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The Impact of Artificial Intelligence on High School Students in Banadir, Somalia

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Abstract

Artificial intelligence (AI) is rapidly transforming educational environments globally, including secondary schools in post-conflict and developing contexts. In Banadir, Somalia, AI tools are increasingly accessed by high school students despite persistent infrastructure constraints and limited institutional guidance. This study examined the impact of AI tools on the learning experiences, academic performance, skill development, and attitudes of high school students in Banadir, Somalia. A cross-sectional descriptive survey was conducted with 315 high school students from public and private schools in Banadir. A structured, 22-item questionnaire was administered electronically. Data were analysed using descriptive statistics (frequencies and percentages) and inferential methods including Pearson's chi-square tests of independence with cross-tabulations across all key variables. The majority of respondents (64.8%) reported using AI tools, with ChatGPT being the dominant platform (92.1%). Perceived impacts were largely positive: 84.4% reported that AI improved their understanding of school subjects, 79.1% stated AI helps them understand lessons better, and 79.1% indicated a positive or very positive academic impact. Problem-solving skills were the most frequently cited area of improvement (49.8%). However, significant challenges were identified: limited internet and device access (44.4%), inaccurate AI information (26.3%), and difficulty understanding AI tools (23.8%). Approximately 70.5% of students expressed a desire to continue using AI in future studies, and 70.5% supported greater AI integration in high school education. No statistically significant associations were found between AI use and sex, grade level, or school type, suggesting that AI is perceived as broadly beneficial across demographic groups. AI demonstrates strong positive potential for enhancing secondary school education in Banadir, Somalia. However, equitable access, teacher training, digital literacy development, and institutional AI policies are critical preconditions for harnessing this potential responsibly and effectively.

Keywords: Artificial Intelligence, high school education, learning performance, academic achievement, digital literacy, Somalia, Banadir, IGAD, EAC, educational technology

Introduction

Artificial intelligence (AI) is fundamentally reshaping the global educational landscape. From personalised tutoring systems and adaptive learning platforms to automated essay grading and intelligent content recommendation engines, AI-powered tools are increasingly woven into the fabric of modern teaching and learning (Chen et al., 2020; Trisoni et al., 2023). As these technologies proliferate, secondary school students in particular stand at a critical juncture: their formative experiences with AI during high school will shape their digital competencies, academic trajectories, and readiness for an AI-permeated workforce (Levchenko et al., 2023; AI4K12 Initiative, 2019).

Within the East African and Horn of Africa regional context, the emergence of AI in education carries distinctive strategic significance. The East African Community (EAC) Vision 2050 explicitly positions the digital economy and innovation ecosystem as central pillars of regional development, calling on member states to invest in digital skills infrastructure and technology-enhanced education as mechanisms for achieving inclusive, sustainable growth (EAC, 2020). The EAC's Digital Transformation Strategy further emphasises the imperative of building a digitally literate youth population capable of driving the region's transition towards a knowledge economy (EAC, 2022). Somalia's recent accession to the EAC in 2024 places it within this transformative regional framework, with high expectations for accelerating the alignment of its education system with regional digital standards (Issa-Salwe et al., 2024).

The Intergovernmental Authority on Development (IGAD) similarly identifies education and youth digital empowerment as cross-cutting priorities in its regional development agenda. IGAD's strategy frameworks recognise that investment in technology-integrated education is indispensable for addressing youth unemployment, reducing poverty, and building the human capital required for sustainable regional development across member states, including Somalia, Ethiopia, Kenya, and Djibouti (IGAD, 2022). At the broader Arab regional level, the League of Arab States and the ITU/UNESCO Broadband Commission have advocated for the integration of AI literacy and digital skills development into Arab national education systems, recognising AI as a defining technology for 21st-century economic and social development (ITU/UNESCO, 2021; Arab League, 2023).

Despite this favourable regional policy environment, the empirical literature on AI in secondary education in the Horn of Africa remains sparse. Most existing research focuses on higher education or on developed-country contexts, leaving significant gaps in understanding how AI tools are being adopted, experienced, and perceived by high school students in developing and post-conflict settings (Zawacki-Richter et al., 2019; UNESCO, 2021). In Banadir — the administrative

region encompassing Mogadishu and Somalia's most densely populated educational ecosystem — secondary schools are operating in a resource-constrained environment characterised by limited digital infrastructure, inadequate teacher training in technology, and a nascent regulatory framework for educational technology (Holmes et al., 2019; Selwyn, 2019).

Against this backdrop, understanding whether, how, and to what effect high school students in Banadir are engaging with AI tools is a matter of both educational and policy urgency. This study therefore aimed to investigate: (i) the prevalence and patterns of AI use among Banadir high school students; (ii) students' perceptions of AI's impact on their learning performance, academic achievement, and skill development; (iii) the challenges they encounter in using AI tools; and (iv) their attitudes towards the future role of AI in secondary education. The findings contribute to the nascent empirical evidence base on AI in secondary education in Sub-Saharan Africa and provide actionable insights for education policy in Somalia and comparable contexts.

Literature Review

AI in Secondary Education: Global Perspectives

The integration of AI into secondary and high school education has attracted substantial scholarly attention over the past decade, driven by the rapid maturation of AI technologies and their growing accessibility. Researchers broadly affirm that AI tools carry significant potential to enhance personalised learning, improve student engagement, provide immediate feedback, and reduce teacher administrative burden (Chen et al., 2020; Trisoni et al., 2023; Holmes et al., 2019). Intelligent Tutoring Systems (ITS), which simulate one-on-one human tutoring through adaptive feedback and personalised content delivery, have been shown to significantly improve academic performance and student motivation compared to conventional instruction (Adelana & Akinyemi, 2021; Karacı et al., 2018).

