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HYBRID EDUCATIONAL ECOSYSTEMS IN UPPER SECONDARY EDUCATION: A SYSTEMIC AND ETHICAL APPROACH TO AI DISRUPTION

Abstract

The emergence of Artificial Intelligence (AI) in upper secondary education is transforming teaching and learning processes beyond the physical classroom and contributing to the formation of digitally mediated educational ecosystems. This study examines the impact of AI integration on student behavior, ethical attitudes, academic performance, and critical thinking at High School No. 7 of the University of Guadalajara. The aim of the study is to identify the relationship between the frequency of AI use and changes in students' behavioral, academic, and ethical patterns, as well as to assess whether AI functions primarily as a learning-support tool or risks becoming a substitute for independent thinking. Using a systemic ecosystem approach, the research considers not only technological adoption but also its cognitive and ethical implications in the context of the Sustainable Development Goals. Methodologically, a quantitative diagnostic study was conducted to examine the relationship between the frequency of AI use and behavioral changes among students, considering both personal interests and required curricular content. The findings reveal a complex relationship between AI use and educational outcomes. Although frequent use is associated with time-saving practices and a potential risk of cognitive dependence, a weak positive association was identified between intensive AI use and academic integrity. Contrary to assumptions about increased passivity, frequent AI users demonstrated higher levels of source verification and informed skepticism. The results suggest that sustained interaction with AI may contribute to the development of algorithmic literacy when its use occurs within an educational environment that prioritizes ethics, critical thinking, and responsible engagement over speed and convenience.

Keywords: Artificial Intelligence, Students, Educational Ecosystem, Upper Secondary Education, Ethics, Critical Thinking, Algorithmic Literacy.

Introduction

The current configuration of teaching and learning has moved beyond the traditional teacher–student interaction, giving rise to hybrid spaces where emerging technologies, especially Artificial Intelligence (AI) and Generative AI (GenAI), play a disruptive role. At High School No. 7 of the University of Guadalajara, this phenomenon appears in what can be described as "digitally mediated educational ecosystems," where technology affects not only academic performance but also student behavior and school culture. The problem is not only the frequency with which these tools are used, but the lack of a systemic integration that considers ethical and cognitive dimensions [1]. While AI offers opportunities to personalize learning, its unregulated use creates significant risks of cognitive dependence and educational inequality, particularly within a culture of immediacy where students feel the need to complete activities quickly and efficiently. This creates an efficiency-versus-autonomy paradox, raising concerns about the ethical use of these tools, such as the "Artificial Intelligence plagiarism" described by Díaz-Arce, where automation acts as a substitute for thought rather than a learning support.

Consequently, it is essential to move beyond an instrumental view of tools like ChatGPT and understand them as part of a complex ecosystem requiring pedagogical intervention. This demands a deep reflection on how AI transforms traditional educational models and problem-solving habits in hybrid environments [2]. The objective of the present research is to analyze these systemic flows and cultural impacts at the upper secondary level to design strategies that respond to the real needs of our current context, ensuring that technology enhances human capabilities rather than replacing them.

This study contributes to the literature by: 1. Providing empirical evidence that a higher frequency of AI usage correlates positively with increased source verification and informed skepticism, effectively challenging the assumption that widespread AI adoption inherently undermines academic integrity. 2. Quantifying the trade-off between AI-driven task efficiency and

cognitive autonomy, thereby establishing a data-backed framework for designing pedagogical interventions that integrate generative AI into secondary curricula without eroding critical thinking skills [3].

Materials and research methods

Theoretical Framework. According to Díaz and Ribera [4] generative artificial intelligence is a type of technology whose “purpose is to produce synthetic data such as text or images from patterns learned in real data.” In other words, it involves the use of artificial intelligence to create content through models that work across different tasks and perform actions based on preconfigured instructions. Examples of artificial intelligence include Siri, Apple’s voice-based assistant, or Mendeley, a tool used for managing bibliographic references. Among generative AI tools, one of the most commonly used is ChatGPT, mainly because of its large number of registered users and its latest versions, such as GPT-4. High school students are no exception in the use of this technology.

To illustrate this, several studies have examined how high school students use artificial intelligence. One example is, who found that students often use AI tools to complete assignments that require writing essays or paraphrasing. However, they do not mention the use of AI in their submitted work, which raises concerns about honesty. This situation is closely related to the purpose of the present research, which aims to document how students use AI in their school activities, including their reasons and motivations, as well as the ethical handling of these technological tools.

