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The impact of technology dependency in higher education: A critical examination of cognitive, behavioural and societal outcomes

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Abstract

This body of comprehensive research, investigates the multifaceted impacts of technology, particularly Artificial Intelligence, in higher education, exploring concerns such as diminished critical thinking, reduced knowledge retention, and declining interpersonal skills among Gen Z students. It critically assesses whether current tech-dependent educational models are "dumbing down" students and examines the potential benefits of re-embracing traditional methodologies. The study also delves into global implications, scrutinising the technological dependency observed in Asian nations' higher education systems and considering the preparedness of students for a potential global system failure in AI. The paper ultimately proposes a balanced pedagogical model that integrates essential AI literacy with robust foundational skill development, drawing insights from international examples and advocating for policy revisions to ensure academic excellence and societal resilience. Ultimately, this research advocates for a proactive, rather than reactive, approach to technology integration in higher education, urging policymakers and educators to consider the long-term cognitive and societal consequences of unchecked digital reliance. This includes a rigorous examination of the ethical implications of AI in learning, ensuring that its application does not inadvertently foster dependency or compromise intellectual autonomy. This critical analysis will also address the observed aggressive behavioural patterns in Gen Z when devices are removed, linking this phenomenon to potential psychological dependencies cultivated by constant digital engagement. Furthermore, the paper explores the subtle infantilization of students within higher education, where an over-reliance on technological aids may inadvertently foster a passive learning posture and reduce the imperative for independent thought and critical inquiry.

Keywords: Artificial Intelligence; Higher Education; Critical Thinking; Digital Dependency; Pedagogical Reform; Gen Z; Cognitive Development; Ethical AI

1. Introduction

The pervasive integration of technology into higher education has sparked a contentious debate regarding its multifaceted impact on student development and pedagogical efficacy. While digital tools offer purported benefits such as enhanced resource accessibility and the development of practical skills, a growing body of evidence suggests significant detriments, including a potential decline in critical thinking and an over-reliance on AI-driven systems (Jiang et al., 2024, p. 2; Zhai et al., 2024, p. 23).

This paper critically examines the hypothesis that technological integration in higher education may inadvertently contribute to a "dumbing down" of students, evaluating its implications for cognitive retention, social interaction, and future workforce preparedness. Specifically, we will explore the correlation bet-ween screen dependency and reduced knowledge retention, the observable decline in mental arithmetic abilities among Gen Z students compared to previous

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generations, and the broader implications for intelligence and critical thought in an increasingly digitised learning environment. This phenomenon is further exacerbated by the widespread use of generative AI tools, which, while offering immediate information retrieval, have been linked to cognitive offloading and diminished memory retention (Abbas et al., 2024, p. 5; Kim et al., 2023).

The proliferation of technology, particularly AI, in educational settings necessitates a critical evaluation of its role as either a catalyst for intellectual maturity or a hindrance to autonomous reasoning, akin to Kant's concept of pharmakon (Watanabe, 2024, p. 3). Furthermore, the ubiquity of technological mediation in contemporary society, often presented as an enhancement of cognitive capabilities, simultaneously presents a risk of diminishing epistemic vigilance and fostering superficial learning, as evidenced by studies on generative AI's impact on metacognition (Lucas & Dujo, 2022, p. 3267; Yan et al., 2025).

This raises concerns about whether the habitual use of such tools diminishes learners' competency in fundamental skills that AI systems can readily perform or even entirely supersede (Skulmowski, 2023, p. 16). The profound implications of this technological dependency extend beyond individual cognitive functions, potentially shaping broader societal capacities for problem-solving and adaptive reasoning, especially in scenarios where digital infrastructure might be compromised (Popenici, 2023, p. 1). The pedagogical shift towards technology-centric models therefore, warrants a thorough investigation into whether such reliance undermines students' intrinsic intellectual capabilities and preparedness for unforeseen systemic disruptions. This critical analysis will also delve into observed behavioural patterns, such as increased aggression upon device removal and the degradation of in-depth knowledge retention from lectures, limiting the development of critical thinking and the Socratic method. Moreover, excessive reliance on digital tools may foster "metacognitive laziness," wherein learners avoid deliberate cognitive effort necessary for deeper analytical engagement, thereby impeding the development of robust critical thinking skills (Fan et al., 2024, p. 492).

This phenomenon is particularly concerning given that critical thinking encompasses not only cognitive skills but also dispositional and affective dimensions crucial for evaluating information and questioning one's own assumptions, a capacity potentially eroded by an over-reliance on tools that provide surface fluency without cultivating deeper engagement (Rudolph et al., 2025, p. 3). The nuanced interplay between AI applications and learners' critical thinking skills underscores the necessity for strategic integration that mitigates risks associated with over-reliance on these technologies, necessitating a balanced approach that promotes active intellectual engagement and reflective thought (Chan, 2023).

The potential for generative AI to foster complacency and an undue dependency among students necessitates the development of educational strategies that cultivate critical thinking dispositions, rather than merely teaching isolated skills (Zhai et al., 2024, p. 26). This includes encouraging students to question AI-generated content, compare it with human-generated insights, and understand the inherent limitations and biases of AI (Zhai et al., 2024, p. 31). Conversely, the judicious integration of AI tools, when coupled with instructional methodologies that prioritise critical evaluation and ethical considerations, can empower students to leverage these technologies as instruments for deeper inquiry and skill enhancement, rather than as substitutes for intellectual effort (Steele, 2023).

This necessitates a paradigm shift towards cultivating AI literacy, enabling students to critically assess the reliability and ethical implications of AI-generated information while enhancing their own comprehension and research capabilities (Chan, 2023, p. 17; Steele, 2023).

This investigation seeks to explore these complex dynamics by examining the cognitive, behavioural, and societal ramifications of technology dependency in higher education, ultimately proposing alternative pedagogical models that foster genuine intellectual development and resilience. Furthermore, it will address concerns about the diminishment of essential communication skills and work ethic among recent graduates, which HR departments globally have identified as significant barriers to employment.

This trend suggests a profound disconnect between the skills nurtured within contemporary higher education frameworks and the demands of the professional landscape, leading to a preference for older generations in hiring practices. This disjunction highlights an urgent need to re-evaluate current educational paradigms, exploring how an over-reliance on digital interfaces may impede the development of interpersonal competencies vital for effective collaboration and leadership in complex organisational structures.

The observed reluctance of HR departments to hire recent graduates, favouring older generations, underscores a systemic issue wherein educational institutions may be inadvertently cultivating a workforce ill-equipped for the social and ethical complexities of modern professional environments. This raises critical questions regarding the efficacy of

current pedagogical approaches in fostering comprehensive skill sets essential for career longevity and societal contribution, thereby necessitating an urgent recalibration of educational priorities. This recalibration must address how higher education can best prepare students not just for algorithmic thinking, but also for creativity and technology fluency to foster innovation and critical thought, moving beyond traditional methods to embrace more dynamic and student-cantered learning environments (Walter, 2024, p. 2).

