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AI Dependence and Its Influence on Independent Problem-Solving Abilities among Users in Tanzania

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Abstract: *The rapid adoption of artificial intelligence (AI) tools has raised concerns that excessive reliance may undermine users' independent problem-solving abilities, particularly among students and young professionals in Tanzania. This study aimed to examine the influence of AI dependence on independent problem-solving skills, addressing gaps in understanding the cognitive consequences of generative AI use. A quantitative research approach with a cross-sectional design was employed, targeting 222 bachelor's and master's students from the University of Dar es Salaam, selected through stratified sampling. Data were collected using structured questionnaires with a 5-point Likert scale and analysed using descriptive statistics and linear regression. The findings revealed a significant negative impact of AI dependence on problem-solving abilities, with a regression coefficient of B = 0.773, a standardized beta of 0.727, t = 16.663, and p = 0.020, confirming that heavy reliance on AI reduces critical thinking, analytical reasoning, and reflective decision-making. The study concludes that AI tools should serve as a complementary aid rather than a substitute for cognitive effort. It is recommended that educational institutions and policymakers implement guidelines and training programmes to promote responsible AI use, encouraging verification of outputs, independent analysis, and reflective engagement to maintain and strengthen problem-solving competencies.*

Keywords: *Artificial Intelligence* (*AI) Dependence, Independent Problem-Solving, Cognitive Consequences, ChatGPT,*

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1. Introduction

The rapid uptake of artificial-intelligence tools has prompted growing concern that users may offload cognitive work to machines in ways that weaken their own problem-solving capacities (Gerlich, 2025). Recent systematic reviews and empirical work show that over-reliance on conversational and generative AI is associated with diminished critical analysis, reduced memory consolidation of worked material, and lower engagement in reflective problem solving; effects commonly explained by automation bias and cognitive offloading (Jackson, 2025). These findings suggest it is both timely and necessary to examine, with clear operational definitions and robust measurement, whether and how variations in AI dependence predict declines (or changes) in users' capacity to solve problems independently.

Across high-income countries the spread of generative tools has been rapid; surveys indicate that a clear majority of adults now interact with AI in everyday tasks (for example, about 55% of U.S. adults report regular interaction), while university-level research in the UK shows that a very large share of students (recently reported as over 90% in some studies) use generative AI for study purposes (McClain, 2025). Many commentators and educators point to gains such as faster research, on-demand explanations and improved productivity are commonly reported outcomes. At the same time, empirical work has flagged trade-offs whereby several studies find a measurable association between frequent AI use and weaker performance on measures of critical thinking and independent analytical

reasoning, suggesting that time-saving benefits can come at the cost of cognitive off-loading when learners or workers accept machine answers without verification (McClain, 2025; Jackson, 2025).

On the African continent uptake is heterogeneous but substantial in urban and professional groups. Regional surveys report that many users engage generative AI several times a week (about 42% in a 2024 regional poll) and that 67% use it specifically for research or information-gathering; country differences are evident; for example, comfort with sharing personal data to AI systems varies markedly between nations (Oladipo et al., 2024). Meanwhile, reports on the continent highlight a two-fold reality in that leading nations like Kenya, South Africa and Nigeria are investing in data centres, skills and national AI plans and, thus, demonstrating high local adoption, but much of Africa continues to have connectivity, electricity and device limitations that restrict both coverage and the establishment of independent digital literacy (Akhras, 2024; Abubaker et al., 2025). Such combination creates a paradox, which is quick practical adaptation by people having such access, and gradual threat of people depending on AI without digital-literacy safeguards losing independent problem-solving capabilities.