In another study, [5] examined the use of artificial intelligence among third-year high school students in schools in Quito. Their results were mostly negative, stating “that students are not using or implementing artificial intelligence for completing assignments, studying, preparing for exams, or developing self-learning or research skills” (p. 29). This statement partially contradicts what is observed in the student community at High School No. 7; however, the present study aims to evaluate the applicability of this finding.

Meanwhile, [6] highlight the potential of generative AI, describing it as a tool that can help high school students strengthen their creative skills and critical thinking. However, they also point out that students feel the need to learn how to use this technology to take full advantage of it for their school tasks and activities. Their research used a quantitative approach with surveys, which aligns with the methodology of the present study, as it also aims to survey high school students from different subjects and grade levels.

Furthermore, the integration of AI in education must align with the Sustainable Development Goals (SDGs), specifically SDG 4, which seeks to guarantee inclusive, equitable, and quality education. According to [7], AI ethics is not an added element but a fundamental requirement. [8] has established clear recommendations: AI should be designed to enhance human capabilities, not replace them. In the context of high school education, this means ensuring that the automation of school tasks does not weaken basic cognitive abilities or increase existing inequalities. This makes it essential to carefully document how AI is being used.

To understand the magnitude of this transformation, it is necessary to adopt an “ecosystem approach.” [9] propose that educational interventions in times of emergency (technological disruption) must be based on principles of autonomy and collaboration. The school is seen as a living system where the introduction of a new agent (AI) affects all relationships. From this perspective, intervention should not be limited to technical training (teaching how to use the software). Still, it should focus on metacognition: helping students reflect on their own learning process when interacting with AI tools. To achieve this, it is first essential to understand what AI tools students use, how they use them, and in what contexts inside or outside the school [10].

Methodology. The final sample consisted of 354 students (61% female, 39% male; average age 16.5 years, range 15–20) enrolled in the third to sixth semesters at High School No. 7. Pearson correlation coefficients were calculated to examine relationships between variables, and a one-way ANOVA test was used to evaluate differences in perceived cognitive dependence across levels of AI usage. The significance level was set at $p < 0.05$. The reliability of the survey instrument was assessed

using Cronbach's alpha ($\alpha = 0.823$), indicating good internal consistency in measuring student attitudes and perceptions.

To ensure methodological clarity and systematic data collection, the research variables were operationalized as follows:

Table 1 - Operationalization of Variables.

Construct (Variable)	Operational Definition	Justification	Items (P#)
Technological Utility	Perception of functional benefits and frequency of usage.	Measures the level of adoption and perceived efficiency.	P1, P2, P7
Cognitive Autonomy	Balance between AI support and critical thinking skills.	Assesses the risk of excessive cognitive offloading.	P3, P5, P12
Ethical & Epistemic Verification	Commitment to truth and verification of synthetic content.	Evaluates academic integrity and algorithmic skepticism.	P9, P11, P14
Creative Efficacy	Use of AI as a catalyst for new ideas and motivation.	Measures AI as a cognitive partner for augmentation.	P6, P8
Institutional & Pedagogical Need	Demand for formal training and curricular updates.	Identifies gaps in digital literacy and teacher support.	P4, P13, P16
Note: compiled by the authors			

The following questions were used, which are abbreviated from P1 to P17 for database management purposes:

1. Do you use any artificial intelligence tools such as chatbots or text/image generators to complete your activities in high school?
2. How often do you use artificial intelligence tools for your high school activities?
3. Do artificial intelligence tools make it easier for you to understand and learn the subjects in high school?
4. Do your teachers recommend that you use artificial intelligence tools in your school activities?
5. Has artificial intelligence improved your ability to carry out school research and projects?
6. Do you believe that artificial intelligence helps you develop creative skills by generating ideas or content?
7. Does AI reduce the amount of time you spend on repetitive or mechanical school tasks?
8. Do you feel motivated to learn more about artificial intelligence and its applications because of its presence in education?
9. Do you trust the information and results you obtain through artificial intelligence tools?
10. Are you concerned that artificial intelligence might replace some of your skills or reduce your knowledge?
11. Does AI make you worry about the originality and authenticity of your schoolwork?
12. Do you think that the use of generative AI could negatively affect the depth of your learning if you rely on it too much?
13. Should teachers include instruction on the ethical and responsible use of artificial intelligence in high school?
14. Do you use AI to quickly solve questions, but always verify the information with other sources?
15. Has artificial intelligence changed the way you interact and collaborate in group work?
16. Should the high school update its curriculum to include topics related to artificial intelligence?