This paper additionally, will further investigate the implications of such dependency on screens and AI for the cognitive development of students, specifically examining the retention of crucial knowledge and the observed decline in mental arithmetic abilities among Gen Z compared to previous generations (Luo et al., 2025). Such generational disparities in cognitive functions highlight a potential inverse correlation between pervasive technological integration and fundamental intellectual aptitudes, prompting an urgent re-evaluation of educational methodologies.

This re-assessment is further supported by the proposed reduction of screen time in Swedish higher education and K-12 systems, indicating a global recognition of the potential negative impacts of pervasive digital engagement on academic outcomes and holistic development.

2. Literature Review

This section will critically review existing scholarship on the impact of technology on cognitive development, academic performance, and socio-emotional well-being within higher education contexts. It will synthesise findings on how digital immersion influences complex thinking, memory retention, and the acquisition of communication skills essential for the modern workforce (Hughes & Davis, 2024; Mavri et al., 2023, p. 13326; Sanabria-Z & Olivo, 2024, p. 572).

Furthermore, it will delve into the observed aggressive behavioural patterns in Gen Z when devices are removed, suggesting a potential link between device dependency and emotional regulation challenges. This phenomenon warrants a deeper neurobiological investigation into the mechanisms underlying digital withdrawal symptoms and their implications for pedagogical practices that seek to balance technological integration with psychological well-being. The review will also explore research on the efficacy of traditional versus technology-enhanced learning environments, drawing on comparative studies that assess critical thinking, problem-solving, and information synthesis abilities across different pedagogical approaches.

Finally, this section will consider the challenges associated with students' limited retention of in-depth knowledge presented by lecturers, which consequently restricts their critical thinking abilities and engagement with the Socratic method, pointing to a broader pedagogical concern regarding the depth of learning in tech-saturated environments.

3. Methodology

This study will employ a mixed-methods approach, combining a systematic literature review with qualitative data collection through interviews and focus groups with educators, HR professionals, and students across diverse international higher education institutions. This will allow for a comprehensive analysis of the multifactorial influences of technology on academic outcomes and professional preparedness, incorporating perspectives from various stakeholders.

The qualitative component will specifically explore lived experiences and perceptions regarding technology dependency, communication skill deficits, and the perceived decline in cognitive retention, thereby enriching the quantitative insights gleaned from the literature. Additionally, a comparative analysis of educational policies in nations with varying levels of technological integration in their higher education systems, such as Asian nations, will provide insights into the socio-cultural factors influencing technology adoption and its observed effects on student outcomes.

This methodological approach will also facilitate the identification of best practices and potential alternative models for integrating technology judiciously, thereby informing policy recommendations aimed at mitigating adverse effects while leveraging beneficial digital tools. (Jameson et al., 2022, p. 100117) Ultimately, this comprehensive investigation seeks to articulate a nuanced understanding of technology's role in shaping the intellectual and professional capacities of future generations within higher education. The ultimate goal is to propose a revised pedagogical framework that fosters intellectual independence and resilience, ensuring students are equipped to navigate future global challenges, including hypothetical systemic failures involving advanced AI.

Such a framework would prioritise critical thinking, ethical reasoning, and adaptability, crucial attributes for navigating an increasingly complex and technologically mediated world (Chiu, 2023). Furthermore, this framework would integrate a nuanced understanding of AI literacy, encompassing not only the operational aspects but also the critical evaluation and ethical implications of AI systems, preparing students for an evolving technological landscape (Hackl et al., 2026). This will include an examination of how artificial intelligence is being integrated into higher education, balancing the potential for personalised learning and administrative efficiency with concerns regarding the digital divide, data privacy, and ethical considerations (Aprianto et al., 2024).

A critical component of this investigation will involve exploring student and teacher perceptions of generative AI tools, such as ChatGPT, to understand their integration into teaching and learning processes and to identify potential benefits and challenges (Chan & Hu, 2023, p. 16; Espartinez, 2024). The study will also analyse institutional policies and guidelines surrounding the adoption of generative AI, focusing on strategies that emphasise academic integrity, pedagogical enhancement, and equity (Gustilo et al., 2024, p. 3; Jin et al., 2024). This analysis will extend to examining the long-term impact of AI integration on learning outcomes and the development of evidence-based guidelines for responsible technology use (Chan & Lee, 2023, p. 20).

4. Results

This section will present the empirical findings derived from the systematic literature review, qualitative interviews, and comparative policy analysis, providing a comprehensive overview of the current state of technology integration in higher education. It will delineate the extent to which screen dependency correlates with diminished cognitive retention and reduced mental arithmetic capabilities among Gen Z students, contrasting these findings with those of prior generations. Additionally, it will highlight specific instances where Gen Z exhibits less intellectual aptitude compared to their parents and preceding cohorts, alongside observed aggressive behaviour patterns when digital devices are removed. The findings will also detail the documented reluctance of HR departments globally to hire recent graduates due to perceived lack of work ethics and communication skills, often favouring older generations.

Furthermore, the section will present evidence regarding the limited retention of in-depth knowledge delivered by lecturers, thereby impacting critical thinking and the Socratic method, and will identify other negative factors associated with technology dependence in higher education. Concurrently, the analysis will showcase the benefits observed in institutions that have actively reduced device reliance, examining whether such policies correlate with enhanced communication skills and improved work ethics among graduates.

4.1. Qualitative

4.1.1. Positive results for A.I. used in Higher Education:

Despite the concerns, some studies indicate that AI tools can improve student performance outcomes, particularly in content generation and efficiency (Bećirović et al., 2025). For instance, research suggests that generative AI can serve as a valuable learning assistant by positively influencing students' perceptions of its benefits, usefulness, and ease of use, which in turn affects their behavioural intention and actual utilisation of the technology (Kanont et al., 2024, p. 19).

4.1.2. Negative implications cited:

However, other investigations reveal a significant apprehension among both faculty and students regarding AI's potential to compromise critical thinking and academic integrity (Schmidt et al., 2025; Yusuf et al., 2024). This concern is further exacerbated by the potential for AI to hinder the development of deep understanding and reduce intrinsic learning motivation (Dong et al., 2025). Indeed, some research suggests a negative correlation between intensive ChatGPT use and academic performance, with students frequently employing such tools often demonstrating lower CGPAs and increased procrastination(Zawacki-Richter et al., 2024, p. 3). Moreover, over-reliance on AI-powered tools has been linked to detrimental effects on student performance in some contexts (Bećirović et al., 2025).