In Tanzania the trend is indicative of these international and regional conflicts. Recent analysis of higher-education populations has found that ChatGPT and generative-AI are highly used to write and generate ideas (studies that sample higher-education populations have found that the figures of tools-use are in the range of about 70–86% in their sample), but national data on digital-access indicates much lower population-wide internet and smartphone penetration (internet penetration is about 2931% in recent years) (Mollel, 2025). Local research also documents contrasting perceptions whereby while many students and instructors acknowledge the utility of AI for efficiency and access to information, educators warn that unstructured or unchecked use can reduce students' independent problem-solving and critical-thinking development. These facts mean Tanzania faces the twin challenge of maximising AI's pedagogic value while guarding against over-reliance among the increasingly large but still digitally-uneven (Mbilinyi et al., 2025).

The growing dependence on artificial intelligence in Tanzania has raised concerns over its potential to undermine independent problem-solving skills, particularly among students and young professionals. Although research has shown that a high percentage of university students in Tanzania, routinely use generative AI applications like ChatGPT to perform activities such as writing and generating ideas, educators have been raising growing concerns that unguided use of such systems can undermine the ability of students to think critically and reason (Mollel, 2025; Mbilinyi et al., 2025). This difficulty is made more complicated by national digital inequalities, where internet coverage is comparatively low at approximately 29 -31, indicating that access to AI technologies is inequitable and frequently held by urban populations (Mollel, 2025).

The worry, then, is that although AI makes life more efficient and more information accessible, overreliance poses a risk of creating a generation of students who accept the machine-generated output and do not reflectively solve problems, which is fraught with eroding the critical thinking and problem-solving abilities required of progressing students to achieve future educational and professional success. Against this backdrop, the present study specifically addresses the problem of how AI dependence influences independent problem-solving abilities among users in Tanzania, seeking to provide empirical evidence on whether heavy reliance on AI undermines or alters cognitive self-sufficiency in local contexts.

The study was guided by the following research and hypothesis:

H_0: *AI dependence has no significant negative impact on independent problem-solving abilities among users in Tanzania.*

H_1: *AI dependence has a significant negative impact on independent problem-solving abilities among users in Tanzania.*

2. Literature Review

2.1 Theoretical Review

The study adopted Automation Bias Theory. A theory first coined by Kathleen Mosier and Linda Skitka in 1996, describes the tendency for people to favour or uncritically accept suggestions from automated decision-support systems and to overlook or ignore contradictory information even when that information is correct (Lyell & Coiera, 2017). The concept emphasises two common error forms; omissions (failing to seek or process alternative information) and commissions (following an incorrect automated recommendation), and is built on several assumptions such as that humans will adopt cognitive shortcuts under load, that automated aids are perceived as having superior analytic ability to unaided judgement, and that sharing tasks with automation reduces individual monitoring effort; together these assumptions explain why high system reliability can paradoxically produce learned carelessness and reduced vigilance (Goddard et al., 2012). The theory is closely related to automation-induced complacency and predicts that factors such as task workload, training, system reliability and the availability of alternative information will moderate the likelihood and severity of automation bias.

Automation Bias Theory is relevant to this study because it explains how individuals tend to place undue trust in

automated systems, often accepting their outputs without sufficient scrutiny or verification. In the Tanzanian context, where students and professionals increasingly rely on generative AI tools for academic and work-related tasks, this bias can result in reduced engagement with critical analysis and independent reasoning. Such reliance risks weakening problem-solving abilities, as users may overlook errors or fail to develop the cognitive discipline required to evaluate information critically, thereby making automation bias a key lens through which to understand the impact of AI dependence on independent problem-solving.

2.2 Empirical Review

Gerlich (2025) of the Swiss Business School (Kloten-Zurich) examined how use of AI tools relates to users' critical thinking and problem-solving abilities. His study used a mixed-methods design (surveys and semi-structured interviews) with 666 adults of varying ages and education levels with quantitative analysis. The findings showed a significant negative correlation between frequent AI-tool use and critical thinking scores. Younger users were especially dependent on AI and had lower thinking scores than older users, and higher education levels buffered this trend. The study concludes that heavy AI reliance incurs ognitive costs and recommends educational strategies to promote active, critical engagement with technology.

