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Issue Overview

This issue of Journal of Psychology & Education presents five articles that examine student development, educational transformation, behavioral addiction, vocational education ethics, and the role of generative artificial intelligence in learning. Together, the contributions reflect the journal's interdisciplinary concern with psychological well-being, educational reform, technology ethics, and responsible human development.

The issue opens with a study of psychological withdrawal, or "lying flat," among university students. Drawing on self-determination theory, the article explains this phenomenon as a defensive motivational response shaped by frustration of competence, autonomy, and relatedness, and proposes counselor-led strategies for developmental support. The issue then turns to the digital-intelligent transformation of vocational education, analyzing ethical risks related to datafication, algorithmic bias, teacher and student agency, craftsmanship, and school-enterprise accountability under the development of new quality productive forces.

Two empirical studies further address behavioral addiction among Chinese college students. One examines how childhood trauma relates to Internet addiction among students with elevated self-reported tobacco-use symptoms through the serial mediating roles of self-control and aggression. The other analyzes the relationship between perceived social support and Internet gaming disorder symptoms, identifying loneliness and self-control as key interpersonal and self-regulatory mechanisms. The final article focuses on generative artificial intelligence and student agency, arguing that the educational value of AI depends on whether it supports questioning, knowledge construction, verification, authorship, and responsibility rather than replacing students' intellectual work.

Taken as a whole, this issue highlights the need to understand education not only as knowledge transmission or technological adoption, but also as a field of psychological support, ethical judgment, cultural and institutional responsibility, and agency formation.

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Psychological Withdrawal ("Lying Flat") Among University Students from the Perspective of Self-Determination Theory: Mechanisms and Counselor-Led Intervention Strategies

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Abstract

Against the background of intensified academic competition, uncertain employment prospects, and increasingly diversified standards of success, some university students display a pattern of motivational withdrawal commonly described in Chinese public discourse as “lying flat.” This article conceptualizes psychological lying flat not as simple laziness, moral failure, or a clinical diagnosis, but as a context-sensitive form of defensive disengagement characterized by reduced goal commitment, avoidance of evaluative situations, diminished initiative, and the protection of self-worth through nonparticipation. Drawing on self-determination theory (SDT), the article proposes that this pattern can be understood as the cumulative result of frustration of the basic psychological needs for competence, autonomy, and relatedness. Competence frustration may generate perceived uncontrollability and helplessness; autonomy frustration may intensify controlled motivation and self-worth-protective withdrawal; and relatedness frustration may weaken social support, help-seeking, and the internalization of personally meaningful goals. These processes can form a self-reinforcing cycle in which withdrawal reduces opportunities for mastery and connection, thereby deepening need frustration. The article further analyzes three practical barriers faced by university counselors: the mismatch between grand educational narratives and students’ current motivational capacity, defensive resistance to relationship-building, and outcome-dominated evaluation systems that overlook incremental progress. An SDT-informed intervention framework is proposed that combines nonjudgmental relational engagement, graded mastery experiences, process-focused feedback, meaningful choice, clear structure, and professional referral when students present substantial psychological impairment. The framework offers a theoretically grounded and operationally feasible approach for moving university counseling from behavioral correction toward motivational support and developmental empowerment.

Keywords: self-determination theory; psychological lying flat; amotivation; basic psychological needs; university counselors; psychological education

1. Introduction

The expression “lying flat” (tangping) has become a visible term in contemporary Chinese discussions of youth motivation. In higher education, it is often used to describe students who reduce effort, avoid competition, disengage from long-term planning, or present an attitude of indifference toward academic and career development. Existing Chinese discussions have linked this phenomenon to competitive pressure, uncertainty, defensive avoidance, and changing youth values (Fu, 2024; Liu, 2024; Zheng, 2024). However, the term remains conceptually broad. It may refer to a temporary reduction in effort, a rhetorical rejection of excessive competition, a coping response to repeated frustration, or a more persistent pattern of motivational withdrawal. Treating all of these forms as equivalent risks both moralizing normal stress responses and overlooking students who require more structured support.

For the purposes of this article, psychological lying flat is defined as a nonclinical pattern of defensive motivational withdrawal in which students reduce goal commitment, avoid situations that may expose inadequacy or failure, and limit psychological investment in academic, social, or career-related tasks. This definition emphasizes three boundaries. First, psychological lying flat is not synonymous with laziness because it may emerge after sustained effort, repeated failure, or perceived lack of control. Second, it should not be treated as a psychiatric diagnosis; similar outward behaviors may arise from very different psychological conditions and therefore require careful assessment. Third, the behavior can have both protective and maladaptive functions. In the short term, withdrawal may reduce shame, anxiety, and exhaustion. Over time, however, it may restrict opportunities for mastery, social connection, and identity development.

