



INNOVATION, TECHNOLOGIES,
EDUCATION & COMMUNICATION

INNOVATION, TECHNOLOGIES, EDUCATION ET COMMUNICATION

N° 10

L'INTELLIGENCE ARTIFICIELLE DANS L'ENSEIGNEMENT SUPERIEUR : ENTRE PROMESSES ET MENACES

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URL CNRS 19

ISSN Numérique : 2737-8195
Novembre 2025

Writing in the Age of Artificial Intelligence: The Case of IFTEC Master's Students at the Faculty of Letters and Human Sciences of Oujda

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Abstract

Artificial intelligence (AI) increasingly influences education by personalizing content and optimizing learning, especially in online platforms. While AI is praised as a pedagogical innovation, critics argue that it may limit students' autonomy and independent skills development. This study surveyed 34 Master's students in the IFTEC program at the Faculty of Letters and Humanities, Oujda, Morocco, and analyzed their work. Results indicate a moderate link between AI tool use and challenges in independent writing, although students did not feel less competent. Qualitative analysis showed AI tools like content generators and grammar checkers did not affect originality. The findings highlight the importance of balanced AI integration, encouraging responsible use while fostering autonomous writing skills. Teacher training in ethical AI practices is essential to maintain educational quality and prevent overdependence.

Keywords: Artificial intelligence, written production, Learning Analytics

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Introduction

The integration of artificial intelligence (AI) has generated significant interest across various fields, including education, where it offers unprecedented opportunities to personalize learning, improve outcomes, and reduce barriers. Advanced systems such as intelligent tutors and automated grading use machine learning and natural language processing to customize educational content to learners' needs (Luckin et al., 2016; VanLehn, 2011). However, it is crucial to assess AI's real impact on essential skills, especially academic writing, which is fundamental for critical thinking and idea expression. This study examines Master's students in the IFTEC program to understand their reliance on AI and its effects on writing quality, authenticity, and autonomy.

The research addresses these questions: To what extent do students depend on AI for learning? How does AI use influence writing quality? Does frequency of AI tool use affect student dependence?

Using a mixed-methods design with surveys and qualitative analysis of student submissions on Moodle—assessed with AI-detection tools GPT Zero and AI Content Detector—this study evaluates AI's influence on originality and autonomy.

Expected results will clarify perceived benefits and risks, especially regarding creativity and independence. The findings aim to inform balanced, ethical integration of AI in education, supporting technological skills without undermining critical academic abilities.

1. Literature Review

This literature review aims to thoroughly analyze and synthesize scientific research on AI and its impact on students' written production. Through this approach, we seek to identify relevant and actionable correlations that will provide a deeper understanding of our research subject. By situating our study within a broader contextual framework, we can develop a robust theoretical and methodological foundation. This will allow us to position our unique contribution in this field. Additionally, this analytical review of previous research will help clarify key concepts and strengthen the argumentation of our work, ensuring a solid and well-supported foundation.

1.1 Artificial Intelligence

AI is a dynamic and rapidly expanding field, captivating both the academic and industrial worlds. Its impact on education is revolutionary, transforming teaching and learning methods. This section delves deeply into all aspects of AI, from its definition to its specific applications in the educational context. We also examine the different categories established by recent research and the ethical questions surrounding its growing integration into education. By incorporating elements such as the Turing test and the findings of recent academic literature, this exploration aims to provide a critical and in-depth perspective on AI in modern education.

Certainly, this issue "definition of AI" is problematic because, as of yet, there is no standard or simple definition of the concept of AI, as Andler explains: "It is a mistake to think of artificial intelligence as something homogeneous and clearly defined" (Andler, 2023, p.22).

The term "artificial intelligence" dates back to the 1950s, coined by John McCarthy, an American computer scientist and one of the founders of AI. It is fundamental to understand that

AI is linked to the generation of algorithms or the solution of a problem, with actions resembling those of a human being. In 1955, John McCarthy defined it as "the act of causing a machine to behave in a way that would be considered intelligent if a human were to behave that way" (Caneva, 2018, p. 9).

AI is a recent computer science field that uses theories and computational processes to simulate human intelligence through machines. AI can also be defined as the use of machines to simulate human intelligence. In our research, we have adopted the definition proposed by Andler in his book titled *Artificial Intelligence, Human Intelligence: The Double Enigma*: "Intelligence is what enables human beings to solve problems by producing thoughts that carry information" (Andler, 2023, p. 31).