17. Write down which artificial intelligence and generative artificial intelligence tools you use or have used in your activities inside or outside of school [11].

To ensure the robust nature of the research, content validity was verified through a rigorous expert review process involving specialists in pedagogy and educational technology. This systematic validation ensured that each item was clear and directly aligned with the study's ecosystemic objectives [12]. Construct validity was addressed by mapping each questionnaire item to the specific dimensions of the educational ecosystem detailed in Table 1. The investigation utilized a structured quantitative survey implemented via a 5-point Likert scale, ranging from *Strongly Disagree* (1) to *Strongly Agree* (5). This design allowed for the objective measurement and quantification of student consensus regarding technological utility and cognitive risks [13]. Furthermore, the study adhered to established methodological guidelines [14], ensuring the instrument's reliability and the sample's relevance within the targeted high school cohorts.

Ethical Considerations and Data Processing.

The study adhered to the ethical guidelines of the University of Guadalajara. An informed consent acceptance form was presented to all participants before the survey, ensuring voluntary participation and explicit assurances regarding anonymity and the aggregate processing of data. The data processing procedure involved an initial cleaning phase to exclude incomplete entries, followed by statistical analysis using R software, focusing on descriptive and inferential verification to ensure internal consistency and reliability.

The analytical depth of this research is grounded in contemporary theoretical frameworks concerning the disruptive impact of digital transformation. As emphasized by [15] and [16], these digitally mediated spaces fundamentally redefine how knowledge is socially constructed and accessed. Within this systemic view, Artificial Intelligence is conceptualized not merely as a tool, but as a cognitive mediation agent that transforms how learners process information and achieve academic outcomes within the hybrid ecosystem.

Study Limitations.

Despite the systematic approach, this study acknowledges several limitations. First, self-selection bias is a known constraint in voluntary surveys; however, this was mitigated by issuing persistent invitations via the institutional network to the entire student body in the selected semesters. Second, social desirability bias—where students might underreport AI use to align with traditional academic integrity norms—was addressed through strict anonymity protocols and explicit instructions that data would be processed aggregately. Finally, the research is limited by its focus on a specific institutional case study at High School No. 7, which may affect the generalizability of the results to other educational contexts with different socio-technological profiles.

Sampling and Data Collection Procedure.

The research utilized stratified random sampling across the third to sixth semesters to ensure a representative cross-section of the student body at High School No. 7 during the 2025-B academic cycle.

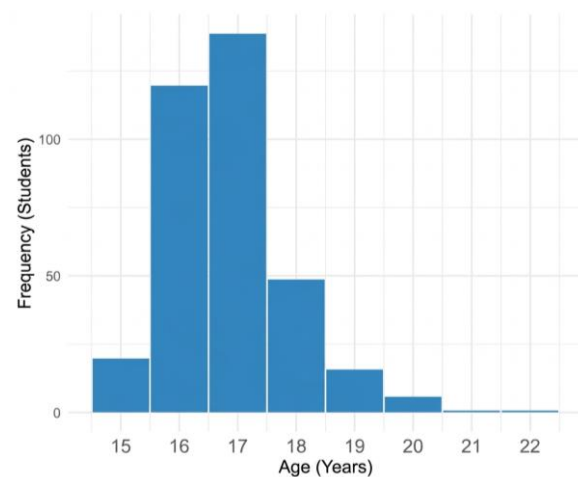


Figure 1 - The age range of the students

Note: compiled by the authors

Students in the first and second semesters were excluded as they are enrolled in the new curriculum implemented in January 2025 as part of the University of Guadalajara's upper-secondary reform.

The following graph (Figure 1) shows the age range of the students who participated in the research, where it can be observed that most of them are between 16 and 17 years old.

Results and their discussion

From the analysis of the results, the following chart is presented. It can be viewed as a radial graph that includes six critical dimensions: Efficiency (Time), Creativity, Understanding, Ethics (Verification), Fear of Replacement, and Risk of Dependence.

The analysis of the figure shows a balanced shape, but with clear tensions. Efficiency and Risk of Dependence score high (close to level 4), suggesting that the educational community sees AI as a powerful tool for optimizing time, while also recognizing a latent concern about losing cognitive autonomy. On the other hand, dimensions such as Fear of Replacement remain at moderate levels, indicating an ecosystem that, although cautious, is not resistant to technology. Instead, it seeks to integrate it under parameters of Ethics and Verification.