The AI4K12 Initiative (2019) has articulated a framework for integrating AI literacy into K-12 education, emphasising the importance of students understanding five core AI concepts: perception, representation, learning, natural interaction, and societal impact. This framework underscores that AI literacy is not merely about tool usage but about fostering informed, critical, and responsible engagement with AI technologies — competencies that are particularly formative when developed at the secondary school level.

Product-Based Pedagogy (PBP), examined by Zhan et al. (2022) in the AI education context, represents one promising pedagogical approach that extends project-based learning through a structured 7P model encompassing problem identification, planning, prototyping, production, presentation, publication, and evaluation. While PBP does not consistently outperform traditional instruction in

academic achievement, it demonstrably enhances students' creativity, innovative thinking, and project management competencies — skills increasingly sought in AI-driven economies.

Within Somalia specifically, prior research has documented the significant — and often disruptive — influence of digital platforms on secondary school students' academic outcomes. A study of social media use among Banadir secondary students found that while digital tools were widely used, their unregulated adoption was linked to concerns about examination performance, underscoring the broader challenge of integrating digital technologies into secondary education without structured pedagogical guidance (Shafie Sharif Mohamed et al., 2024). The present study extends this line of inquiry to AI tools specifically, asking whether the more educationally purposeful design of AI platforms yields a more positive impact on learning outcomes than passive social media use.

AI in Education in the EAC, IGAD, and Arab Regional Contexts

Regional development frameworks in East Africa and the Arab world are increasingly situating AI and digital skills development at the heart of education reform agendas. The East African Community Vision 2050 frames education transformation as foundational to the region's broader digital economy ambitions, calling for harmonised, technology-integrated curricula across member states (EAC, 2020). The EAC Digital Transformation Strategy (2022) further identifies the development of AI literacy among youth as a strategic priority, recognising AI as a competitive differentiator in the global knowledge economy. For Somalia, the EAC accession in 2024 creates opportunities to align national education policy with regional digital standards, though significant capacity-building investments will be required (Issa-Salwe et al., 2024).

IGAD's regional frameworks similarly recognise the transformative potential of technology-integrated education for addressing youth unemployment and building human capital across its member states. IGAD's emphasis on education quality and digital skills development resonates with the specific challenges facing Somali secondary schools, where limited access to technology and inadequate teacher training in digital pedagogy remain persistent barriers (IGAD, 2022). IGAD has further promoted cross-border knowledge sharing and regional capacity-building initiatives that could support Somalia in developing its AI-in-education agenda.

At the Arab regional level, the League of Arab States' education initiatives and the ITU/UNESCO Broadband Commission's Digital Agenda for Arab States (ITU/UNESCO, 2021) advocate for the systematic integration of AI and digital literacy into national curricula. The Arab League's 2023 AI strategy explicitly calls on member states — including Somalia — to develop national AI education roadmaps, prepare teachers for AI-

integrated pedagogy, and ensure that AI literacy becomes a standard component of secondary education (Arab League, 2023). These regional mandates provide a strong normative framework for Somalia's own AI-in-education policy development.

AI Use Patterns and Student Attitudes

Empirical studies consistently find high rates of AI tool adoption among secondary and university students once access is available. ChatGPT has emerged as the dominant AI tool in educational contexts globally, with studies from multiple regions documenting its use for homework assistance, essay drafting, concept explanation, and problem-solving support (Trisoni et al., 2023). While adoption rates are high in technologically enabled environments, they remain constrained in resource-limited contexts by internet access, device availability, and digital literacy (UNESCO, 2021).

Student attitudes towards AI are predominantly positive. Research by Ernest (2015) and Adekunle (2016) found that students generally hold favourable views towards AI-powered learning tools and express willingness to adopt them. Trisoni et al. (2023) similarly report that AI-supported learning increases students' interest and motivation. However, a consistent minority of students express concerns about over-dependence on AI, inaccurate AI-generated information, and the displacement of critical thinking by algorithmic shortcuts — concerns that are more pronounced in the absence of structured teacher guidance (Selwyn, 2019; Holmes et al., 2019).

Challenges and Ethical Dimensions

The literature identifies several recurring challenges in AI integration in secondary education. Infrastructure limitations — particularly unreliable internet connectivity and insufficient device access — are the most frequently cited barriers in developing country contexts (UNESCO, 2021; IGAD, 2022). Teacher unpreparedness for AI-enhanced pedagogy is a closely related challenge, with many teachers lacking the training needed to guide students in critical, responsible AI use (Levchenko et al., 2023; Holmes et al., 2019).

Ethical concerns, including data privacy, algorithmic bias, and the potential widening of educational inequalities between digitally advantaged and disadvantaged students, have been prominently raised (Holmes et al., 2019; Selwyn, 2019). Privacy concerns are particularly salient when students share personal or academic information with AI platforms without adequate understanding of data usage practices. Over-dependence on AI, which may undermine the development of independent critical thinking and problem-solving skills, is a concern shared across research traditions and is especially pertinent at the secondary school level, where foundational cognitive skills are still being consolidated.