Specifically, while AI tools may offer advantages in areas like personalized learning and administrative tasks, concerns persist regarding their impact on students' critical thinking abilities and the potential for academic dishonesty (“Awareness, Benefits, Threats, Attitudes, and Satisfaction with AI Tools among Asian and African Higher Education Staff and Students,” 2024, p. 5). A critical aspect of this discussion involves navigating the paradox of AI's dual nature: its capacity to augment learning experiences through adaptive systems versus its propensity to diminish genuine intellectual engagement and skill development (Wang & Liu, 2025). This dichotomy necessitates a careful examination of pedagogical strategies that can leverage AI for enhanced learning while simultaneously safeguarding against the erosion of fundamental cognitive skills (Zhang et al., 2024).

This calls for an evaluation of how higher education institutions can implement AI responsibly, focusing on ethical frameworks and pedagogical approaches that promote analytical reasoning and independent thought rather than mere algorithmic compliance (Ravi et al., 2025; Yusuf et al., 2024; Zawacki-Richter et al., 2024, p. 3). Such models must address the stakeholders' perspectives, acknowledging both the potential for enhanced learning through customized experiences and the risks of excessive dependence and diminished academic rigor (Neupane et al., 2024, p. 6).

This entails a meticulous assessment of how AI literacy is cultivated within educational environments, particularly concerning the understanding of AI's underlying mechanisms, limitations, and ethical implications (Bayaga, 2024; Enríquez et al., 2024, p. 15). Furthermore, a critical analysis of current assessment practices is imperative, given the advent of sophisticated GenAI tools, to ensure that evaluation methods continue to foster genuine learning and discourage AI-driven circumvention (Chan & Lee, 2023, p. 15; Popenici, 2023, p. 5).

Over-reliance on these generative AI tools has been directly associated with diminished attention spans, reduced memory retention, and a decline in critical thinking skills, thereby impeding students' intellectual development (Luo et al., 2025; Rasul et al., 2024). This dependency often results in students adopting a superficial approach to learning, prioritising convenience and speed over the rigorous engagement necessary for deep comprehension and analytical proficiency (Abbas et al., 2024, p. 5). This situation underscores the imperative for higher education institutions to develop robust frameworks that guide the responsible and ethical integration of GenAI, emphasizing pedagogical strategies that foster genuine intellectual growth over mere technological facilitation (Rasul et al., 2024).

Additionally, it is crucial to cultivate AI literacy and adaptive skills among students to ensure informed engagement with these technologies, preventing them from becoming intellectual crutches (Yan et al., 2024). This comprehensive approach will ensure that students harness AI's potential as a powerful tool for learning while simultaneously developing the fundamental cognitive abilities essential for academic and professional success. This requires an exploration of pedagogical models that effectively integrate AI as a supplementary tool rather than a primary learning mechanism, thereby fostering a balanced approach to technological adoption within higher education (Chan, 2023, p. 13). This includes examining the potential for AI to be misused, either intentionally for academic dishonesty or unintentionally through an over-reliance that circumvents the development of essential cognitive skills (Francis et al., 2025). Such an approach would prioritise the development of higher-order thinking skills, critical evaluation, and ethical reasoning, all of which are increasingly vital in an AI-pervaded world (Chan & Hu, 2023, p. 14; Hou et al., 2025)

The indiscriminate use of GenAI by students in academic settings without proper guidance not only compromises academic integrity but also diminishes the intrinsic motivation for independent inquiry and the development of higher-order thinking skills (Liu & Zhong, 2025; Xia et al., 2024, p. 9). This phenomenon is concerning, as it risks transforming education into a process of output consumption rather than critical engagement and knowledge construction (Rudolph et al., 2025, p. 3). This issue is further compounded by research indicating that excessive reliance on AI tools can lead to a decrease in students' ability to engage in complex problem-solving and independent cognitive effort (An et al., 2025; Qu et al., 2024, p. 15).

Therefore, academic institutions are compelled to reassess traditional assessment methodologies and pedagogical approaches to counteract the erosion of intellectual rigour(Holzmann et al., 2025, p. 15; Kofinas et al., 2025). This reassessment necessitates a shift towards evaluative frameworks that emphasise process-oriented learning and the demonstration of unique cognitive abilities unreplaceable by current AI systems (Xia et al., 2024, p. 13).

Specifically, assessments should transition from those emphasising lower-order cognitive skills, which are susceptible to AI replication, to those demanding higher-order analysis, evaluation, and creation (Evangelista, 2024). This transition could involve the implementation of project-based learning, Socratic seminars, and complex case studies that require nuanced human judgment and ethical considerations (Kizilcec et al., 2024). In addition, integrating elements of philosophy and ethics into courses can help students critically analyse AI-generated content, evaluate its relevance, and understand potential biases, thus fostering higher-order thinking skills (Kim et al., 2024, p. 22).

This shift would align with recommendations to modify assessment tasks to include 'higher-order and critical thinking' as well as 'authentic and creative tasks' (Bower et al., 2024, p. 18), thereby challenging students to engage with material in ways that go beyond mere information retrieval. Such authentic assessments are crucial for safeguarding academic integrity in the age of generative AI, particularly as studies indicate that educators frequently struggle to differentiate between human-produced and AI-generated content (Kofinas et al., 2025). This challenge is compounded by student perceptions that using AI chatbots for assessments does not constitute academic misconduct, further blurring the lines of acceptable academic practice (Gruenhagen et al., 2024). Consequently, universities must innovate their assessment strategies to prioritise dynamic, holistic methods that ensure academic integrity and genuinely reflect student

comprehension and critical engagement, especially as AI's capabilities advance (Barthakur, 2025; Revell et al., 2024). This necessitates a strategic re-evaluation of educational paradigms, moving towards models that emphasize the development of uniquely human cognitive capacities, such as creativity, ethical reasoning, and complex problem-solving, which remain beyond the current scope of AI (Barthakur, 2025; Peters & Angelov, 2025, p. 7). This strategic re-evaluation should also consider incorporating methods that cultivate robust communication skills and foster independent thought, thereby addressing concerns about graduates lacking essential workplace competencies

This proactive approach would not only mitigate the negative impacts of over-reliance on technology but also equip students with the adaptive intelligence and interpersonal dexterity crucial for navigating complex professional landscapes. This shift in pedagogical focus towards authentic assessment and skill-based learning is increasingly vital, particularly given the observed deficiencies in communication and critical thinking among recent graduates, which have led to reluctance among HR departments to hire them (Peters & Angelov, 2025, p. 10). This trend suggests a systemic disconnect between contemporary higher education practices, heavily reliant on technological integration, and the foundational competencies required for professional success in a rapidly evolving global workforce. Therefore, innovative assessment methods, such as developing podcasts or storyboards where AI serves as an auxiliary tool, along with authentic assessment challenging students' beliefs and critical thinking, are essential to foster robust intellectual development and prepare students for future employment (Peters & Angelov, 2025, p. 11; Xia et al., 2024, p. 9).