To interpret this visualization from an academic perspective, the following four pedagogical categories are established as key elements that guide interaction at Prepa 7:

1. Emerging technologies must serve as cognitive partners that augment human intellect instead of substituting it. It is essential to transition from a paradigm of mere temporal efficiency ("automation") toward one of creative expansion ("augmentation"), establishing a conceptual framework where AI catalyzes profound cognitive processing rather than simply accelerating task completion (Figure 2) [18].
2. Educational environments necessitate a structural equilibrium; excessive algorithmic dependency threatens to erode analytical competencies. This tenet advocates for AI to function as a scaffolding mechanism that diminishes as learner proficiency advances, thereby avoiding the creation of a cognitive dependency that might substitute for authentic intellectual mastery [19].
3. Educational ecosystems rely on institutional confidence; here, rigorous verification functions as a systemic defense mechanism against algorithmic hallucinations and biased data. This tenet emphasizes academic integrity and empirical accuracy, advocating for technology as an instrument that supports the scholarly community rather than erodes its ethical foundations [8.-32].

4. Educational ecosystems are transformed by the interplay of learners, educators, and digital tools. This tenet emphasizes systemic co-evolution: rather than a substitute, AI catalyzes reimagining the pedagogical function toward mentorship—preserving the vital human bond that remains beyond the reach of algorithmic logic [17.-17].

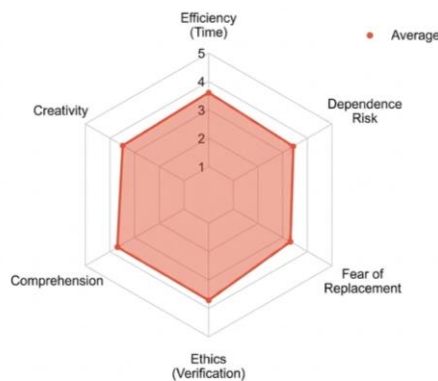


Figure 2 - Ecosystemic Radial Chart of AI

Note: compiled by the authors

Regarding the intensity of use vs. the ethical behavior shown by upper-secondary students when using Artificial Intelligence tools in their school activities, Figure 3 allows us to identify this through a stacked bar chart. This chart explores the correlation between the Frequency of AI Use (horizontal axis) and the Level of Source Verification (vertical axis and color code). The visualization makes it possible to break down the students' ethical behavior according to their familiarity with the tool.

The data analysis reveals a significant positive trend: as the frequency of use increases (from 1 to 5), the proportion of students who carry out rigorous verification (represented by the blue segments, levels 4 and 5) increases notably. In contrast, at low levels of use (column 1), behaviors of no or low verification dominate (red and orange segments, levels 1 and 2).

This finding, shown in Figure 3, suggests that continuous immersion in the AI ecosystem does not promote passivity. On the contrary, it appears to develop critical awareness of the technology's limitations (such as algorithmic hallucinations), pushing frequent users to adopt stricter validation protocols to ensure the quality of their work.

Figure 3. Stacked Bar Chart Comparing Intensity of Use and Ethical Behavior

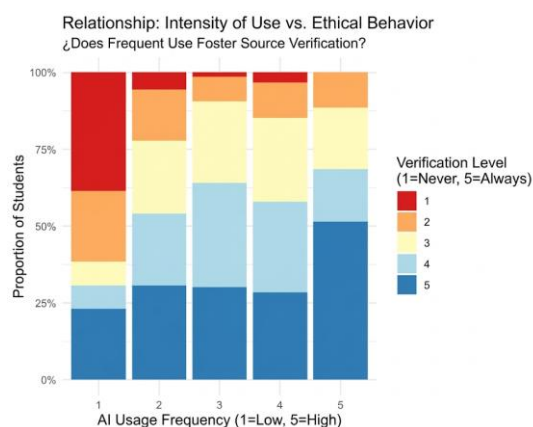


Figure 3 - Stacked Bar Chart Comparing Intensity of Use and Ethical Behavior

Note: compiled by the authors

To support this phenomenon, the following four pedagogical categories are proposed to explain the transition from a novice user to an ethical user:

1. Technological Maturity Curve and Informed Skepticism. The digital ecosystem rewards experience. Occasional users tend to trust blindly in the “magic” of the tool (automation bias). However, Figure 3 shows that repeated exposure reveals AI errors to the user, fostering “informed skepticism.” This principle states that ethical competence evolves alongside technical competence: knowing how to use the tool also means knowing when to question it [20]

2. Epistemic Responsibility in Hybrid Environments. In an ecosystem where information is generated by machines but validated by humans, the responsibility for truth falls on the user. The chart shows that “superusers” (Frequency 5) mostly assume this responsibility (Verification Level 5). This principle indicates that high-intensity use transforms the student from a passive consumer into an active curator of knowledge, taking on epistemic responsibility for the results they present [21].