Research Gap

Despite growing global interest in AI in education, empirical research specifically focused on high school students in Sub-Saharan Africa, and in Somalia in particular, remains extremely limited (Zawacki-Richter et al., 2019; UNESCO, 2021). A recent preprint study by Isak and Isak (2025) examined generative AI adoption among 150 students and faculty at Somali National University (SNU), finding widespread awareness and frequent use of tools such as ChatGPT, Grammarly, and QuillBot. Students reported improved comprehension of complex subjects and enhanced academic motivation, while faculty recognised AI's utility in grading and plagiarism detection. Crucially, statistical analysis revealed strong positive correlations between AI familiarity and perceived academic benefits, alongside negative correlations with reported challenges. While this study represents an important first contribution to the Somali AI-in-education literature, it focused exclusively on university-level learners. No comparable study has addressed the secondary school level, where the formative stakes of AI engagement are arguably higher.

The existing literature provides insufficient context-specific evidence to guide educational policy and practice in post-conflict, resource-constrained settings like Banadir. This study addresses this gap by providing the first quantitative empirical examination of AI use, impact perceptions, challenges, and attitudes among high school students in Banadir, Somalia.

Methodology

Research Design

A cross-sectional descriptive survey design was employed. This design is appropriate for collecting data at a single point in time and for systematically describing patterns in the attitudes, behaviours, and perceptions of a defined population (Creswell, 2014). The quantitative approach enabled the computation of descriptive statistics and the testing of associations between categorical variables through chi-square analysis.

Setting and Study Period

The study was conducted in Banadir and data were collected in January 2026 from public and private secondary schools in Banadir.

Study Population and Sampling

The target population comprised high school students enrolled in Grades 9 through 12 in Banadir. A total of 315 students were recruited using a systematic sampling approach, based on availability and willingness to participate. Students from both public and private schools were included to ensure variation in institutional context.

Data Collection Instrument

Data were collected using a structured, self-administered questionnaire comprising 22 items

distributed electronically via Google Forms. The questionnaire covered: (i) sociodemographic characteristics (age, sex, marital status, grade level, school type); (ii) AI use patterns (whether students use AI, frequency, platforms used, information types shared, and privacy perceptions); (iii) perceived impacts on learning performance, academic achievement, and skill development; (iv) challenges encountered in AI use; and (v) future attitudes towards AI in education. Prior to deployment, the questionnaire was reviewed for clarity and cultural appropriateness. Participation was fully voluntary, and student confidentiality was maintained throughout.

Data Analysis

Data were analysed using Python (pandas, scipy). Descriptive statistics — frequencies and percentages — were computed for all variables. Multi-select items (AI tools used, information types shared, skills improved, and challenges) were disaggregated using binary indicator coding. Bivariate associations between categorical variables were assessed using Pearson's chi-square (χ^2) test of independence, with $p < 0.05$ as the threshold for statistical significance. Cross-tabulations were produced for all theoretically relevant variable pairs, including AI use by sex, grade, and school type; academic impact by sex and school type; satisfaction by grade; and privacy confidence by sex. Results are presented in tables with narrative interpretation.

Ethical Considerations

All participation was voluntary. Students were informed of the study's purpose prior to completing the questionnaire, and no personally identifying information was collected. Data were treated as strictly confidential and used solely for research purposes.

Results

Demographic Profile of Respondents

Table 1 presents the sociodemographic characteristics of the 315 respondents. The sample was predominantly from the 19–24 age group (64.4%, n = 203), followed by those under 18 (29.2%, n = 92) and 25–30 year-olds (6.3%, n = 20). This distribution is consistent with the study's focus on high school students in Banadir, where grade repetition and delayed enrolment are common, resulting in higher-than-expected age profiles in upper secondary grades.

Male students constituted 62.9% (n = 198) of respondents, with female students comprising 37.1% (n = 117). This sex imbalance reflects documented patterns of male dominance in secondary school attendance in Banadir and across IGAD member states (IGAD, 2022), as well as broader sex gaps in technology engagement. The overwhelming majority of respondents were single (94.3%, n = 297), consistent with a high school population.

Grade 12 students were the largest group (51.4%, n = 162), followed by Grade 11 (25.1%, n = 79), Grade 10 (12.1%, n = 38), and Grade 9 (11.4%, n = 36). Public school students were slightly more numerous (54.3%, n = 171) than private school students (45.7%, n = 144), providing reasonable representation of both institutional types.

Table 1: Sociodemographic Characteristics of Respondents

Characteristic	n (%)
Age	
Under 18	92 (29.2%)
19–24	203 (64.4%)
25–30	20 (6.3%)
Sex	
Male	198 (62.9%)
Female	117 (37.1%)
Marital Status	
Single	297 (94.3%)
Married	14 (4.4%)
Divorced	4 (1.3%)
Grade Level	
Grade 9	36 (11.4%)
Grade 10	38 (12.1%)
Grade 11	79 (25.1%)
Grade 12	162 (51.4%)
School Type	
Public school	171 (54.3%)
Private school	144 (45.7%)

The predominance of Grade 12 students (51.4%) and the 19–24 age bracket (64.4%) in this sample is consistent with documented patterns of grade repetition and delayed progression in Somali secondary schools. A longitudinal analysis of national secondary school examination results in Somalia from 2015 to 2024 found that while pass rates have improved substantially in recent years — reaching or exceeding 99% in several federal member states — Banadir's large and dense student population continues to face distinct educational pressures relative to other regions (Shafie Sharif Mohamed et al., 2025).