According to (Luckin et al., 2016) there are two major reasons behind the difficulty in defining AI: one concerns the constant evolution of AI, and the other primarily lies in its interdisciplinary nature.

1.1.1 AI in Education

AI in education refers to the use of AI techniques and technologies to enhance teaching and learning processes. This includes the use of computer systems capable of simulating intelligent human behaviors, such as natural language understanding, machine learning, and data analysis, to support learners and educators in various educational contexts. AI is a term that can mean many things. When applied to education, it aims to accomplish complex tasks that were previously carried out solely by humans (such as providing feedback or adapting instructional materials based on the optimal difficulty level for a group of students). (Romero et al., 2023, p. 83)

Exploring some applications of AI in the Educational Context:

- **Intelligent Tutoring Systems (ITS):** These systems personalize the learning journey by adapting content to individual student needs and automating routine tasks for teachers, offering tailored assessments and support.
- **Learning Analytics & AI:** Learning analytics is the "measurement, collection, analysis, and reporting of data about learners and their contexts to optimize learning" (Siemens et al., 2017, p. 241). Integrating AI enhances this process by enabling a deeper analysis of student interactions. In writing, for example, AI can evaluate lexical complexity and text coherence to pinpoint areas needing intervention and inform the design of targeted support tools.
- **Personalized and Adaptive Learning:** AI facilitates personalized education by creating learning paths tailored to each student's skill level, pace, and interests. This is often achieved through **adaptive learning systems**, which use performance data to dynamically adjust content. For instance, a system can provide extra support for a struggling student or offer advanced challenges to one who is excelling.
- **Teaching Evaluation:** AI streamlines teaching evaluation by automating tasks like grading and exam question generation. This provides faster, more accurate, and personalized feedback for students, improving overall teaching efficiency.
- **Virtual Assistants:** AI-powered virtual assistants offer students instant support by answering questions and providing guidance using natural language processing. When

combined with technologies like virtual and augmented reality (VR/AR), they can create immersive and interactive learning environments.

- **The Smart Campus:** This concept integrates AI to improve university life, from operational efficiency to the student experience. By using services like data analytics, smart campuses foster an intelligent environment that supports innovative management and data-informed decision-making.

1.1.2 AI Typology

Artificial intelligence is a dynamic and multidisciplinary field characterized by diverse methodologies and applications. The typology of AI can be categorized based on several criteria, including processing methods, cognitive abilities, application areas, and levels of autonomy.

- **Processing Methods:** AI is divided into **symbolic AI**, which uses logical rules (e.g., in medical diagnostics), and **subsymbolic AI**, which uses machine learning to identify patterns in raw data.
- **Cognitive Abilities:** In terms of cognitive ability, **weak (or narrow) AI** is designed for specific tasks like grammar checking, whereas **strong AI** aims to replicate generalized, human-like reasoning and comprehension.
- **Application Areas:** Key application areas include **Natural Language Processing (NLP)**, which enables machines to understand human language for chatbots and translation, and **Computer Vision**, which allows computers to interpret visual information for facial recognition.
- **Levels of Autonomy:** AI's levels of autonomy range from **reactive AI** (responds to inputs without memory) and **limited memory AI** (uses past data for decisions, like in self-driving cars) to **generative AI**, which can create original content.

1.1.3 The Turing Test

The Turing Test, proposed by Alan Turing in 1950, assesses a machine's ability to mimic human-like intelligence. The test involves a human judge who interacts with both a machine and a human, aiming to determine which is which based on their responses. If the judge cannot tell them apart, the machine is considered to exhibit intelligent behavior.

This test has generated discussions about the meanings of "thinking" and "intelligence" in AI. Although not originally intended as a practical evaluation tool, it has inspired frameworks for assessing chatbots and virtual assistants.

While the Turing Test has influenced areas like social robotics and human-computer interaction, it has significant limitations. It lacks a precise definition of "intelligence," making it hard to create effective experiments. Moreover, it overlooks emotional and social aspects of human intelligence, allowing machines to pass the test by mimicking behavior without genuine understanding.

Despite its impact, the Turing Test is not a conclusive measure of machine intelligence but remains an important reference point in AI research.