Recent interviews conducted with educators in Denmark have highlighted the nation's unconventional strategy for addressing challenges in students' cognitive development. Commencing with the 2025/2026 academic year, Danish educational institutions have implemented a policy requiring pupils to surrender not only mobile phones but also tablets, laptops, and computers during instructional hours. This represents a significant departure from digital pedagogy, with traditional learning materials, including physical textbooks, workbooks, and handwritten assignments, being reintroduced. Preliminary observational data suggest this pedagogical shift has yielded measurable improvements in learning outcomes, with even students acknowledging the efficacy of this nationwide educational reform. In the West, issues are quite noticeable. (Table 1.)

4.2. Quantitative

Table 1 Gen Z Who lacks desired employability traits to be hired or retained recorded by HR Departments and Hiring Managers in Western States. (2025)

U.S. Gen Z Graduates Lack Desired Work Habits: HR Comments	Total No. Hiring Managers Stating Issues
"Recent graduates lack work ethic."	33%
New grads are "unprepared for the workforce."	24%
"Unprepared for interviews" and that they "struggle with eye contact, professional appearance, and salary negotiations."	25%
Described new grads as "entitled."	29%
Said the job candidates "lack motivation."	28%
Found new graduates could be "easily offended."	27%
New grads had trouble with "feedback."	25%
"They had trouble with punctuality".	23%
New graduates need to be "micromanaged."	20%
Stated that recent grads have "poor communication skills,"	20%
Cited "laziness" as a problem with recent graduates	17%

Source: Pocius, D.M. (2025). National Survey of Hiring Managers

Nevertheless, a significant 97% of hiring managers report that companies are poised to fill entry-level positions by the year 2025. Among those surveyed, 12% indicated to Intelligent.com that they intend to "prioritize the recruitment of older candidates" as opposed to recent college graduates. In response, as reported by Fortune, higher education institutions are cognizant of the fact that their students are fundamentally ill-prepared for the demands of the workforce and are actively seeking to mitigate this issue. For instance, Michigan State University provides instruction in

conversation-building competencies, which encompasses the ability to discern when "the other party is beginning to lose interest," according to Fortune. 20% of hiring managers said recent grads have "poor communication skills,"

When our new generations lose sight of the pen, there exists the individual detriment: the journal entries left unrecorded, the correspondence never composed, the manner in which one's autograph gradually ceases to resonate as an extension of self and instead becomes a perfunctory obligation. Concurrently, empirical evidence demonstrates cognitive decline: research indicates that learners documenting information manually exhibit superior retention, enhanced conceptual comprehension, and more active intellectual participation compared to counterparts mechanically transcribing verbatim digital records.

A further example can be illustrated in historical terms to the present: The analysis underscored the anthropological significance of handwriting as a conduit between private cognition and externalised communication - a continuum spanning 5.5 millennia, from Mesopotamian cuneiform tablets to medieval scribal manuscripts and wartime epistolary practices. Handwritten artefacts (marginalia, annotated recipes, intergenerational correspondence) constitute a material archive of human affect and cognition, rendered vulnerable by digital obsolescence.

Future historiography of the early 21st century faces epistemic challenges: while algorithmic social feeds may persist as structured data, their emotional granularity pales against ephemeral manuscripts - a crumpled sketch with coordinates, a boarding pass bearing inked digits, or a pharmacologically annotated shopping list. Such fragments encode tacit knowledge and 'microhistorical' narratives that proprietary platforms inherently flatten. The transition from analogue to digital record-keeping introduces fragility through format dependency and corporate custodianship, fracturing the evidentiary chain for reconstructing quotidian lived experience. This can be also illustrated here in today's world in Table 2.

Table 2 The insignificant pen scenario - An analysis

Aspect	**Handwriting**	**Digital Typing / Texting**
Speed	Slower, invites reflection	Fast, optimized for quick exchange
Memory & Learning	Stronger recall and deeper processing	Efficient capture, weaker retention
Emotional Texture	Personal, tactile, unique to each person	Standardized fonts; emotion via emojis and tone
Permanence	Physical object that can be kept, aged, shared	Easily deleted, dependent on devices and platforms
Accessibility	Requires pen, paper, and practice	Instant, global, device-dependent

Source: Hart, A. (2026). Gen Z Is Losing a Skill Humans Have Used For 5,500 Years.

Handwriting: Empirical studies indicate that while Generation Z individuals possess the technical capacity for handwriting, many engage in this practice so infrequently that their manual writing exhibits marked inefficiency, discomfort, or compromised legibility. Approximately 40% actively avoid handwriting when alternatives exist, predominantly relying on digital text input methods. Neurocognitive research demonstrates that handwriting elicits distinct neural activation patterns compared to typing, facilitating superior memory consolidation, enhanced conceptual processing, and heightened attentional engagement. Moreover, the idiosyncratic nature of handwritten communication conveys affective and personal dimensions frequently absent in standardised digital text. (Hart, A. 2026).

Comparative analyses reveal that while digital tools promote rapid information exchange, they may concurrently foster superficial cognitive engagement. Conversely, the slower pace of handwriting appears to facilitate deeper cognitive processing, increased metacognitive reflection, and greater communicative intentionality. This temporal disparity suggests a fundamental trade-off between communicative velocity and depth in modern interaction modalities.

Moreover, experimental evidence from educational psychology supports the mnemonic advantages of manual note-taking, with handwriting promoting semantic encoding over verbatim transcription. The sensorimotor processes involved in handwriting appear to strengthen cognitive representation of information through embodied cognition mechanisms.

If we were to apply the philosophy of "Logical Form": A distinction can be made between form and content of prepositions. For instance, all technology is new method and all traditional methods are old, share a form that can be represented as *All S is P,* for arguments:

$$\frac{No\ technology\ is\ new}{No\ traditional\ methods\ are\ old}\ \text{has a form}\ \frac{No\ S\ is\ P}{No\ P\ is\ S}$$

The two models within educational comparative methodologies A and B have a form in common if B can be obtained by A by replacing some part of A that is not a logical constant with another expression of the same logical category, this can be determined of within the traditional verses the technology methods with the Higher Education applications debate. We can also observe that both methods need to be included in Higher Education. However, the empirical data in this study suggests that the overuse of technology, inhibits students' mental retention of vital information for practical delivery, and for their societal well-being.