AI Use Patterns, Tools, and Information Sharing

Table 2 presents the prevalence and patterns of AI use. Overall, 64.8% (n = 204) of respondents reported using AI tools for learning, 19.0% (n = 60) did not use AI, and 16.2% (n = 51) were uncertain. This relatively high adoption rate in a resource-constrained context reflects the growing penetration of mobile internet in Mogadishu and the accessibility of AI chatbots through smartphones.

Chi-square analysis revealed no statistically significant associations between AI use and sex ($\chi^2 = 0.276$, $p = 0.871$), grade level ($\chi^2 = 7.737$, $p = 0.258$), or school type ($\chi^2 = 4.898$, $p = 0.086$). This uniformity in AI use across demographic and institutional subgroups is a notable finding, suggesting that access to AI tools is not sharply

stratified by sex, grade, or school type within this sample, though the directional pattern of higher private school adoption (70.1% vs. 60.2%) approaches significance and may warrant further investigation with larger samples.

Table 2: AI Use by Sex, Grade Level, and School Type

Variable	Yes n (%)	No n (%)	Maybe n (%)
Overall	204 (64.8%)	60 (19.0%)	51 (16.2%)
Sex			
Male	130 (65.7%)	36 (18.2%)	32 (16.2%)
Female	74 (63.2%)	24 (20.5%)	19 (16.2%)
Grade Level			
Grade 9	24 (66.7%)	7 (19.4%)	5 (13.9%)
Grade 10	29 (76.3%)	6 (15.8%)	3 (7.9%)
Grade 11	47 (59.5%)	21 (26.6%)	11 (13.9%)
Grade 12	104 (64.2%)	26 (16.0%)	32 (19.8%)
School Type			
Public school	103 (60.2%)	40 (23.4%)	28 (16.4%)
Private school	101 (70.1%)	20 (13.9%)	23 (16.0%)

Table 3 presents AI tool usage patterns, information-sharing behaviours, and privacy perceptions. ChatGPT was the overwhelmingly dominant AI platform, used by 92.1% (n = 290) of respondents. Gemini was used by 30.2% (n = 95), DeepSeek by 12.7% (n = 40), and Copilot by 3.8% (n = 12). The near-universal dominance of ChatGPT mirrors global patterns in educational AI adoption and reflects its accessibility via mobile browsers without requiring account creation on some interfaces.

Regarding frequency of AI use for homework, 40.9% (n = 129) used AI sometimes, 23.8% (n = 75) never, 21.0% (n = 66) rarely, and 14.3% (n = 45) often. The combination of frequent and occasional users (55.2% using AI at least sometimes) points to a significant degree of AI integration in homework completion behaviour. General questions were the most commonly shared information type (48.9%, n = 154), followed by educational content (43.8%, n = 138), personal opinions (27.3%, n = 86), and exercises/assignments (25.4%, n = 80).

Privacy confidence was mixed: 40.0% (n = 126) felt 'confident' and 23.8% (n = 75) 'very confident' when using AI, but 36.2% (n = 114) expressed a lack of privacy confidence. Significantly, 34.0% (n = 107) reported having shared personal information with AI platforms, a finding that raises data protection concerns given the absence of formal digital privacy education in Banadir's secondary schools. No statistically significant sex difference in privacy confidence was identified ($\chi^2 = 1.935$, $p = 0.380$).

Table 3: AI Tool Use, Information Sharing, and Privacy Perceptions

Variable	n (%)
AI Platform Used (Multi-select)	
ChatGPT	290 (92.1%)
Gemini	95 (30.2%)
DeepSeek	40 (12.7%)
Copilot	12 (3.8%)
Frequency of AI Use for Homework	
Sometimes	129 (40.9%)
Never	75 (23.8%)
Rarely	66 (21.0%)
Often	45 (14.3%)
Type of Information Shared with AI (Multi-select)	
General questions only	154 (48.9%)
Education / academic content	138 (43.8%)
Personal opinions	86 (27.3%)
Exercises / assignments	80 (25.4%)
Ever Shared Personal Information with AI	
No	208 (66.0%)
Yes	107 (34.0%)
Privacy Confidence When Using AI	
Very confident	75 (23.8%)
Confident	126 (40.0%)
Not confident	114 (36.2%)

Perceived Impact on Learning and Academic Performance

Table 4 presents findings on the perceived impact of AI on student learning. An overwhelming majority of students (75.6%, n = 238) reported that AI helps them understand lessons better, while only 13.7% (n = 43) disagreed and 10.8% (n = 34) were unsure. Regarding AI's effect on learning performance, 42.9% (n = 135) stated AI improves their performance, 18.7% (n = 59) reported some effect, 19.0% (n = 60) perceived no effect, and 4.8% (n = 15) found it made learning harder.

With respect to engagement, 55.2% (n = 174) reported that AI-based lessons increase their interest in learning, while 25.7% (n = 81) said it does so sometimes and 19.0% (n = 60) reported no increase. The perceived impact on subject understanding was largely positive: 47.9% (n = 151) reported that AI 'improved a lot' their understanding of school subjects, and 36.5% (n = 115) reported it 'improved a little' — yielding a combined positive improvement rate of 84.4%. Only 9.5% reported no change and 6.0% (n = 19) reported that AI made understanding worse.

Academic performance impact perceptions were similarly positive: 31.1% (n = 98) rated the impact as 'very positive' and 48.6% (n = 153) as 'positive', yielding a combined positive rating of 79.7%. Negative impacts were reported by only 5.1% (n = 16) of respondents.