1.2 Written production:

This section examines key aspects of written production, including linguistic quality based on the Common European Framework of Reference for Languages (CEFR), the significance of authenticity, the impact of AI tools on learners' writing production, the effects of AI dependence on student learning, and the impact of AI on learner autonomy.

1.2.1 Linguistic Quality: The CEFR

The CEFR is an international standard for assessing language proficiency, introduced by the Council of Europe in 2001. It categorizes skills into six levels from A1 (beginner) to C2 (proficient), offering a framework for evaluating writing abilities.

This framework promotes a communicative approach, emphasizing real-life language use. It provides clear descriptors for evaluating reading, writing, and interaction skills, facilitating international recognition of language competencies.

The CEFR is also a valuable resource for assessing written quality, allowing researchers to analyze complexity, coherence, and vocabulary richness in written texts while providing criteria for organizing ideas.

1.2.2 Authenticity in written production

Authenticity is essential in written production, as it ensures the credibility of works and genuinely reflects the author's skills and original ideas.

a) Understanding Authenticity

According to the LAROUSSE dictionary, authenticity refers to the quality of being authentic or accurate. In writing, authenticity involves truthfulness and sincerity, meaning that the author recounts real events or expresses genuine feelings. An authentic text is characterized by deep honesty and credibility, creating a genuine connection between the author and reader.

b) The role of Authenticity in writing

In writing, authenticity corresponds to sincere and truthful texts that convey the author's voice and intentions. The content must be original, reflecting the author's ideas and emotions while avoiding clichés. Authenticity allows the unique personality of the author to shine through.

c) Importance of Authenticity for students

For students, authenticity in writing is crucial for several reasons. It fosters personal reflection and self-expression, helping them develop their voice and style. Authentic writing enhances credibility and trust, making it more likely to persuade readers, leading to better evaluations and increased recognition.

d) Authenticity and AI

With the rise of AI in education, preserving authenticity in written production is vital. While tools like grammar checkers and text generators can assist, they should not overshadow the student's unique voice. These tools should enhance writing without compromising its authenticity.

e) Strategies for Maintaining Authenticity

Students can maintain authenticity in their writing by employing key strategies. Focusing on personal reflection, which helps them draw from their experiences, creating sincere content. Avoiding clichés and seeking original expressions enhance uniqueness, while fact-checking ensures accuracy and credibility. Seeking constructive feedback from teachers and peers offers valuable insights without compromising their voice. Additionally, the ethical use of AI tools can improve writing quality while preserving integrity. By adopting these practices, students can produce authentic work that reflects their individuality; failing to do so may compromise both authenticity and quality.

1.2.3 Impact of AI tools on learners' writing production

The integration of AI in education presents a complex dynamic, offering significant advantages while raising critical concerns for student writing. AI tools can provide instant feedback and personalized support, creating new opportunities for continuous improvement. However, this integration also poses risks to the creativity, originality, and critical thinking skills of learners. An overreliance on AI may transform how students develop ideas, hindering personal expression and core thought processes. It's therefore essential to position AI as a **complementary tool** rather than a substitute for human intellect, encouraging students to remain the primary authors of their work.

Several theoretical frameworks illuminate these challenges. **Sweller's cognitive load theory**, for instance, warns that while AI can reduce the burden of mechanical tasks like spelling and grammar, excessive automation can foster dependency and weaken fundamental skills. From the perspective of **Salomon's theory of distributed cognition**, AI acts as a powerful cognitive extension, allowing students to offload tasks like brainstorming and synthesis. The danger, however, is that this externalization can diminish the development of internal cognitive abilities if not managed carefully. The **Technology Acceptance Model (TAM)** helps explain why students might become over-reliant, as technology adoption is often driven by perceived usefulness and ease of use. This can lead to passive learning, which directly contradicts the principles of **deliberate practice theory**, where skill mastery requires structured, intentional effort and self-assessment.

1.2.4 Impact of AI on Learner Autonomy: A Critical Analysis

Beyond skill development, the growing integration of AI raises fundamental questions about **learner autonomy**. A crucial aspect of responsible implementation is ensuring learners have the freedom to decide whether to follow the advice and suggestions of an AI system. This flexibility preserves their independence in the learning process and encourages them to exercise critical judgment regarding technological recommendations.

By providing this freedom of choice, we motivate learners to think for themselves rather than automatically submitting to directives. This enriches their educational experience and enhances their capacity to make informed decisions. Such an approach ensures that AI systems support learners in their development as responsible and active individuals in their learning, rather than limiting their autonomy and freedom of choice.