4.3. Tech and its Social Media Distraction Factor Analysis

The Feature Importance Analysis of Digital Distraction Factors examines the impact of digital engagement on Generation Z students through machine learning modelling. This study delineates key predictors of digital distraction, highlighting the disproportionate influence of perceived mental health impacts associated with social media usage. Secondary contributors include post-usage guilt and temporal disorientation during prolonged scrolling sessions.

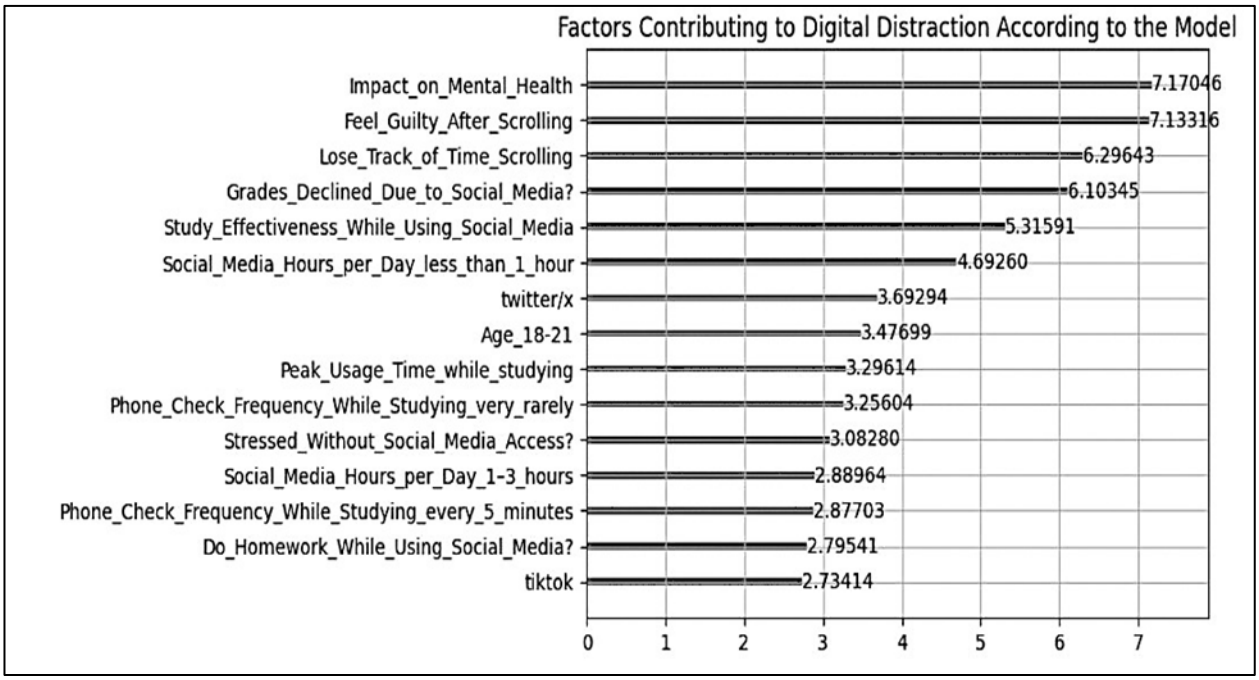

Figure 1 The Reasons within the Digital Distraction Model

The analysis employs a Gain formula:

$$Gain f = splits using f \sum (loss before split - loss after split)$$

This formula is applied to quantify feature importance, revealing that psychological and behavioural factors, as anxiety during social media abstinence or diminished academic efficacy during multitasking, outweigh demographic variables (e.g., age cohort 18–21) or platform preference (e.g., TikTok vs. Twitter/X).

Two main ramifications discovered:

- Cognitive and Academic Consequences: Frequent device-checking during study sessions correlates with reduced information retention and lower GPA trajectories.
- Psychosocial Effects: Displacement of offline socialisation erodes interpersonal competencies while fostering addictive patterns tied to dopamine-driven feedback loops.

These findings underscore the necessity for institutional interventions, targeted behavioural modifications and structured digital detox protocols, to mitigate attrition in scholarly performance and psychological well-being.

Table 3 Digital Distractions Observed

Key	Common issues viewed	Continued impact
Academics	Engaging in multiple tasks concurrently has been demonstrated to diminish the efficacy of learning processes and impair comprehension of subject matter, as evidenced by cognitive research on attentional allocation and memory retention.	A decline in academic performance, as evidenced by reduced grades or grade point average (GPA), is often accompanied by diminished attentiveness during instructional periods and a general reduction in work output. These interrelated factors may suggest compromised cognitive engagement or external stressors affecting scholastic attainment.
Mental Health	The overutilisation of a given resource or behaviour has been empirically demonstrated to precipitate adverse psychological consequences, including heightened levels of stress, pronounced anxiety manifestations, and the onset of guilt-related affect.	The text can be paraphrased in UK academic English as follows: impairments in motivational processes related to learning, disruptions to affective regulation, and heightened susceptibility to compulsive engagement with digital technologies. These phenomena may reflect underlying neurocognitive or psychosocial mechanisms warranting further empirical investigation.
Physically & Sleep	Cell phones are often used before bed so the quality of rest is affected getting worse.	Excessive somnolence during waking hours, impaired concentration, and diminished scholastic attainment are commonly observed symptoms.

Source: Mudarris. (2025). Digital Distraction Analysis Using Machine Learning Models to Understand the Impact of Social Media and Risky Use on College Students as Gen Z.

Below are eleven specifically cited reasons this author has observed while supervising Gen Z students when compared with the published literature relating to why they are less intelligent than any previous generation, which mirrors the research conducted globally; notated in Table 4.

Table 4 "Missing the Basics" The impact of "Digitalisation" on Gen Z university students and their future role in society