3. Algorithmic Literacy as an Epistemic Safeguard. Within this hybrid framework, verification transcends isolated actions to become a fundamental pillar of digital literacy. The identified correlation indicates that high-intensity interaction serves as a form of implicit training in algorithmic discernment. By navigating the probabilistic and non-deterministic landscapes of generative systems, students integrate rigorous validation as a systemic requirement within their academic workflows. This developmental practice functions as a critical epistemic safeguard, fortifying the educational ecosystem against informational instability while preserving the cognitive integrity of the learning journey [1.-64].

4. Cognitive Dissonance and Error Correction. The ecosystem self-regulates through dissonance. When a student uses AI frequently and encounters inconsistencies, they experience cognitive dissonance, which they resolve through verification. Low-frequency users (Column 1) are not exposed enough to these inconsistencies to develop the habit. This principle states that AI errors are, paradoxically, the strongest pedagogical drivers of critical thinking and ethical validation [22].

Figure 4 presents the Pearson correlation matrix for the quantitative variables analyzed in the study. The heatmap reveals significant association patterns that shape the ecosystem of Artificial Intelligence adoption among high school students, showing a latent tension between perceived usefulness and ethical and cognitive concerns.

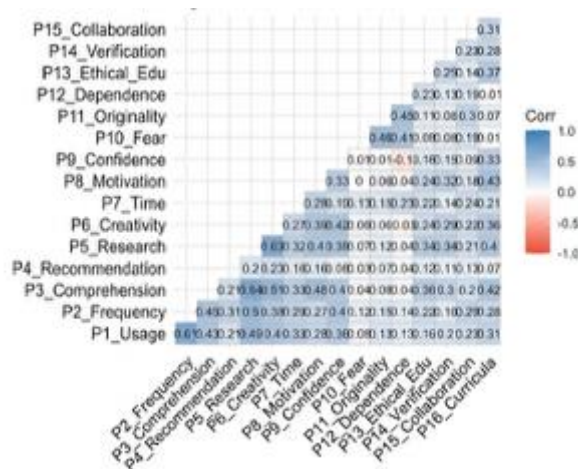


Figure 4 - Correlation Matrix of Variables

Note: compiled by the authors

First, an instrumental usefulness cluster is identified. As expected, there is a very strong positive correlation between general use (P1) and frequency of use (P2, $r = 0.76$). More importantly, the frequency of use (P2) shows moderate positive correlations with the perception of specific benefits, such as easier understanding (P3, $r = 0.37$), research support (P5, $r = 0.42$), increased creativity (P6, $r = 0.34$), and time efficiency (P7, $r = 0.32$). These data suggest that students who use AI more intensively in their academic routines are motivated by immediate functional advantages and the optimization of cognitive processes. This trend aligns with recent findings showing that students quickly adopt generative AI tools mainly as assistants for efficiency and cognitive offloading in academic tasks [23].

In contrast, a second cluster related to anxiety and risk emerges. The strongest correlation in the whole matrix, outside of the direct use variables, appears between the fear of replacing human skills (P10) and the concern about the originality of academic work (P11) ($r = 0.62$). In addition, both variables show moderate correlations with the perceived risk of cognitive dependence (P12) ($r = 0.41$ and $r = 0.45$, respectively). This indicates that, along with enthusiasm for usefulness, there is also significant awareness of the long-term risks of uncritical dependence on these technologies. This reflects global concerns about academic integrity and the possible erosion of autonomous critical thinking in the AI era [24].

Finally, the most important finding for pedagogical intervention is the gap between use and ethical verification. A weak correlation is observed between frequency of use (P2) and the practice of checking the information obtained (P14, $r = 0.19$). This near statistical independence shows that greater interaction with AI does not automatically lead to critical validation of sources. Although students who verify information tend to agree more with the need for ethical education in high school (correlation between P14 and P13, $r = 0.39$), the actual practice of verification remains low even among frequent users. This discrepancy highlights the urgency of moving from merely instrumental access to critical AI literacy, ensuring that human judgment remains in control of the results generated by algorithms, as recommended by international guidelines for AI in education.