1.2.5 Exploration of AI's effects on student writing: Researcher positioning

This literature review aims to thoroughly examine academic research focusing on the complex interactions between AI and student writing. By analyzing existing studies through the lenses of the aforementioned theories, we seek to identify trends, correlations, and conclusions that offer new perspectives on how AI reshapes the academic writing process.

The ultimate goal is to provide educators, researchers, and policymakers with enlightening information to guide the **ethical and effective integration of AI**. The primary challenge is to balance traditional educational values with technological innovation. A collaborative effort from all educational stakeholders is necessary to establish guidelines that foster a learning environment where technology enhances, rather than replaces, human creativity and critical thought.

2 Methodology

This study employs a mixed-methods approach to analyze the impact of artificial intelligence tools on the written production of Master's students. The primary objective is to understand how students interact with AI in their academic writing and to evaluate its influence on the quality and originality of their work.

2.1 Data Collection and Preparation

Our research is based on authentic student work collected from two Moodle-based modules: "Research Tools and Information Management Techniques" and "Introduction to Neuro-Education." These modules were strategically chosen for their high volume of student interactions, providing a rich data sample. We gathered a variety of productions, including forum discussions and essays, to analyze existing digital traces without influencing student behavior. Before analysis, all texts were systematically cleaned and formatted to isolate the original written content, ensuring the integrity of our analysis.

2.2 Two-Pronged Analysis

Our methodology combines automated textual analysis with qualitative data from student feedback.

a) Textual Analysis

A multi-step process was used to evaluate the collected texts for AI influence and writing quality.

- **AI Content Detection:** Each text was analyzed using two distinct AI detection tools: GPT Zero and AI Content Detector. Employing both tools enables methodological triangulation, allowing us to cross-validate findings and more reliably identify texts with a high probability of AI generation. This dual analysis ensures a more comprehensive understanding of the phenomenon.
- **Stylistic Evaluation:** We also utilized Scribens, a web-based tool, to assess writing quality by highlighting errors related to syntax, grammar, and clarity.

b) Student Questionnaire

To complement the textual analysis, we administered an anonymous questionnaire to all participating students. This survey was designed to gather crucial information on their perceptions, attitudes, and self-reported behaviors regarding AI. Key areas of inquiry included the frequency of AI tool use, the specific types of tools employed, and the perceived impact of AI on their writing and learning process. Anonymity was guaranteed to encourage honest and accurate responses.

2.3 Synthesis and Validation

In the final stage, we synthesize the data from both prongs of our analysis. The quantitative results from the AI detection tools are cross-referenced with the qualitative insights from the questionnaire. This crucial step allows us to compare students' perceived use of AI with the empirical evidence from their written work, thereby validating our findings. By analyzing trends and patterns, we can draw informed conclusions about AI's evolving role in academic writing and provide evidence-based recommendations for educators on managing its use while upholding academic integrity.

2.3 Research Participants

This study included all 34 students from the 2022-2024 and 2023-2024 cohorts of the IFTEC Master's program at the Faculty of Letters and Humanities in Oujda. This comprehensive sample ensures a diverse representation of student profiles, featuring a balanced distribution of gender and age, with a majority (70.6%) of participants aged 22-31. Including both first-year (S1) and second-year (S3) students allows for a comparative analysis of AI usage trends over time.

3. Data Collection and research design

We employed a **mixed-method approach** combining qualitative analysis of written work with quantitative questionnaires to investigate students' use of AI. The research was guided by three central questions:

1. To what extent do students use AI in their learning process?
2. How does AI affect the quality and originality of their written work?
3. Does frequent AI tool usage foster student dependence?

To answer these questions and test our corresponding hypotheses, we collected data from two key sources. First, we analyzed student-written outputs (essays, reports, and Moodle discussions) from two modules: "Research Tools and Information Management" and "Introduction to Neuro-Education." These submissions were examined using AI detection tools like **GPT Zero** and **AI Content Detector** to assess originality.

Second, we administered a questionnaire to gather self-reported data on the frequency of AI use, the types of tools used, and students' perceived dependence on them. This dual approach allowed us to correlate empirical findings from the texts with students' perceptions. Our research indicates widespread AI tool usage, and while these tools may enhance some writing skills, proper guidance is essential to maintain academic integrity and encourage critical reflection.