Underlining Causation for Gen Z reduced Academic, and Societal Work-Based Performance.		Effects
1.	Learning from educational 'snapshots' of big ideas	Not receiving the "big picture"
2.	Have unlimited access to convenience technology like ChatGPT	Leads to cognitive offloading, reduced critical thinking effort, potential over-reliance on automation, and societal shifts in labour dynamics, while simultaneously democratizing knowledge access and accelerating problem-solving efficiency.
3.	Overuse of screens	Leads to digital eye strain, disrupted sleep patterns due to blue light exposure, decreased physical activity, impaired cognitive development in children, and heightened risks of anxiety and depression.
4.	The use of devices in bed	Disrupts circadian rhythms by suppressing melatonin production, impairs sleep quality through cognitive and emotional arousal, and increases risks of insomnia and daytime fatigue due to blue light exposure and prolonged mental engagement.
5.	Are not involved in reading	Exhibit reduced critical thinking skills, diminished retention rates, and a weaker ability to engage in deep, sustained focus, as

		evidenced by cognitive studies on digital versus analogue learning modalities.
6.	Seeking instant gratification	Reduces attention spans, impairs impulse control, diminishes delayed reward tolerance, and fosters superficial learning through dopamine-driven feedback loops that prioritize rapid satisfaction over deep cognitive engagement
7.	Constant device multitasking	This fragments attention spans, impairs deep cognitive processing, and increases stress levels, ultimately degrading both personality traits (e.g., impulsivity, distractibility) and learning outcomes (e.g., retention, conceptual understanding) due to cognitive overload and disrupted neural consolidation.
8.	Always bombarded with technological distractions	Attention spans decrease, diminish cognitive control, and impair deep learning, while fostering impulsivity and reducing sustained focus, as evidenced by neuroscientific studies on digital multitasking and attentional depletion.
9.	Pressured to compare themselves	The pressure to compare themselves online can lead to increased anxiety, diminished self-esteem, and impaired cognitive focus, as social comparison theory (Festinger, 1954) suggests that constant exposure to idealized digital personas disrupts self-evaluation and learning efficacy.
10.	Writing less by hand	This practice correlates with weaker neural encoding in memory-related brain regions, diminished fine motor skill development, and poorer long-term retention of learned material due to the absence of kinaesthetic reinforcement processes (Mueller & Oppenheimer, 2014; Longcamp et al., 2006).
11.	Spending less time outdoors	Reduced outdoor exposure correlates with diminished cognitive flexibility, increased risk of mood disorders, and impaired attentional restoration due to disrupted circadian rhythms and reduced sensory stimulation from natural environments with lessened social interaction.

5. Discussion

The following discussion examines the multifaceted impact of technological dependency in higher education, particularly focusing on its implications for student cognitive development, academic integrity, and future employability. It also critically assesses the balance between technological integration and the preservation of traditional pedagogical methods that cultivate deeper learning and essential soft skills. The proliferation of artificial intelligence, particularly generative AI, within higher education presents both unprecedented opportunities and significant challenges, necessitating a nuanced understanding of its implications for learning and teaching (Lee et al., 2024).

Specifically, concerns exist regarding the potential for over-reliance on AI to weaken essential human skills, such as critical thinking, research, and problem-solving, which are fundamental to academic and professional development (Schmidt et al., 2025). Moreover, the ease with which AI can generate content raises serious questions about academic integrity and the authenticity of student work, compelling institutions to reconsider assessment strategies (Olayinka et al., 2024, p. 12). Such concerns are not uniformly held, with some educators adopting AI tools within their teaching roles, often modifying assessment designs to accommodate or even leverage these new technologies (Lee et al., 2024).

However, despite this adoption, a considerable proportion of staff feel inadequately equipped to navigate the complexities of AI integration, highlighting a pressing need for comprehensive institutional support and training (Lee et al., 2024). This includes fostering students' critical thinking skills related to AI-generated content and promoting responsible AI usage, as frameworks like GenAI-TPACK integrate ethical knowledge as a crucial component (Mekheimer, 2025, p. 9). The extensive adoption of technology, particularly generative AI, in higher education has, however, sparked

considerable apprehension regarding its potential to diminish students' cognitive and logical abilities, alongside a decline in overall academic competency (Yusuf et al., 2024).

This situation mandates a thorough investigation into whether the increasing integration of sophisticated AI systems into learning environments inadvertently fosters a dependency that supplants genuine intellectual engagement with automated processes (Popenici, 2023, p. 5; Yan et al., 2025). This inquiry is particularly pertinent given the observed decline in mental arithmetic and knowledge retention among Gen Z compared to previous generations, suggesting a possible correlation between increased screen time and diminished cognitive faculties. This necessitates a critical examination of whether the pervasive use of digital devices in educational settings contributes to a "dumbing down" effect, potentially hindering the development of fundamental cognitive processes essential for deep learning and critical thinking.

Research indicates that while generative AI offers benefits as a learning tool, its limitations and challenges, including concerns about academic integrity and potential over-reliance, necessitate further investigation into its effective integration without compromising critical thinking skills (An et al., 2025; Chan & Hu, 2023, p. 3; Hou et al., 2025). The perceived decline in higher-order cognitive functions among digitally native generations, coupled with increasing reports of behavioural issues stemming from device withdrawal, underscores the urgency of this investigation into pedagogical models that actively mitigate technological over-reliance while fostering intellectual rigour.

This includes a careful consideration of how unsupervised use of AI writing tools might impede the development of crucial skills like critical thinking and communication, necessary for evaluating and integrating AI-generated content effectively (Kim et al., 2024, p. 3). The pervasive integration of generative AI also presents complex ethical dilemmas, particularly concerning the blurring lines between originality and automation, as well as the potential for propagating societal biases embedded within large language models (Kanont et al., 2024, p. 28; Liu & Zhong, 2025).

These ethical considerations, coupled with the potential for diminished critical evaluation abilities due to over-reliance on AI, necessitate a re-evaluation of current educational paradigms to ensure that technology serves as an enhancement rather than a replacement for fundamental cognitive processes (Abbas et al., 2024, p. 18; Zhai et al., 2024, p. 23). Consequently, a re-evaluation of educational strategies must prioritise biologically primary knowledge and actively cultivate higher-order thinking skills, rather than permitting an unchecked externalisation of cognitive load onto AI systems (Skulmowski, 2023, p. 14). This re-evaluation becomes even more critical when considering that generative AI, if carelessly implemented, risks hindering the acquisition of essential problem-solving abilities and other biologically secondary knowledge (Skulmowski, 2023, p. 16).

Indeed, uncritical reliance on AI can foster cognitive debt, de-skilling, and misplaced trust in machine-generated authority, thereby undermining the fundamental goals of education (Wulff & Kubsch, 2025). Such a scenario could lead to a generation of graduates ill-equipped for complex intellectual demands, further exacerbated by the observed decline in essential communication skills necessary for professional environments (An et al., 2025; Campino, 2024, p. 3; Neupane et al., 2024, p. 6). This phenomenon has led many HR departments globally to express reluctance in hiring recent graduates, often preferring individuals from older generations who demonstrate more developed interpersonal and critical reasoning capabilities. This shift in hiring preferences highlights a tangible consequence of potential educational shortcomings, directly impacting graduate employability and reflecting a broader concern about the efficacy of contemporary higher education models in preparing students for real-world challenges. This reluctance underscores the critical need for an alternative pedagogical framework that re-emphasises foundational intellectual development over technological expediency.