Figure 5 shows the results of the One-Way Analysis of Variance (ANOVA); which was designed to determine whether there are statistically significant differences in the perception of cognitive dependence (P12) among different groups of students segmented by their frequency of use of Artificial Intelligence tools (P2). The boxplot allows us to visualize the dispersion and the median of the perceived risk at each level of use intensity; from low frequency (1) to high frequency (5). The analysis yielded a p-value of 0.003, indicating a statistically significant difference ($p < 0.05$) in cognitive dependence perceptions across different intensity levels.)

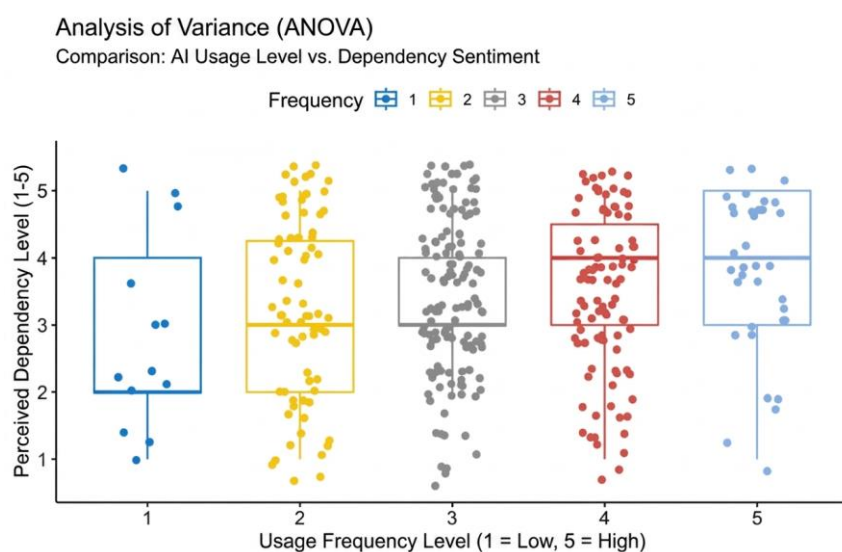


Figure 5 - ANOVA Analysis

Note: compiled by the authors

The analysis shows an upward trend in the perception of dependence as the frequency of use increases. Students located in the upper quartiles of use (frequencies 4 and 5) report higher medians on the scale of concern about cognitive dependence compared with occasional users. This finding suggests the existence of an “efficiency paradox”: while the tool is adopted to optimize mechanical tasks, intensive use awakens in students a latent awareness of the possible weakening of their own abilities to solve problems without algorithmic assistance. This phenomenon aligns with what [25] describe as the risk of “excessive cognitive offloading,” where delegating mental processes to AI may hinder the consolidation of deep learning schemes.

Likewise, the variability observed in the high-frequency groups indicates that, although use is intensive, it does not have a homogeneous subjective impact. Some students manage to integrate the tool without feeling a loss of agency, while others experience clear anxiety about becoming disconnected from their own creative and analytical processes. This tension confirms the need for pedagogical interventions that not only teach the instrumental use of AI but also strengthen self-regulated learning [26]. The statistical significance of these differences highlights that technological dependence is not a uniform risk, but a variable conditioned by the intensity of exposure to generative models, which requires differentiated digital literacy strategies in the upper-secondary curriculum [27]

Hypothesis to be tested: “Do students who use AI very frequently (Group 5) feel greater cognitive dependence than those who use it rarely (Group 1)?”

Interpretation of the p-value result:

- If $p < 0.05$, it means that there *are* significant differences. In other words, excessive use really changes the perception of dependence.
- If $p > 0.05$, there is no statistical difference between using AI a lot or a little regarding cognitive dependence.

The empirical findings from High School No. 7 challenge and extend prior research on AI adoption in secondary education. Our results contradict the findings of [5.-20], who reported low AI adoption in secondary contexts. Conversely, our data confirms that AI is already a central component of the students' educational ecosystem. However, this high integration does not imply that students use AI solely for academic dishonesty; instead, it reveals an efficiency-autonomy paradox that demands immediate pedagogical intervention.

First, regarding the Efficiency-Autonomy Paradox, our findings suggest that students view AI primarily as a time-optimization tool (P7, $r = 0.32$). While this efficiency is perceived as a benefit, it correlates with a high concern for cognitive dependence (P12). Pedagogically, this implies that traditional take-home assignments; which focus on product output rather than process; are increasingly obsolete. To address this, educators should shift toward process-based assessment, requiring students to submit not only the final output but also their iterative prompts, the AI's initial draft, and their subsequent corrections. This transition from product-grading to process-auditing turns AI usage into a transparent learning step rather than a black box.