4. Data Analysis

Our data analysis tested three core hypotheses using a mixed-methods approach, combining qualitative analysis of student work from Moodle with quantitative data from a student questionnaire. This allowed us to triangulate our findings for a more robust conclusion.

4.1 Extent of AI Usage

To test our first hypothesis that **most students use AI**, the questionnaire gathered direct data on the types and frequency of tools employed, such as grammar checkers and writing assistants. We then validated these self-reported behaviors by analyzing platform data for evidence of AI tool use. The dependent variable was the use of AI, while the independent variables were the specific types of tools.

4.2 Impact on Originality

For the second hypothesis, that AI negatively affects originality, we analyzed written work from first-semester (S1) and third-semester (S3) students. We used tools like GPT Zero and AI Content Detector to measure originality and quality (grammar, coherence) as dependent variables. These metrics were then compared against AI usage as the independent variable.

4.3 Student Dependence

To investigate our third hypothesis that frequent use fosters dependence, we correlated AI usage frequency (from the questionnaire) with student responses about the difficulties they face when writing without these tools.

This integrated analysis confirms the widespread use of AI, highlighting its tangible impact on student study methods and underscoring the need to better understand its influence on academic quality and originality.

5. The Results

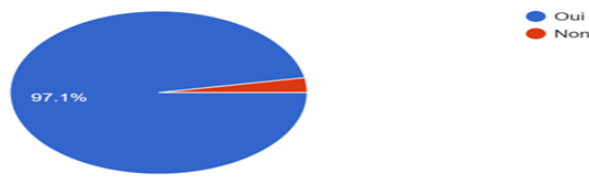
In this part, we present our study's results, addressing each of the three research questions. We analyze collected data, descriptive statistics, and correlation tests to explore the relationship between AI tool dependence and the quality of student learning.

5.1 Results of the first question:

Our first research question explored the prevalence of AI in students' learning processes. The findings overwhelmingly confirm our hypothesis that a vast majority of students rely on AI.

Figure 1: Percentage of Students using AI tools

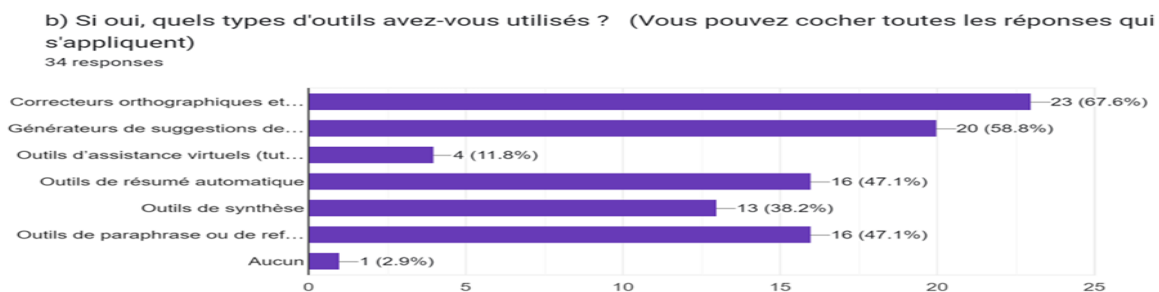
a) Avez-vous déjà utilisé des outils d'IA pour améliorer votre production écrite ? NB: Si la réponse est non, fin du questionnaire
34 responses



A striking 97.1% of students (33 out of 34) reported using AI tools to improve their academic writing. This self-reported data correlates with our analysis of their online activity on Moodle, which revealed a collective plagiarism and AI-content score of 40.07%.

a) Most used AI tools:

Figure 3: Distribution Chart by type of AI tools



Our analysis shows a clear preference for tools that provide direct writing assistance. The most frequently used AI tools were:

- Spelling and grammar checkers (67.6%)
- Content suggestion generators (58.8%)
- Automatic summarizers and paraphrasing tools (both at 47.1%)

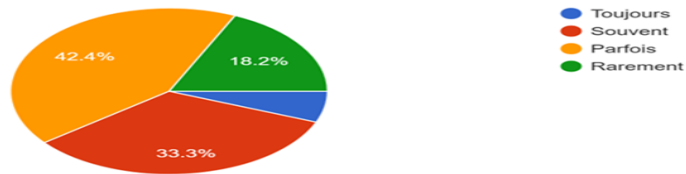
More advanced technologies like virtual assistants were the least popular, with only 11.8% usage, highlighting that students primarily use AI for foundational writing tasks rather than complex interaction.

b) Frequency of use

AI is a consistent part of the writing process for most students. The data revealed that 81.8% of students use AI tools at least occasionally, with 33.3% using them "often" and 6.1% using them "always." Only 18.2% reported using these tools rarely, demonstrating AI's deep integration into their academic workflow.