Lee et al. (2025) conducted a study on a collaboration between Carnegie Mellon University and Microsoft Research, surveyed 319 knowledge-workers (professionals in diverse fields) in a study titled on the impact of generative AI on critical thinking. Using a cross-sectional survey design. They asked how reliance on AI assistants (e.g. ChatGPT) affects workers' critical thinking and effort. Analysis of 936 examples of AI-assisted work showed that when workers trusted AI more, they exerted less critical thinking effort, particularly shifting from solving problems themselves to integrating AI responses. In fact, although Generative AI often improved efficiency, the authors warn it can inhibit critical engagement and ultimately diminish skills for independent problem solving. Thus, higher confidence in AI's output was linked to lower verification and reflection.

Revesai (2025) conducted a mixed-methods case study at a major Zimbabwean university, on Generative AI dependency, the emerging academic crisis and its impact on student performance. Using surveys, interviews, AI-usage tracking and grade data for 248 undergraduates, the study examined students' addictive AI usage. Remarkably, 32.7% of students exhibited addictive patterns (e.g. 18 daily interactions, repeated failed attempts to cut back). Statistical analysis revealed these heavy users had significantly poorer outcomes, on average 0.41 GPA points lower than peers. Regression modeling identified three main pathways. In other words, over-dependence on AI corresponded to declines in analytical skills and learning.

Olatunji-Ishola et al. (2025) investigated AI use in Nigerian education via a broad stakeholder survey on the risks and rewards of AI dependence in Nigerian education. Their cross-sectional study sampled 800 Nigerian participants (students, teachers, administrators, policymakers, EdTech professionals) and analyzed their perceptions. The survey and analysis revealed strong concerns that unchecked AI use could weaken students' ability to think independently. In particular, many respondents predicted that AI tools (like chatbots) might reduce problem-solving skills and creativity among students if over-relied upon.

Kyumana et al. (2025) explored Tanzanian students' perceptions in impacts of ChatGPT on critical thinking. Using a mixed-methods survey design, they collected 133 completed questionnaires from two Tanzanian universities (IFM and MoCU). Results were mixed with an overwhelming majority (93%) of respondents were aware of ChatGPT and used it for study support. Interestingly, 55% of students reported that ChatGPT had enhanced their critical thinking and problem-solving by providing ideas and writing support, whereas about 27% felt it detracted from their thinking, mainly due to overreliance and disrupted learning habits. In other words, while many saw ChatGPT as a helpful aid, a substantial minority warned it could supplant effort. Nearly all agreed ChatGPT should play a supportive rather than replacing role (85% supportive), but noted a lack of clear usage guidelines.

Matto (2024) surveyed 163 Tanzanian undergraduates in a study titled "Is ChatGPT Building or Destroying Education? Perception of University Students in Tanzania." Using a questionnaire tool, he assessed students' views on ChatGPT's role. The findings were revealed that most respondents (81.5%) felt ChatGPT should be allowed but regulated, believing it could bring positive benefits if properly managed. Indeed, Matto reports that students acknowledged ChatGPT helped them learn faster and access materials, suggesting potential boosts in performance. However, when unregulated, students anticipated serious downsides. Thus independent problem-solving and thought could suffer if AI use is unchecked. The study concluded that under well-designed policies ChatGPT could build rather than destroy.

3. Methodology

3.1 Research Approach

Research approach refers to the overall strategy or plan a researcher uses to conduct a study and gather data (Grover, 2015). A quantitative approach was employed in this study. A quantitative approach is justified for this study as it enables the measurement of the extent of AI dependence and its statistical relationship with

independent problem-solving abilities, thereby providing objective, generalizable evidence. This method also allows for the use of standardised instruments and statistical tests to establish patterns and correlations with greater precision

3.2 Research Design

Research design is the overarching plan or strategy that directs the process of conducting a research study (Boru, 2018). A cross-sectional design was employed. Cross-sectional design was adopted as this type of design would allow collecting the information at only one point of time and therefore, effectively analysing the relationship between AI dependence and independent problem-solving abilities among the users. This design is scientifically reasonable because it offers an account of existing trends and relationships among the study population without the costly investigation of longitudinal tracking.