Second, the unexpected positive correlation between high frequency of AI use and rigorous verification (Figure 3) provides a crucial insight for digital literacy. This relationship is not merely a behavioral outcome but is rooted in a fundamental mechanism of error calibration driven by cognitive dissonance. Intensive users, exposed more frequently to the limitations of generative models (such as algorithmic hallucinations inevitably experience a clash between expectation and output). Rather than leading to apathy, an association was observed between this dissonance and a transition from a passive consumer approach to informed skepticism. In this ecosystem, the student functions as the semantic anchor that the model lacks; as users increase their interaction, they internalize verification as an essential epistemic safeguard [23.-50]. For pedagogical practice, this suggests that teachers

should not merely hope for accidental learning, but should explicitly design AI-Auditing exercises where students are tasked with identifying errors. This reinforces the premise that ethical competence evolves alongside technical maturity, transforming the student from a reliance on the tools into an intentional and active curator of knowledge.

Finally, while moderate levels of Fear of Replacement (P10) indicate that students still view AI as a cognitive copilot, the weak statistical link between frequency and actual verification ($r = 0.19$) highlights a competency gap. High adoption does not automatically ensure critical evaluation. Therefore, the pedagogical ideal is to introduce strategic cognitive friction; designing assignments that require students to reconcile AI-generated data with primary, verified sources. By mandating this step, institutions can bridge the gap between instrumental use and epistemic responsibility, ensuring that technology expands human cognitive capacity rather than eroding the critical skills necessary for quality education in the digital age.

Conclusion

This investigation elucidates the intricate synergy between learners and generative systems, presenting a digital transformation paradigm that extends beyond its specific regional context. Drawing from the empirical data, the subsequent fundamental conclusions are established:

From Plagiarism to Verification

Our findings contest the widespread conviction that algorithmic tools inevitably result in scholarly misconduct. The data reveals that adoption intensity predicts ethical engagement: as familiarity with these models matures, students increase their commitment to source validation and develop a necessary skepticism. Thus, digital proficiency appears to be associated with an ethical maturity, where active engagement - rather than restrictive measures - seems to play a role.

The Need for "Cognitive Friction"

The identified ecosystem profile highlights a substantial risk of operational dependency. It is a pedagogical necessity for organizations to deliberately integrate "cognitive friction" into the educational journey, designing structured challenges that resist algorithmic resolution to safeguard analytical competencies and counteract the cognitive atrophy linked to a focus on pure efficiency.

Ecosystem Maturity and Global Applicability

High School No. 7 functions as a microcosmic representation of the digital shifts currently impacting educational frameworks in emerging territories, such as Kazakhstan and other CIS regions. Our results suggest that schools should pivot toward an Academic Integrity strategy rather than relying on punitive mandates. This framework is transferable to various contexts seeking to fulfill SDG 4 objectives amid rapid technological disruption. Our systemic view indicates that institutions can effectively assimilate AI by nurturing a culture that prioritizes analytical skepticism over rapid completion.

Future Implications: The Real Gap Is Not Access, but Judgment

The divergence between individuals who perform verification and those who abstain confirms that the "digital divide" has shifted from physical availability to the capacity for epistemic judgment. Prospective curricula must emphasize the importance of algorithmic auditing and reflective editing. Learners must transition from being passive recipients of synthetic data to becoming intentional and ethical curators of knowledge.

Final Reflection

The transformation of the educational ecosystem toward a hybrid model is irreversible. However, the trajectory of this change is manageable through strategic pedagogical intervention. Both the literature and the study results agree that prohibition is ineffective. The recommended path is "critical literacy": integrating ethics and algorithmic skepticism as transversal components, ensuring that AI expands human cognitive capacity and aligns pedagogical practice with the requirements of quality education in the digital age.

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ОРТА МЕКТЕПТЕГІ ЖОҒАРЫ СЫНЫПТАРДАҒЫ БІЛІМ БЕРУ ЭКОЖҮЙЕЛЕРІ: ЖАСАНДЫ ИНТЕЛЛЕКТТІҢ БҰЗЫЛУЫНА СИСТЕМАЛЫҚ ЖӘНЕ ЭТИКАЛЫҚ ҚАРАУ