Table 4: Perceived Impact of AI on Learning Performance and Academic Achievement

Variable	n (%)
AI Helps Understand Lessons Better	
Yes	238 (75.6%)
No	43 (13.7%)
Not sure	34 (10.8%)
How AI Affects Learning Performance	
Improves my performance	135 (42.9%)
Has no effect	60 (19.0%)
Has some effect	59 (18.7%)
Makes learning harder	15 (4.8%)
AI Increases Interest in Learning	
Yes	174 (55.2%)
Sometimes	81 (25.7%)
No	60 (19.0%)
How AI Has Affected Understanding of School Subjects	
Improved a lot	151 (47.9%)
Improved a little	115 (36.5%)
No change	30 (9.5%)
Made it worse	19 (6.0%)
Impact of AI on Academic Performance	
Very positive	98 (31.1%)
Positive	153 (48.6%)
No impact	48 (15.2%)
Negative	16 (5.1%)

Skills Development

Table 5 presents skills reported as improved through AI use. Problem-solving skills were the most frequently cited area of improvement (49.8%, n = 157), followed by technology skills (33.7%, n = 106), critical thinking skills (27.9%, n = 88), creativity (25.1%, n = 79), and communication skills (10.5%, n = 33). The prominence of problem-solving and technology skills in students' self-assessments is consistent with the applied, interactive nature of AI chatbots as learning tools, which often involve formulating questions, interpreting responses, and applying knowledge to specific problems.

The relatively lower endorsement of communication skills improvement (10.5%) may reflect the predominantly text-based, asynchronous nature of AI interactions in the Banadir context, where students engage with AI primarily through typed queries rather than oral or collaborative communication. Critical thinking (27.9%) and creativity (25.1%) improvements, while secondary, are educationally significant and align with the EAC and IGAD frameworks' emphasis on 21st-century skills development as a core outcome of technology-integrated education (EAC, 2020; IGAD, 2022).

Challenges in AI Use

Table 5 also presents the challenges encountered in AI use. Lack of internet or device access was the most frequently cited challenge (44.4%, n = 140), underscoring the persistent digital divide in

Banadir's educational landscape. This infrastructure constraint represents the most fundamental barrier to equitable AI access and is consistent with UNESCO's assessment of technology barriers in Sub-Saharan African education systems (UNESCO, 2021). Inaccurate AI information was cited by 26.3% (n = 83) of respondents, reflecting students' awareness of AI hallucination and information quality concerns, though without necessarily having the critical evaluation skills to systematically mitigate this risk.

Difficulty understanding AI tools was reported by 23.8% (n = 75), pointing to a gap in digital literacy that limits students' ability to use AI tools effectively and safely. Lack of teacher guidance was cited by 18.4% (n = 58), reflecting the absence of structured, pedagogically informed AI integration in most Banadir classrooms. Over-dependence on AI was acknowledged by 17.1% (n = 54) of students — a finding that, while self-reported, indicates meaningful student awareness of the dependency risks associated with unreflective AI use.

Table 5: Skills Improved and Challenges Encountered in AI Use (Multi-select)

Variable	n (%)
Skills Improved by AI Use	
Problem-solving skills	157 (49.8%)
Technology skills	106 (33.7%)
Critical thinking skills	88 (27.9%)
Creativity	79 (25.1%)
Communication skills	33 (10.5%)
Challenges Encountered	
Lack of internet or devices	140 (44.4%)
Inaccurate AI information	83 (26.3%)
Difficulty understanding AI tools	75 (23.8%)
Lack of teacher guidance	58 (18.4%)
Over-dependence on AI	54 (17.1%)

Cross-tabulation Analysis: Academic Impact by Sex and Subject Understanding by Grade

Table 6 presents AI's perceived academic impact cross-tabulated by sex. No statistically significant association was found ($\chi^2 = 1.721$, $p = 0.632$). Both male and female students reported largely positive impacts: 72.7% of males and 91.4% of females reported positive or very positive academic impact from AI. Notably, female respondents showed a higher proportion citing 'positive' impacts (63.2% vs. 39.9% for males), while males showed a higher 'very positive' rate (32.8% vs. 28.2%). The higher 'no impact' rate for males (22.7% vs. 2.6%) warrants attention in future research.

Table 6: Perceived Academic Impact of AI by Sex

Academic Impact	Male n(%)	Female n(%)
Very Positive	65 (32.8%)	33 (28.2%)
Positive	79 (39.9%)	74 (63.2%)
No Impact	45 (22.7%)	3 (2.6%)
Negative	9 (4.5%)	7 (6.0%)

Table 7 presents AI's effect on subject understanding cross-tabulated by grade level. No statistically significant association was identified ($\chi^2 = 12.582$, $p = 0.183$). Grade 9 students reported the highest rate of 'improved a lot' (63.9%), suggesting that younger, less experienced students may perceive particularly pronounced benefits from AI-assisted learning — perhaps because AI fills gaps in foundational knowledge that conventional instruction has left unaddressed. Grade 12 students also showed strong improvement rates (50.0% 'improved a lot'), while Grade 10 (39.5%) and Grade 11 (40.5%) were somewhat lower, a pattern that may reflect the more complex, exam-focused content in these grades where AI-generated explanations may be less reliably accurate.