3.3 Study Area

The research was carried out at the University of Dar es Salaam, the oldest and largest government-operated public university in Tanzania that has a diverse student population across the country and has been categorized as one of the best centres of higher learning and research. This environment was rationally grounded because it offers a significant source of technologically involved students that actively use generative AI tools, which forms a suitable environment to investigate the impact of AI reliance on independent problem-solving skills.

3.4 Population of the Study

The population used in the study was 500 undergraduate and post-graduate students of the University of Dar es Salaam, a widely range of academic fields and degrees of digital literacy. This sample was scientifically justified as these students actively use AI in their studies and thus could be chosen to research the implications of AI dependence on the independent problem-solving skills.

3.5 Sample Size

Sample size was determined using the formula below which is adopted from Slovin (1960).

$$n = \frac{N}{1 + N(e)^2}$$

$$n = \frac{500}{1 + 500\ (0.05)^2}$$

$$\mathrm{n} = 222$$

n - The sample size, N – Population of study,
Error estimate (e) = 5%

Therefore, the study employed a total of 222 bachelor's and master's students from the University of Dar es Salaam.

3.6 Sampling Techniques and Procedures

Stratified sampling was employed in this study. Stratified sampling was employed to ensure that both bachelor's and master's students were proportionately represented in the study, reflecting the diversity of the University of Dar es Salaam population. The total population of 500 students was divided into two strata based on academic level, after which a proportionate number of participants was randomly selected from each stratum to form the sample. This technique was scientifically justified as it reduces sampling bias, enhances the representativeness of the sample, and ensures that differences in AI use and independent problem-solving across academic levels could be accurately captured and analysed.

3.7 Data Collection Method and Instruments

The research employed a questionnaire method of data collection that was in the form of a closed questionnaire. Questions were structured such that they had a pre-determined response structure, that is, with a 5-point Likert scale that is strongly disagree to strongly agree. The format was used to simplify the process of the collection of data by providing the respondents with specific choices clearly and it was easy to respond to the questions and increased the efficiency of data analysis. The closed-ended questions that used standardized response scale provide consistency among the participants and aided easy quantitative analysis. Moreover, the research was not using many open ended questions to investigate the issues, suggested solutions and other pertinent perceptions of the interviewees.

3.8 Measurement of the Variables

Table 1 below presents the measurement of the study variables, outlining how each key concept was operationalised for analysis. The independent variable, AI dependence, and the dependent variable, problem-solving abilities, were measured using standardised items adapted from established studies. Each construct was assessed through a series of statements rated on a five-point Likert scale ranging from "strongly disagree" to "strongly agree," allowing for the quantification of participants' perceptions and behaviours in relation to the study objectives.

Table 1: Measurement of the Variables

Variable	Measurements	Measurement Scale	Source
Independent Variable			
AI Dependence (AD)	AD1: Frequency of Use AD2: Trust in AI AD3: Task Reliance AD4: Verification Effort AD5: Decision Support AD6: Information Seeking AD7: Time Saved	5-point Likert scale	Olatunji-Ishola et al. (2025)
Dependent Variable			
Problem-Solving Abilities (PSA)	PSA1: Critical Thinking PSA2: Analytical Skills PSA3: Decision Making PSA4: Creativity in Solutions PSA5: Information Evaluation PSA6: Independent Reasoning PSA7: Problem Identification	5-point Likert scale	Kyumana et al. (2025)

3.9 Data Analysis methods

The study utilized descriptive statistics and linear regression analysis through Statistical Package for the Social Sciences(SPSS) version 26 to analyse the data. Descriptive statistics was used to provide an overview of key variables. This helped to identify patterns and trends in the data. Linear regression analysis then employed to assess the strength and nature of the relationships between the independent variable and the dependent variable. Data collected through structured questionnaires were coded and entered into statistical software, where assumptions of linearity, normality, and homoscedasticity were checked before fitting the regression model. This method was scientifically justified because it allows for quantifying the strength and direction of the impact of AI dependence on problem-solving skills, providing objective evidence of whether increased reliance on AI predicts changes in users' independent cognitive performance.