Аңдатпа

Жалпы орта білім беру жүйесінде жасанды интеллектінің (ЖИ) пайда болуы оқыту мен білім алудың дәстүрлі сынып шеңберінен шығатын трансформациясына ықпал етіп, цифрлық делдалдықтағы білім беру экожүйелерінің қалыптасуына жағдай жасауда. Мақалада Гвадалахара университетінің №7 жоғары мектебі мысалында ЖИ-ді білім беру үдерісіне интеграциялаудағы оқушылардың мінез-құлқына, этикалық ұстанымдарына, оқу үлгеріміне және сыни ойлау қабілетіне әсері зерттеледі. Зерттеудің мақсаты – ЖИ-ді пайдалану жиілігі мен оқушылардың мінез-құлықтық, академиялық және этикалық сипаттарындағы өзгерістер арасындағы өзара байланысты анықтау, сондай-ақ ЖИ-дің оқуды қолдау құралы ретінде басымдық танытатынын немесе дербес ойлауды алмастыру қаупін тудыратынын бағалау. Жүйелік экожүйелік тәсіл негізінде зерттеуде ЖИ-ді қолданудың технологиялық аспектілерімен қатар оның когнитивтік және этикалық салдары тұрақты даму мақсаттары аясында қарастырылды. Әдіснамалық негізді ЖИ-ді пайдалану жиілігі мен оқушылардың мінез-құлқындағы өзгерістер арасындағы байланысты анықтауға бағытталған сандық диагностикалық зерттеу құрады. Зерттеу барысында оқушылардың жеке қызығушылықтары мен міндетті оқу мазмұны ескерілді. Нәтижелер ЖИ-ді пайдалану қарқындылығы мен білім беру нәтижелері арасында күрделі өзара байланыстың бар екенін көрсетті. ЖИ-ді жиі пайдалану уақытты үнемдеумен және когнитивтік тәуелділіктің ықтимал қаупімен байланысты болғанымен, оны қарқынды пайдалану мен академиялық адалдық арасында әлсіз оң байланыс анықталды. ЖИ-ді жиі қолданатын оқушылар дереккөздерді тексеру және ақпаратқа саналы скептицизм таныту деңгейінің жоғары екенін көрсетті. Нәтижелер этикаға, сыни ойлауға және технологияларды жауапты пайдалануға басымдық беретін білім беру ортасында ЖИ-мен тұрақты өзара әрекеттесу алгоритмдік сауаттылықты дамытуға ықпал етуі мүмкін екенін көрсетеді.

Негізгі сөздер: Жасанды интеллект, білім беру экожүйесі, орта білім беру, этика, сыни тұрғыдан ойлау, алгоритмдік сауаттылық.

ОБРАЗОВАТЕЛЬНЫЕ ЭКОСИСТЕМЫ В СТАРШИХ КЛАССАХ СРЕДНЕЙ ШКОЛЫ: СИСТЕМНЫЙ И ЭТИЧЕСКИЙ ПОДХОД К РАЗРУШЕНИЮ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА

Аннотация

Появление искусственного интеллекта (ИИ) в системе общего среднего образования трансформирует процессы преподавания и обучения, выходя за пределы традиционной классной среды и способствуя формированию цифровых образовательных экосистем. В статье исследуется влияние интеграции ИИ на поведение учащихся, их этические установки, академическую успеваемость и критическое мышление на примере средней школы № 7 Университета Гвадалахары. Цель исследования заключается в выявлении взаимосвязи между частотой использования ИИ и изменениями в поведенческих, академических и этических характеристиках учащихся, а также в определении того, выступает ли ИИ преимущественно инструментом поддержки обучения или создает риск замещения самостоятельного мышления. Системный экосистемный подход позволил рассмотреть не только технологические аспекты использования ИИ, но и его когнитивные и этические последствия в контексте целей устойчивого развития. Методологическую основу составило количественное диагностическое исследование, направленное на выявление взаимосвязи между частотой использования ИИ и изменениями в поведении учащихся с учетом их личных интересов и обязательного учебного содержания. Результаты демонстрируют сложную взаимосвязь между интенсивностью использования ИИ и образовательными результатами. Несмотря на связь частого применения ИИ с экономией времени и потенциальным риском когнитивной зависимости, выявлена слабая положительная взаимосвязь между интенсивным использованием ИИ и академической добросовестностью. Вопреки предположению о формировании пассивности, учащиеся, активно использующие ИИ, демонстрировали более высокий уровень проверки источников и осознанного скептицизма. Полученные результаты позволяют предположить, что постоянное взаимодействие с ИИ способствует развитию алгоритмической грамотности при условии образовательной среды, ориентированной на этику, критическое мышление и ответственное использование технологий, а не на скорость и удобство.

Ключевые слова: Искусственный интеллект, образовательная экосистема, среднее образование, этика, критическое мышление, алгоритмическая грамотность.

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