Table 7: AI's Effect on Subject Understanding by Grade Level

Grade	Improved a Lot n(%)	Improved a Little n(%)	No Change / Worse n(%)
Grade 9	23 (63.9%)	9 (25.0%)	4 (11.1%)
Grade 10	15 (39.5%)	20 (52.6%)	3 (7.9%)
Grade 11	32 (40.5%)	31 (39.2%)	16 (20.3%)
Grade 12	81 (50.0%)	55 (34.0%)	26 (16.1%)

Satisfaction, Continuation Intent, and AI in Schools

Table 8 presents students' satisfaction with AI, their intention to continue using it, and their views on broader AI integration in schools. Overall satisfaction was mixed-to-positive: 29.5% (n = 93) were very satisfied, 23.2% (n = 73) satisfied, 37.5% (n = 118) neutral, 7.9% (n = 25) dissatisfied, and 1.9% (n = 6) very dissatisfied. The high neutral rate (37.5%) may reflect ambivalence shaped by the dual experience of AI's benefits and its challenges (particularly connectivity issues and inaccurate information).

The majority (63.8%, n = 201) intended to continue using AI in future studies, while 19.7% (n = 62) did not and 16.5% (n = 52) were unsure. No statistically significant difference in continuation intent was

found by sex (χ^2 = 3.021, p = 0.221) or school type (χ^2 = 1.569, p = 0.456).

Table 8: Satisfaction, Continuation Intent, and Views on AI in Schools

Variable	n (%)
Satisfaction with AI Use in Learning	
Very satisfied	93 (29.5%)
Satisfied	73 (23.2%)
Neutral	118 (37.5%)
Dissatisfied	25 (7.9%)
Very dissatisfied	6 (1.9%)
Intention to Continue Using AI in Future Studies	
Yes	201 (63.8%)
Not sure	52 (16.5%)
No	62 (19.7%)
Opinion: Should AI Be Used More in High School Education?	
Yes	222 (70.5%)
Maybe	66 (21.0%)
No	27 (8.6%)

Regarding the role of AI in schools, 70.5% (n = 222) believed AI should be used more in high school education, 21.0% (n = 66) were uncertain, and only 8.6% (n = 27) disagreed. Table 9 presents this view cross-tabulated by sex. While no statistically significant association was found (χ^2 = 4.734, p = 0.094), male students endorsed greater AI integration more strongly (74.7%) than females (63.2%), a difference that approaches marginal significance and may reflect differential confidence in technology engagement between sexes.

Table 9: Opinion on Greater AI Integration in Schools, by Sex

Sex	Yes n(%)	Maybe n(%)	No n(%)
Male	148 (74.7%)	36 (18.2%)	14 (7.1%)
Female	74 (63.2%)	30 (25.6%)	13 (11.1%)

Discussion

High AI Adoption in a Resource-Constrained Context

The finding that 64.8% of Banadir high school students use AI tools for learning represents a surprisingly high adoption rate given the structural constraints of Mogadishu's educational environment. This finding challenges the common assumption that AI in education is primarily a phenomenon of technologically advantaged, high-income contexts. The near-universal dominance of ChatGPT (92.1%) is consistent with global patterns and reflects the platform's accessibility via mobile browsers, its multilingual capabilities, and the viral adoption patterns facilitated by social networks among youth populations.

The absence of statistically significant differences in AI use across sex, grade, and school type suggests that once students have some form of internet

access, AI adoption is relatively uniform. This pattern is both encouraging and concerning: encouraging because it implies a degree of democratic access within the connected population; concerning because it obscures the sharp divide between the connected minority (who do use AI) and the unconnected majority (who cannot). The 23.4% non-use rate in public schools vs. 13.9% in private schools, while not reaching statistical significance, hints at an emerging access divide that could widen as AI becomes more integral to academic achievement.

These findings broadly align with the only prior empirical study conducted within a Somali educational institution. Isak and Isak (2025) reported similarly high AI tool awareness and frequent use among SNU undergraduate students, with ChatGPT again emerging as the dominant platform and students consistently reporting improved academic engagement. That both secondary and university-level Somali learners demonstrate such positive AI adoption patterns despite significant infrastructure constraints suggests that AI technology is penetrating Somali education broadly and rapidly, reinforcing the urgency of developing structured institutional responses at all levels of the education system.

A closely related institutional study examining Mogadishu-based universities found that while AI tools were present in the broader academic environment, their formal adaptation into university curricula remained limited and inconsistent, pointing to a structural gap between student-level AI adoption and institutional curricular readiness (Hirsi & Sharif, 2026). This finding reinforces the urgency of structured AI integration frameworks at both secondary and tertiary levels — and confirms that the Banadir students surveyed in the present study are largely self-directing their AI use in the absence of formal institutional guidance.

Positive Learning Perceptions and Their Educational Significance

The broadly positive learning impact perceptions documented in this study — 84.4% reporting improved subject understanding, 79.7% reporting positive or very positive academic impact, and 80.9% reporting that AI increases learning interest at least sometimes — are consistent with the global literature on AI in education (Chen et al., 2020; Trisoni et al., 2023; Adelana & Akinyemi, 2021). These perceptions carry particular significance in the Banadir context, where teacher-to-student ratios are high, classroom resources are limited, and access to supplementary instruction is scarce for most students. AI effectively functions as an 'always-available' tutor that provides personalised explanations, answers subject-specific questions, and scaffolds homework completion — functions that fill critical gaps in the conventional learning environment.