3.10 Ethical Concerns

The ethical standards and guidelines was adhered. The originality of the work was maintained, and all necessary permissions relevant authorities was secured prior to data collection. Data obtained from participants was handled with the utmost confidentiality, with personal information securely stored to ensure privacy. Anonymity was preserved in all presentations of the data, and the researcher's interactions with participants was conducted with professionalism and respect throughout the research process. Participants were fully informed about the study purpose and voluntarily agree to contribute to the research.

4. Results and Discussion

4.1 Validity Test

Table 2 presents the results of the validity test using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. The KMO value of 0.896 exceeds the minimum acceptable threshold of 0.6, indicating that the sampling was adequate for analysis. Furthermore, Bartlett's Test of Sphericity produced a significant Chi-square value ($\chi^2 = 2898.372$, $df = 105$, $p < 0.001$), confirming that the correlation matrix was not an identity matrix and that the variables were sufficiently correlated to justify analysis. These results imply that the data collected were valid and appropriate for further statistical analysis.

Table 2: KMO and Bartlett's Test Results (n = 222)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.896
Bartlett's Test of Sphericity	Approx. Chi-Square	2898.372
	Df	105
	Sig.	.000

Source: Field Data, 2025

4.2 Reliability Test

The reliability test was performed in a bid to determine internal consistency of the study tools used to measure the AI dependence and problem-solving abilities (Table 3). Findings indicate that AI Dependence had a Cronbach alpha of 0.924 which represents excellent reliability and Problem-Solving Abilities had Cronbach alpha of 0.882 which represents the very good reliability. The conclusions made by these findings suggest that questionnaire items were comparable in terms of the desired constructs and therefore one can be assured that the data collected will be reliable in the further statistical analysis.

Table 3: Reliability test results (n = 222)

Variable	No. of Items	Cronbach's Alpha	Remarks
1. AI Dependence	7	.924	Excellent
2. Problem-Solving Abilities	7	.882	Very reliable

Source: Field Data, 2025

4.3 Descriptive Statistics

Descriptive statistics were computed to summarise and understand the central tendencies, dispersion, and distribution characteristics of the study variables (Table 4). These statistics provide a clear overview of the data, highlighting patterns and potential deviations that inform subsequent analyses.

Table 3: Descriptive Statistics Results (n = 222)

Variable	Mean	Std. Deviation	Variance	Skewness	Kurtosis
1. AI Dependence	3.7618	.86023	.740	-1.308	1.569
2. Problem-Solving Abilities	3.6440	.91479	.837	-.808	.104

Source: Field Data, 2025

The Descriptive statistics show that the mean scores of AI Dependence (3.76) and Problem-Solving Abilities (3.64) fall above the middle of the range indicating moderate to high scores of AI use and problem-solving skills of the respondents. The values of the standard deviations (0.86 and 0.91) and the variances (0.74 and 0.84) indicate a moderate variability in the responses, and the values of skewness are negative (-1.31 and -0.81), which implies that most respondents reported greater-than-average values of both variables. The kurtosis values (1.57 in case of AI Dependence and 0.10 in case of Problem-Solving Abilities) indicate that the distribution is slightly peaked in the case of AI Dependence, and it is close to normal in the case of Problem-Solving Abilities. Such findings suggest that the data used in the study is diverse enough and is distributed in a relatively acceptable manner to warrant further inferential testing, to include regression tests.