Figure 4: Frequency of AI tools usage for Written Production

c) À quelle fréquence utilisez-vous l'IA pour produire des travaux écrits ?
33 réponses



5.2 Results of the second research question: How does AI affect writing quality?

The second question examined AI's impact on the quality and originality of student work, revealing a fascinating contrast between student perceptions and empirical data.

a) Student Perceptions

Student opinions on AI's impact were mixed. A significant portion (**45.5%**) felt that AI had **no negative effect** on their writing quality, and **21.2%** **believed it had enhanced their skills**. Conversely, about a third of students noted a negative impact, with 27.3% reporting a slight decrease in quality and 6.1% noting a significant decline.

Figure 5: Perceptions of the Impact of AI tools on the quality of Written Production

Avez-vous remarqué une baisse de la qualité de vos productions écrites depuis que vous utilisez ces outils d'IA?
33 réponses



b) Moodle Data Analysis

Contrary to our hypothesis and the concerns of some students, our analysis of submitted work showed a positive relationship between AI use and quality. A Pearson correlation test revealed a moderate-to-strong positive correlation ($r = 0.653$) between the percentage of AI-generated content and the quality scores from the Scribens writing tool. This result was highly statistically significant ($p < 0.001$), indicating that increased AI use was strongly associated with higher-quality written work.

Table 1: Pearson Correlation Test SPSS Between the Use of AI Tools and the Quality of Written Production

Test de Corrélations			
Plagiat (%)	Corrélation de Pearson	Plagiat (%) 1	Scribens (%) ,653**
	Sig. (bilatérale)		,000
Scribens (%)	N	30	30
	Corrélation de Pearson	,653**	1
	Sig. (bilatérale)	,000	
	N	30	30

**. La corrélation est significative au niveau 0.01 (bilatéral).

5.3 Results of the third research question: Does frequent AI use lead to dependence?

Our final question investigated the link between frequent AI use and student dependency, a connection our data strongly supports.

a) Self-Reported Dependence vs. Difficulty

Students' self-perceptions of dependency were varied: 33.3% considered themselves moderately dependent, while an equal 33.3% reported no dependence at all. However, when asked about the difficulty of writing *without* AI, a significant portion (36.4%) reported never having issues, while a combined 39.5% said they sometimes, often, or always struggle.

b) Correlation Analysis

The most crucial finding came from a Spearman correlation test. While we found no significant link between usage frequency and students' *perception* of their own dependency, we did find a statistically significant positive correlation ($r = 0.372$, $p = 0.030$) between how often students use AI and the difficulty they experience when writing without it.

This result strongly suggests that the more students use AI tools, the more they struggle to produce work independently, indicating a growing functional dependency.

In summary, while AI adoption is widespread and positively correlated with writing quality, this benefit comes at a cost. The more students rely on these tools, the more they struggle to write without them, highlighting the critical need for educational strategies that balance the benefits of AI with the development of independent skills.

6. The Discussion

In this part, we will explore the key findings of our study, compare them with existing knowledge, and examine their implications. We begin by analyzing how our results enhance the current understanding of the subject and then discuss the perspectives they offer, suggesting directions for future research.

6.1 The Extent of AI Use

Our study confirms the near-universal adoption of AI tools among students, with 97.1% reporting their use for writing tasks. This establishes AI as a standard component of the modern academic toolkit. Usage patterns vary, with a small group (6.1%) using AI systematically, a third (33.3%) using it frequently, and the largest group (42.4%) using it occasionally for specific needs.

Students overwhelmingly prefer tools for linguistic accuracy and idea generation, with 67.6% using spelling and grammar checkers. While beneficial for immediate corrections, this heavy reliance raises concerns about the long-term development of students' foundational writing skills. The low adoption of more advanced tools like virtual assistants (11.8%) also indicates untapped potential for enhancing learning efficiency.