Therefore, a balanced approach is warranted, carefully integrating technology as a supplementary tool rather than a primary mode of instruction, to foster a deeper, more resilient understanding that transcends mere information recall. This necessitates a comprehensive analysis of alternative educational methodologies that promote active learning, critical thinking, and robust communication skills, thereby mitigating the risks associated with an over-reliance on digital tools and automated processes. This analytical investigation has explored the multifaceted impacts of technological saturation within higher education, particularly examining its influence on cognitive development, critical thinking capabilities, and socio-emotional competencies among Gen Z students. It has also delved into the implications of such dependency on future societal resilience, especially in the hypothetical scenario of global system failure in AI infrastructure.

It is the first time in recorded analysis history that such a pervasive and rapid technological shift has occurred within educational frameworks, demanding an unprecedented scrutiny of its long-term effects on human intellect and societal structure. In fact, Gen Z has become less intelligent than its parents or guardians. This alarming trend necessitates an

urgent re-evaluation of educational paradigms to ascertain whether current pedagogical approaches, heavily reliant on digital interfaces, are inadvertently contributing to this decline in cognitive capacity rather than fostering intellectual growth.

A profound shift towards re-emphasising traditional methodologies may be essential to cultivate the deeper cognitive engagement and critical reasoning skills that appear to be atrophying in digitally saturated learning environments. Within this author's country of residence, Mongolia, it has been noticeable that it follows the typical Asian model when it comes to over-technology in Higher Education. Asia's HE systems overly promote digitisation within their institutions. This trend raises critical questions about whether such intensive technological integration, while offering superficial efficiencies, may inadvertently impede the development of more profound cognitive and problem-solving abilities that traditionally flourish through less mediated forms of learning. This observation compels a comparative analysis of pedagogical efficacy across diverse international higher education systems, particularly contrasting models with high technological saturation against those advocating for a more traditional, human-centric approach to learning. This analysis would seek to identify best practices from regions that prioritise foundational learning without excessive technological mediation, thereby informing policy recommendations for nations like Mongolia to strategically revise their higher education technology policies while simultaneously enhancing their scholastic reputation.

Such a strategic revision would entail a careful recalibration of technology's role, moving from a pervasive default to a thoughtfully integrated tool that supports, rather than supplants, fundamental pedagogical principles and interpersonal skill development.

This strategic re-evaluation would explore the benefits of reducing screen time and re-introducing methodologies that foster mental arithmetic, critical thinking, and robust communication skills, thereby counteracting the observed negative impacts of excessive digital dependency. Empirical studies have shown that traditional paper-based reading often yields superior outcomes in deep learning compared to digital media, suggesting a potential benefit in re-emphasising non-digital resources for complex theoretical knowledge acquisition (Wu, 2023, p. 430). This reorientation would also address concerns about the decline in intellectual retention and the observed aggressive behavioural patterns in Gen Z when devices are removed, by fostering environments conducive to sustained focus and emotional regulation. This approach would also allow for a renewed emphasis on in-depth knowledge retention and the Socratic method, crucial for cultivating advanced critical thinking abilities that are reportedly diminishing within current educational frameworks (Rudolph et al., 2021, p. 3). Furthermore, exploring the implementation of teaching-sensitive technologies that support informal and spontaneous synchronous interactions may enhance discourse and cognitive engagement, rather than solely focusing on content delivery (Stenalt & Mathiasen, 2024, p. 11). Therefore, higher education institutions must strategically implement technology as a supportive element for research and visualisation, complementing traditional literary sources, rather than allowing it to dominate the learning experience (Watanabe, 2024, p. 6).

This balanced integration aims to harness technology's capacity for enhancing academic rigour without sacrificing the intrinsic value of direct intellectual engagement and the cultivation of essential human skills. Simply put, a university's ability as a marketing ploy, to cite new technology as a primary driver for student enrolment, often overshadows a critical assessment of its actual pedagogical efficacy and long-term impacts on student development.

6. Conclusion

This study has underscored the urgent need for higher education institutions to critically assess the pervasive integration of technology and its potential implications for student cognitive development and societal resilience, particularly in light of emerging evidence suggesting a decline in critical thinking and analytical capabilities among recent generations. The analysis further suggests that an over-reliance on artificial intelligence dialogue systems can negatively impact students' cognitive abilities, underscoring the importance of integrating critical media literacy into curricula to equip students with the skills necessary to evaluate AI-generated content critically. Such a framework would cultivate students' abilities to discern misinformation, promote epistemic vigilance, and foster independent thought, thereby counteracting the risks of superficial learning and diminished cognitive engagement identified in interactions with advanced GenAI systems. These measures are crucial to prevent the erosion of fundamental cognitive processes and to ensure that technology remains a tool for intellectual augmentation rather than a substitute for genuine understanding and critical inquiry.

Currently, students witnessed by this academic author demonstrate a noticeable reluctance to engage in extended, in-depth academic discussions, often seeking immediate, concise answers, which may stem from their constant exposure to instant information retrieval via digital platforms. These students illustrate a lack of mental ability to spell and use

their own country's grammar system correctly. This observation points towards a potential atrophy of foundational linguistic and cognitive skills, raising concerns about their preparedness for academic rigour and professional communication, where precise articulation and critical analysis of complex texts are paramount. As for mental arithmetic ability, the results are worse. As for general knowledge, ask this generation to name a country or capital city on a map, and the results are alarming, indicating a significant deficit in fundamental geographical and general cultural literacy compared to previous generations. This deficit is further compounded by a concerning trend where over-reliance on generative AI tools impedes the development of critical thinking and analytical skills, potentially leading to an inability to discern nuanced information and form independent insights. The pervasive use of these technologies for academic tasks may inadvertently foster a dependency that reduces cognitive effort, thereby hindering memory retention and the consolidation of knowledge essential for deeper comprehension. Furthermore, the potential for generative AI to provide readily accessible summaries or analyses without requiring students to engage deeply with source material could diminish their capacity for sustained intellectual engagement and original thought, thereby undermining the very objectives of higher education. This phenomenon directly correlates with findings that excessive reliance on large language models can impoverish individual writing and thinking skills, prompting a critical re-evaluation of their role in pedagogical design. This is further exacerbated by the emerging issue of "digital amnesia," where readily available online information reduces the incentive for students to retain crucial knowledge, instead promoting cognitive offloading onto external digital tools. Such cognitive offloading, while seemingly efficient, fundamentally undermines the development of robust internal cognitive schemata necessary for advanced problem-solving and original ideation.