4.4 Hypothesis Testing

Hypothesis testing was conducted using linear regression analysis to examine the influence of AI Dependence on Problem-Solving Abilities among students (Table 5). This analysis allows for determining whether variations in AI use significantly predict changes in independent problem-solving skills, providing empirical evidence to support or refute the study hypotheses

Table 5: Linear Regression Analysis Results (n = 222)

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.737	.179		4.116	.000
	AI Dependence	.773	.046	.727	16.663	.020

a. Dependent Variable: Problem-Solving Abilities

Source: Field Data, 2025

The linear regression outcomes in Table 5 show that there is a strong negative effect of AI Dependence on independent problem-solving skills among the users in Tanzania, which rejects the null hypothesis (H_0). In particular, the regression coefficient was found as B = 0.773 and the standardized beta is 0.727, t = 16.663 and p = 0.020, which indicates that the relationship is statistically significant. The results indicate that the alternative hypothesis (H_1) is true and that overuse of AI-based tools may lead to a lower ability of users to engage in independent thinking and solve problems critically, which is why interventions aimed at promoting balanced and contemplative user interactions with AI-based tools may be necessary.

4.5 Discussion of the Findings

The results show that during excessive use of AI tools, the independent ability to solve problems by users is lower, which complies with the earlier research data concerning cognitive offloading and automation bias. Although the concept of AI might bring efficiency and assistance in doing activities, it seems that too much reliance tends to harm critical thinking, analytical reasoning, and thoughtful decision-making. This highlights the need to teach users to use AI in a manner that is supportive rather than substitutive of personal mental effort so that the technology support stimulates, not suppresses, personal problem-solving abilities.

The results are close with other studies that have been conducted by Gerlich (2025), who showed a negative significant correlation with the scores of critical thinking of the frequent users of AI, especially the younger users. Both articles indicate that the overuse of AI may decrease the ability to think independently, which proves that cognitive offloading takes place when users overuse AI in solving problems.

On the same note, the findings are aligned with Lee et al. (2025), who found that an increase in trust in AI output resulted in less critical thinking effort and less information verification. Another finding of the current study is that excessive reliance on AI reduces reflective decision-making, which aligns with the idea that although AI can make the process more efficient, it might also prevent the decision-maker to act independently.

The results are also relevant in the African context because Revesai (2025) and Olatunji-Ishola et al. (2025) have found a reduction in analytical skills and creativity in students who relied on AI excessively. The Tanzanian-specific research conducted by Kyumana et al. (2025) and Matto (2024) is partly in line with each other; though some students have reported the beneficial impact of using AI in a supportive way, a significant proportion of the students' experiences adverse effects of overreliance. On balance, the present paper justifies the fact that the uncontrolled use of AI could jeopardize the development of autonomous cognitive skills, and the cultivation of effective use of AI resources should be guided and thought-out.

5. Conclusion and Recommendations

5.1 Conclusion

The analysis of results concludes that AI dependence has the major negative effect on the independent problem-solving skills of the users in Tanzania. Although AI tools can streamline the efficiency and offer great assistance to learning and fulfilling the assignment, overdependence will decrease the ability to think critically, analyze, and make analytical decisions. The results point to the need to use AI as a supplementary tool instead of a substitute to cognitive effort.

5.2 Recommendations

Based on the study findings, several recommendations are proposed to promote responsible and balanced use of artificial intelligence tools while safeguarding users' independent problem-solving abilities:

1. Schools and policymakers should formulate clear policies and educational initiatives that encourage equitable and responsible use of AI technologies across learning environments.
2. Users should be trained to critically evaluate AI-generated outputs, verify information, and integrate AI assistance in ways that complement rather than replace their own cognitive and analytical processes.
3. Educational institutions should incorporate awareness programmes highlighting the cognitive risks of excessive AI dependence, ensuring users understand the importance of maintaining independent reasoning and critical thinking.
4. Stakeholders in education and technology should collaborate to design frameworks that promote effective use of AI tools for learning and productivity while preserving users' capacity for creative and reflective problem-solving.

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