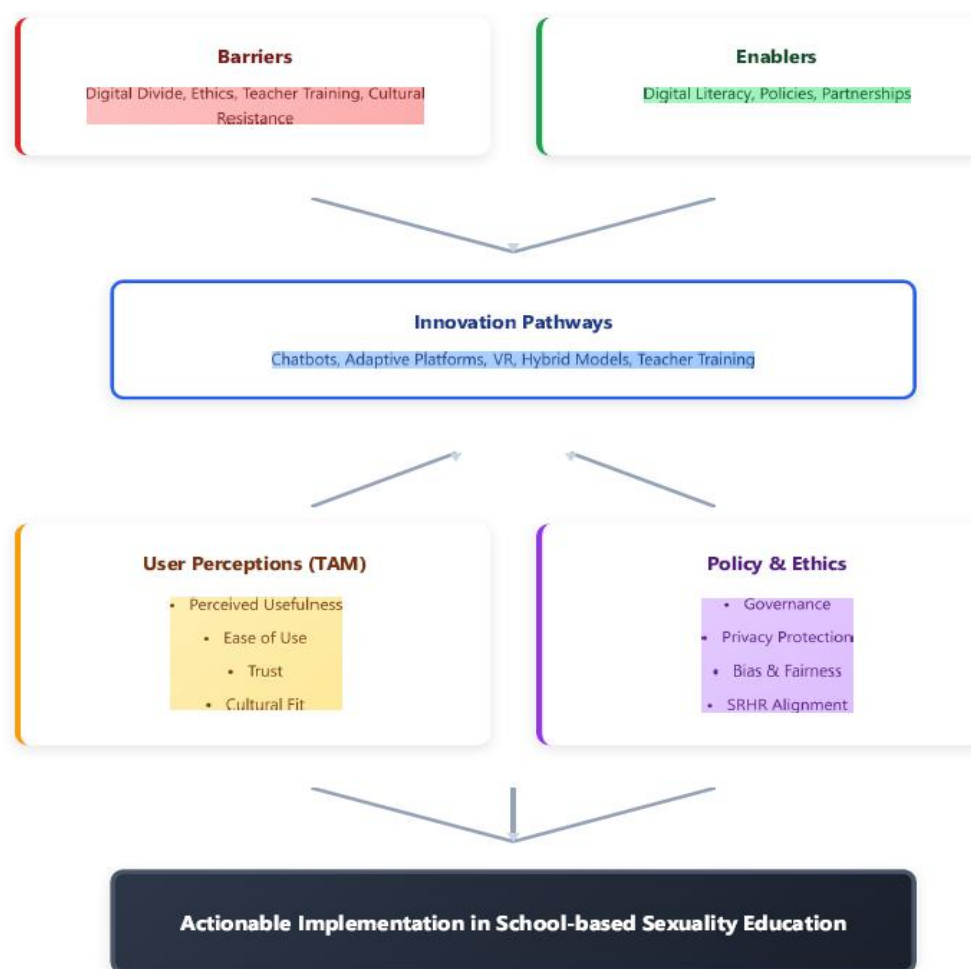


Figure 2: Framework for AI integration in School-based Sexuality Education in South Africa

5.2. Limitations of the study

The limitations of this study include its reliance on the existing literature, which remains sparse on AI applications in South African sexuality education contexts. The rapid pace of technological advancement of AI implies that current insights must be interpreted in light of emerging developments in the field. Although TAM provides theoretical grounding, it fails to adequately capture the complex socio-cultural, political, and infrastructural dynamics unique to South Africa's diverse educational landscape. The proposed framework remains conceptually and empirically untested in actual school settings, thereby limiting its validation of practical applicability. Additionally, the review's focus on published literature may overlook valuable grey literature and community-based initiatives. At the same time, its cross-sectional nature cannot account for the longitudinal evolution of stakeholder attitudes and policy developments.

5.3. Recommendations for Future Research

Future studies should explore long-term behavioural outcomes of AI-supported sexuality education, compare AI-driven interventions across rural and urban settings, and investigate ethical concerns such as data privacy, cultural

appropriateness, and algorithmic bias. Mixed-methods and participatory designs involving adolescents and educators are recommended

6. Conclusion

This study demonstrates that while significant barriers, including digital divides, ethical concerns, and cultural resistance, challenge the integration of AI in South African sexuality education, substantial enablers exist through youth digital literacy, supportive policies, and multi-sector partnerships. Furthermore, this study contributes to a nascent but critical field by synthesising available evidence and offering a grounded framework to guide policy and practice. It provides a foundation for designing equitable, inclusive, and contextually relevant AI-enhanced sexuality education initiatives that uphold learners' rights, foster digital empowerment, and bridge persistent inequalities in access to information.

The TAM reveals that perceived usefulness and ease of use determine stakeholder acceptance. The proposed implementation framework offers actionable pathways that address foundational infrastructure, capacity development, technological innovation, governance, and community engagement. Successful integration requires simultaneously addressing multiple interdependent factors while maintaining cultural sensitivity and ethical integrity. Future research should empirically test this framework across diverse school contexts, evaluate long-term impacts on sexual health outcomes, and refine approaches based on stakeholder experiences to realise AI's transformative potential in sexuality education.

7. Conflict of Interest

The author declares no conflict of interest.

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