Crucially, our analysis of students' work on Moodle revealed a 40.07% rate of AI-generated content, corroborating their self-reported usage. This consistency validates our data and underscores the deep integration of AI in academic writing. This widespread use presents both opportunities and challenges, particularly regarding academic integrity. The ease of generating and paraphrasing content heightens the risk of plagiarism, making it imperative to establish clear ethical guidelines and provide training on the responsible citation and use of AI-generated sources.

6.2 AI's Impact on Writing Quality

Our second research question explored AI's influence on the quality of student work, yielding a significant and somewhat counterintuitive finding. While student perceptions were mixed—with 45.5% reporting no negative impact and some even noting improvements (21.2%)—our empirical data told a clearer story.

The Pearson correlation test revealed a statistically significant, positive relationship (coefficient of 0.653, $p < 0.001$) between the rate of AI use and the quality of written work, as measured by Scribens scores. This result refutes the common hypothesis that AI degrades writing quality. Instead, it suggests that when used as an assistive tool, AI can positively influence academic writing by enhancing grammar, coherence, and clarity.

These findings imply that the focus should not be on prohibiting AI, but on promoting its balanced and critical use. Educators must guide students to leverage these tools effectively without becoming passive recipients of automated suggestions. This requires integrating specific training into curricula that teaches students how to maintain their authorial voice and engage in active revision. Clear institutional policies are essential to govern the ethical use of AI and prevent its misuse.

6.3 AI Use and Student Dependence

The final part of our study investigated the complex relationship between the frequent use of AI and student dependency. The results highlight a critical distinction between perceived dependency and functional dependency.

Students' self-perceptions of dependency were varied and did not significantly correlate with their usage frequency. The majority were split between feeling moderately dependent (33.3%) and not dependent at all (33.3%). This suggests that many students can use AI pragmatically without feeling psychologically reliant on it.

However, the most important finding was a moderate and statistically significant correlation (Spearman's $Rho = 0.372$; $p = 0.030$) between the frequency of AI use and the difficulty students experienced when writing without it. This indicates a growing functional dependency: the more students rely on AI, the more they struggle when the tool is unavailable. This may signal a gradual erosion of foundational writing skills among frequent users, even as the immediate quality of their work improves.

6.4 Recommendations

Based on these findings, a proactive and balanced approach to AI in education is necessary:

Training and Awareness: Educational institutions should provide comprehensive training for both students and educators on the benefits and limitations of AI. Curricula should include modules on ethical AI use, focusing on its role as an aid rather than a substitute for fundamental skills.

- **Encouraging Autonomy:** To counteract functional dependency, educators should integrate regular writing exercises that are completed without AI assistance. Activities like in-class handwriting or assignments on locked-down browsers can help reinforce independent writing abilities and critical thinking.
- **Monitoring and Assessment:** Institutions must continuously monitor AI's impact on student skills. Regular assessments can help detect a decline in writing proficiency due to over-reliance, allowing for timely intervention and support.

This study reveals a complex landscape where AI offers significant benefits but requires careful management to avoid undermining the core goals of education.

The conclusion

This study's findings highlight that AI is a significant asset for education, with its capacity for advanced data analysis and personalized adaptation transforming how students learn. Intelligent tutoring systems, for example, can offer individualized support tailored to diverse learner needs, enhancing the effectiveness of teaching.

However, while AI can create tailored learning experiences by adapting to each student's strengths and weaknesses, its use has broader implications. The drive for efficiency may foster an over-dependence on technology, reducing opportunities for students to develop crucial skills like independent problem-solving and critical thinking.

To mitigate these risks, a balanced and thoughtful approach is essential. This requires developing technological skills in both teachers and learners, establishing robust ethical frameworks, and providing continuous training for educators to integrate these tools effectively. Fostering a culture of innovation through controlled experimentation allows institutions to assess the real impact of new technologies on learning outcomes.

Furthermore, ongoing dialogue between all stakeholders—teachers, students, administrators, and developers—is critical. A Collaborative Decision Making (CDM) approach enables the sharing of best practices and solutions to emerging challenges. To maximize AI's benefits, continued interdisciplinary research is imperative, particularly on how student-AI interaction influences skills beyond writing, such as creativity and collaboration.

The future of education with AI is promising yet complex. By taking a proactive and informed approach, we can turn challenges into opportunities, ensuring that technology genuinely enriches the educational experience while preserving the core values of learning.

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