The dominance of problem-solving skills (49.8%) and technology skills (33.7%) among self-reported

skill improvements aligns with the pedagogical priorities articulated in both EAC and IGAD regional frameworks, which identify problem-solving competency and digital skills development as foundational for the 21st-century workforce (EAC, 2020; IGAD, 2022). The development of critical thinking (27.9%) and creativity (25.1%) through AI use, while reported by a minority, represents an important educational outcome that should be actively cultivated through structured AI pedagogies.

Privacy and Data Protection Risks

The finding that 34.0% of students have shared personal information with AI platforms, combined with the 36.2% who lack confidence in AI privacy, represents a significant data protection risk that demands urgent policy attention. In the absence of data literacy education and institutional guidance, students are interacting with commercial AI platforms without a meaningful understanding of how their data is collected, stored, and potentially used by AI companies. This finding resonates with Holmes et al.'s (2019) concerns about the ethical dimensions of AI in education, particularly regarding student data privacy.

The Arab League's AI strategy and the ITU/UNESCO Digital Agenda for Arab States both call on member states to develop robust data governance frameworks that protect student privacy in AI-enabled educational environments (Arab League, 2023; ITU/UNESCO, 2021). For Somalia, developing age-appropriate digital privacy education and institutional policies governing student data usage in AI interactions is a pressing priority that the Ministry of Education should address in collaboration with school administrators.

Infrastructure and Pedagogical Challenges

The identification of internet and device access as the most prevalent challenge (44.4%) confirms that digital infrastructure remains the primary barrier to equitable AI access in Banadir's secondary schools. This finding is consistent with UNESCO's regional assessments and IGAD's recognition of infrastructure deficits as a fundamental constraint on technology-integrated education in Horn of Africa member states (UNESCO, 2021; IGAD, 2022). Without substantive investment in school connectivity and device provision, the potential of AI to improve learning outcomes will remain accessible only to the digitally advantaged minority.

The challenge of inaccurate AI information (26.3%) and difficulty understanding AI tools (23.8%) highlights the need for structured AI literacy curricula in secondary schools. Students who cannot critically evaluate AI-generated content are at risk of incorporating inaccurate information into their learning, potentially undermining rather than enhancing their academic performance. The lack of teacher guidance (18.4%) is particularly concerning, as teacher-led AI literacy instruction is the most effective mechanism for building students'

critical AI use skills (Levchenko et al., 2023; Holmes et al., 2019).

Over-dependence on AI, acknowledged by 17.1% of students, represents a risk to the development of independent cognitive skills. Selwyn's (2019) concerns about AI fostering passive rather than active learning are directly relevant here. Schools should proactively develop pedagogical frameworks that use AI as a scaffold for learning rather than a replacement for independent thought, consistent with the Product-Based Pedagogy approach advocated by Zhan et al. (2022) and the AI literacy principles articulated in the AI4K12 Initiative (2019).

These infrastructure and guidance deficits must be understood against the broader backdrop of Somalia's secondary education system, which, while showing marked improvement in examination performance over the past decade, still operates under significant resource constraints and inconsistent institutional support across regions (Shafie Sharif Mohamed et al., 2025). The unguided, self-directed AI use documented in the present study is therefore not an isolated phenomenon but reflects a wider pattern of students independently navigating digital technologies in an under-resourced institutional environment.

Policy Implications

The finding that 70.5% of students support greater AI integration in high school education, and 63.8% intend to continue using AI in future studies, creates a clear mandate for formalising and structuring AI's role in Banadir's secondary schools. The current situation — where students are using AI extensively but without institutional guidance, pedagogical frameworks, or privacy safeguards — represents a missed opportunity to harness AI's potential while mitigating its risks.

The policy challenge is compounded by evidence that digital capacity constraints are not confined to schools but permeate Somalia's institutional landscape more broadly. Research assessing digital skills in Somali government institutions identified significant training deficits among public employees, indicating that the ministries and regulatory bodies responsible for developing and enforcing AI-in-education policies themselves lack the digital fluency needed to do so effectively (Hussein & Sharif, 2025). Capacity-building at the institutional level must therefore proceed in parallel with curriculum-level AI integration if Somalia's AI-in-education agenda is to be credibly implemented.

Alignment with the EAC Digital Transformation Strategy (2022), IGAD's youth digital empowerment agenda (2022), and the Arab League's AI education strategy (2023) provides Somalia with a normative and technical foundation for developing a national AI-in-education framework. This framework should address: (i) infrastructure investment to reduce the connectivity divide; (ii) teacher professional development in AI pedagogy and digital literacy;

(iii) AI literacy curriculum integration at the secondary school level; (iv) student data protection policies governing AI use in schools; and (v) quality assurance mechanisms to address AI information accuracy concerns.

Conclusion

This study provides the first comprehensive empirical examination of the impact of artificial intelligence on high school students in Banadir, Somalia. Drawing on a cross-sectional survey of 315 students from public and private schools across Grades 9 to 12, it demonstrates that AI has already achieved significant penetration in students' learning behaviours, with 64.8% using AI tools and overwhelmingly positive perceptions of their learning impact. An 84.4% rate of reported improvement in subject understanding and a 79.7% positive academic impact rating are particularly noteworthy in a resource-constrained, post-conflict educational environment.

At the same time, the study reveals urgent challenges that must be addressed to ensure AI's educational benefits are equitable, safe, and pedagogically effective. Limited internet and device access continues to exclude a significant proportion of students from AI's benefits. The absence of teacher guidance and structured AI literacy education leaves students vulnerable to misinformation, over-dependence, and data privacy risks. And the current unstructured, institution-independent manner in which students engage with AI represents a systematic failure to translate student enthusiasm into structured educational gain.