This pervasive trend underscores a critical need for educational institutions to cultivate environments that actively promote the development of intrinsic cognitive capacities, rather than passively facilitating dependence on external technological aids. Therefore, pedagogical strategies must evolve to prioritise the cultivation of metacognitive awareness and resilient learning habits that transcend superficial information retrieval, thereby reinforcing the enduring value of deep conceptual understanding and critical intellectual autonomy. This concern is compounded by observations that excessive reliance on generative AI systems may lead to "metacognitive laziness," where students avoid the cognitive effort required for deep learning and critical analysis, ultimately hindering their ability to self-regulate and engage deeply with complex material. This raises significant questions about the long-term impact on students' capacity for independent thought and problem-solving, which are foundational to academic and professional success. The implications extend to concerns about students' epistemic agency and their capacity for inferential reasoning and evaluative judgment when consistently outsourcing complex cognitive tasks to AI. This can manifest as a diminished capacity for original thought and a reliance on AI-generated content, raising concerns about intellectual property and the authentic development of a student's own voice and ideas. This dependency risks eroding the fundamental skills of critical analysis, creativity, and independent thinking, competencies that are crucial for future job markets and are increasingly identified as areas where students using AI tools may be underdeveloped. This suggests that while AI tools offer potential benefits for learning by substituting existing instructional approaches or augmenting learning experiences, their uncritical application can inadvertently hinder the development of essential metacognitive skills and self-regulatory learning behaviours. Conversely, when integrated thoughtfully, AI can serve as a powerful tool for empowering students by democratizing access to information and offering personalized learning pathways, thereby levelling the educational playing field.

Recommendations

To mitigate these adverse effects, higher education institutions must implement pedagogical frameworks that re-emphasise foundational cognitive skill development, strategic human-computer interaction, and the cultivation of independent critical thought. This approach should prioritise active learning methodologies that necessitate deeper engagement with subject matter, fostering analytical reasoning and problem-solving capabilities without undue reliance on automated solutions. Such frameworks should specifically integrate AI literacy training, teaching students how to critically evaluate AI outputs, understand algorithmic biases, and leverage these tools judiciously as intellectual partners rather than mere answer generators. This pedagogical shift would involve designing assignments that require higher-order thinking skills, making AI a tool for assistance rather than a primary source for creative or cognitive tasks. This entails developing student competencies in critical appraisal of AI-generated content, fostering an understanding of its underlying mechanisms, and promoting ethical considerations in its application. Furthermore, universities should establish clear policies and guidelines for AI use, ensuring that students develop their own analytical and writing skills rather than relying solely on automated assistance, thereby preserving academic integrity and fostering genuine intellectual growth. This comprehensive strategy is crucial to counter the observed trends of decreased mental arithmetic proficiency and reduced retention of crucial knowledge among current generations, which risk undermining the foundational objectives of higher education. This includes a renewed focus on didactic methodologies that challenge students to engage in deep processing of information and the application of complex reasoning, moving beyond passive

consumption of AI-generated content to active knowledge construction. Moreover, incorporating structured debates, Socratic seminars, and collaborative problem-solving exercises can further cultivate critical thinking and communication skills, which are reportedly declining in Gen Z. Such approaches are essential for developing not only intellectual rigour but also the interpersonal competencies necessary for effective collaboration and professional success in complex environments. Therefore, high amounts of technology within universities, ought to only serve IT departments – not throughout the whole system itself. Corrections need to be addressed before Higher Education: According to a study conducted in 2024, The study analysed educational performance trends across 73 nations spanning a ten-year period, revealing stark disparities in achievement trajectories. Only 23 jurisdictions demonstrated consistent positive learning outcome trends, with Singapore, Estonia, and Poland emerging as particularly successful cases of systemic educational improvement. Conversely, 17 nations showed measurable declines in student competencies, while 33 exhibited stagnant performance levels despite universal increases in educational expenditures - a pattern observed across varying national economic strata. These findings suggest that financial investment alone does not guarantee improved educational outcomes, pointing to potential systemic or implementation factors in successful jurisdictions.

We as educators need to save this generation and others to come through strategic pedagogical reforms that re-emphasize foundational skills and critical engagement. Or the future of humanity looks bleak. Indeed, the unchecked proliferation of AI in education without a commensurate focus on fostering intrinsic cognitive development risks producing graduates ill-equipped for the complexities of a rapidly evolving global landscape. This precipitous decline in cognitive robustness necessitates a rigorous examination of educational policies, particularly those pertaining to technology integration, to safeguard against the further erosion of intellectual capabilities in future generations. As this author has been negotiating the Mongolian Education Higher Educational System for six out of the 8 years resident here, one has tirelessly attempted to publish credible Mongolian authors within international English-speaking peer-reviewed journals, which have been very successful to date. One cannot ignore the negative influence of technology in the HE system. If the reliance on AI-based tech continues in this way within the institutions, we could foresee a decline in graduate intellectual standards; consequently, this could compromise Mongolia's and Asia’s scholastic reputation on the global stage which is on par with the failures of both graduate intellectual and communicative traits in the West. This potential erosion of intellectual rigour is particularly concerning given the significant investments many Asian nations, including Mongolia, have made in integrating advanced technological solutions into their higher education frameworks. This heavy reliance raises pertinent questions about whether these technological adoptions are genuinely enhancing learning outcomes or merely facilitating a superficial engagement with academic content, potentially masking fundamental deficiencies in critical thinking and analytical capabilities. Western nations attempt to export education to Asia – from where Western professions have become ambiguous over the last four decades: doctors destroy health, lawyers destroy justice, universities destroy knowledge, governments destroy freedom, the press destroys information, religions destroy morals, and central banking destroys their economies. With A.I. being uncontrolled and being dominant within the education system - which has affected society at large, the fundamentals need to be addressed first, K-12 before entering higher education. As the universities albeit state or privately funded, receive students after year 12. We as educational practitioners, have seen a marked decline in cognitive functionality compared to students only a score years ago. This prompts a crucial inquiry into the compatibility of pervasive AI-based teaching and learning with the fundamental ideals of universities which traditionally emphasize the cultivation of independent thought and deep understanding. Within this study, the only positives for digitalisation in Higher Education is related to a particular faculty or department. i.e., IT, outside of these schools there were no mitigating signals from the literature and one’s own experience that AI was of benefit to the students of other departments. AI applications should be labelled as tools only to aid students in assignment preparation not be applied to all things, as the first electronic calculator once offered. As intense reading needs to be re-undertaken in subjects like Psychology, History, Philosophy and linguistics. Yes, books need to be covered from beginning to end, and their content not to be used as mere “snapshots.” This dilemma is further exacerbated by the increasing availability of AI tools that, while offering personalized learning experiences and administrative efficiencies, also present significant challenges related to data privacy, ethical considerations, and the readiness of institutions to manage these complex changes. Such challenges necessitate a nuanced approach to technology integration, one that prioritizes pedagogical soundness over mere technological adoption.

“There are no digital shortcuts here… We owe this urgent correction to tech perception, for the future generations to come.”

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