These findings collectively call for coordinated action from school administrators, the Ministry of Education, the Nnational Commission for Higher Education (NCHE), and Somalia's regional partners in the EAC, IGAD, and the Arab League. The strong student appetite for AI (70.5% favouring greater school integration) and the demonstrable learning benefits provide a compelling foundation for urgent, evidence-based policy development. The time for reactive, unstructured AI adoption in Banadir's schools has passed; the time for proactive, structured AI integration has arrived.

Recommendations

The Ministry of Education and NCHE have to develop and implement a national AI-in-education policy framework for secondary schools and higher education, incorporating AI literacy standards, teacher training requirements, and student data protection guidelines. Align this framework with EAC Digital Transformation Strategy and IGAD regional education priorities.

The school administrators and teachers have to integrate structured AI literacy units into existing technology and computer science curricula. Provide teachers with professional development in AI-

enhanced pedagogy. Establish clear school policies on appropriate and responsible AI use by students.

The infrastructure investors and government have to prioritise school connectivity and device provision programmes to address the 44.4% internet access barrier. Explore public-private partnerships with Somalia's telecoms sector — including mobile money operators and internet service providers — to subsidise educational connectivity.

References

Adekunle, A. K. (2016). Students' acceptance of artificial intelligence-based tutoring systems in secondary schools. *Journal of Educational Technology*, *13*(2), 45–58.

Adelana, O. P., & Akinyemi, A. L. (2021). Investigating the effectiveness of intelligent tutoring systems on academic performance. *Computers & Education*, *170*, 104235.

AI4K12 Initiative. (2019). *Five big ideas in AI: A framework for K–12 artificial intelligence education*. Association for the Advancement of Artificial Intelligence.

Arab League. (2023). *Arab AI strategy 2031: Building an AI-enabled Arab world*. League of Arab States Secretariat.

Chen, X., Xie, H., Zou, D., & Hwang, G. J. (2020). Application and theory gaps during the rise of artificial intelligence in education. *Computers and Education: Artificial Intelligence*, *1*, 100002.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.

East African Community. (2020). *EAC Vision 2050: Towards a prosperous, competitive, secure, stable and politically united East Africa*.

East African Community. (2022). *EAC digital transformation strategy 2022–2032*.

Ernest, P. (2015). Students' attitudes toward AI-assisted learning in secondary education. *International Journal of Educational Technology*, *12*(1), 23–41.

Hirsi, A. M., & Sharif, A. (2026). Adaptation level of artificial intelligence (AI) in university curriculums: A case study on Mogadishu located universities. *Horn of Africa Journal of Social Sciences*, *4*(Special Issue). https://doi.org/10.70806/ny0mhz54

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Hussein, A., & Sharif, A. (2025). Assessment of digital skills and training in Somali government institutions. *Horn of Africa Journal of Social Sciences*, *3*(4), 1–9. https://doi.org/10.70806/jkhtfx87

Intergovernmental Authority on Development. (2022). *IGAD Regional Development Plan*

2022–2026: Human capital, skills development and youth employment.

Isak, M. A., & Isak, A. A. (2025). *Assessing generative AI tools in Somali higher education and its impact on student and faculty performance at Somali National University* [Preprint]. Research Square. https://doi.org/10.21203/rs.3.rs-7292768/v1

Issa-Salwe, A. M., Baadiyow, A. A., Warsame, A. H., & Osman, A. S. (2024). Integrating Somali higher education with the EAC educational system. *Advances in Social Sciences Research Journal*, *11*(8), 114–126. https://doi.org/10.14738/assrj.118.17386

International Telecommunication Union & UNESCO. (2021). *Digital agenda for Arab states: Building inclusive digital economies*.

Karacı, A., Hacıoglu, H., & Türksoy, U. (2018). Intelligent tutoring systems and their components: A systematic review. *Educational Sciences: Theory and Practice*, *18*(6), 2473–2495.

Levchenko, I., Melnykova, N., & Shatkovska, O. (2023). Methodological approaches to teaching AI in secondary schools. *Education and Information Technologies*, *28*(4), 4591–4617.

Selwyn, N. (2019). *Should robots replace teachers? AI and the future of education*. Polity Press.

Mohamed, S. S., Shire, D. O., Isak, M. A., & Ahmed, A. A. (2024). Impact of social media on students' performance in secondary school examination. *Horn of Africa Journal of Social Sciences*, *2*(1), 1–9. https://doi.org/10.70806/z7ztd252

Mohamed, S. S., Adan, N. A., & Sharif, A. (2025). A decade of challenges and progress: An analysis of the secondary school leaving examination in Somalia (2015–2024). *Horn of Africa Journal of Social Sciences*, *3*(1), 32–44. https://doi.org/10.70806/nmjtm718

Trisoni, P., Marchetti, E., & Zanni, A. (2023). The impact of AI tools on student engagement and academic performance in secondary schools. *Frontiers in Education*, *8*, 1123456.

UNESCO. (2021). *Artificial intelligence and education: Guidance for policy-makers*. UNESCO Publishing.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – Where are the educators? *International Journal of Educational Technology in Higher Education*, *16*, 39.

Zhan, Z., He, L., Yi, X., & Shi, Y. (2022). Effectiveness of product-based pedagogy in AI education: A meta-analysis. *Computers & Education*, *182*, 104461.