Self-determination theory (SDT) provides a coherent framework for explaining why students become energized and persistent in some environments but passive or resistant in

others. SDT proposes that high-quality motivation and psychological functioning depend substantially on the satisfaction of three basic psychological needs: autonomy, or the experience of volition and self-endorsement; competence, or the experience of effectiveness and growing capability; and relatedness, or the experience of mutual care, belonging, and meaningful connection (Deci & Ryan, 2000; Ryan & Deci, 2000, 2017). Importantly, contemporary SDT distinguishes low need satisfaction from active need frustration. A student may simply lack sufficient opportunities to feel competent, whereas competence frustration involves experiences of failure, inadequacy, or ineffectiveness. Similarly, autonomy frustration involves pressure and coercion, while relatedness frustration involves exclusion, rejection, or relational insecurity (Chen et al., 2015; Vansteenkiste et al., 2020). This distinction is central to understanding psychological lying flat because persistent withdrawal is more likely when students experience not only an absence of support but repeated need-thwarting experiences.

This article develops an SDT-based account of the psychological mechanisms underlying lying-flat tendencies and translates that account into intervention strategies for university counselors. In the Chinese higher education context, counselors occupy a distinctive position at the intersection of student affairs, developmental guidance, educational management, crisis identification, and psychological support. Their proximity to students gives them opportunities to identify motivational deterioration early, but their effectiveness depends on whether intervention practices support or further frustrate students' basic psychological needs.

2. An SDT-Based Explanation of Psychological Lying Flat

2.1 Competence Frustration, Perceived Uncontrollability, and Helplessness

Competence refers to the need to experience oneself as capable of producing desired effects and making progress through interaction with the environment. University students encounter frequent evaluative situations, including examinations, scholarship selection, postgraduate admission, internships, competitions, and employment recruitment. When effort is repeatedly followed by failure, ambiguous feedback, or outcomes perceived as structurally unattainable, students may begin to doubt the instrumental value of action. The problem is not merely that they feel temporarily unsuccessful; rather, they may infer that their behavior has little influence over outcomes.

This process resembles learned helplessness, in which exposure to uncontrollable negative events weakens subsequent attempts to act even when some degree of control becomes available (Maier & Seligman, 2016). In student populations, helplessness may be reinforced by global and stable interpretations of setbacks, such as “I am fundamentally incapable” or “nothing I do will change the result.” Chinese educational discussions have similarly identified repeated frustration and negative attribution as important contributors to learned helplessness among students (Jin, 2019). Once these beliefs are consolidated, withdrawal can appear subjectively rational: reducing effort protects the student from investing further resources in an outcome that is expected to remain unchanged.

Competence frustration also interacts with self-efficacy. Students with weakened efficacy beliefs are less likely to select challenging goals, persist after setbacks, or interpret temporary difficulty as informative feedback (Bandura, 1997). Consequently, psychological lying flat may be maintained by a circular process: low perceived competence reduces action; reduced action limits mastery experiences; and the absence of mastery experiences further

confirms low competence. An effective intervention must therefore do more than encourage effort. It must restore credible experiences of controllability and progress.

2.2 Autonomy Frustration, Controlled Motivation, and Self-Worth Protection

Autonomy is not equivalent to independence or unrestricted freedom. Within SDT, autonomy refers to acting with a sense of volition and psychological ownership. Students may comply with externally imposed expectations while experiencing little personal endorsement of those expectations. A history of tightly controlled schooling, intense parental expectations, and narrow definitions of success can produce students who are behaviorally compliant but have limited experience identifying personally meaningful goals. When they enter a university environment characterized by greater choice and less direct supervision, they may lack the internalized values and self-regulatory skills needed to transform freedom into purposeful action.

Under conditions of autonomy frustration, students often experience motivation as pressure: they study to avoid criticism, compete to protect status, or pursue credentials primarily because significant others expect them to do so. Controlled motivation can produce short-term performance, but it is less likely than autonomous motivation to support sustained engagement, adaptive coping, and well-being (Deci & Ryan, 2000; Ryan & Deci, 2000). When externally prescribed goals become increasingly difficult, withdrawal may function as a rejection of the controlling system as well as an escape from the emotional costs of failing within it.

Self-worth theory further clarifies why deliberate nonparticipation can become psychologically attractive. When achievement is closely tied to personal worth, failure threatens not only a specific performance outcome but the individual's overall sense of value. Withholding effort allows a student to preserve an alternative explanation: "I failed because I did not try," rather than "I tried fully and was not capable." This self-worth-protective

strategy can reduce immediate shame but also prevents accurate feedback, skill development, and corrective experience (Covington, 1984). Thus, lying flat may represent a defensive attempt to maintain dignity under conditions in which both success and failure feel externally controlled.

2.3 Relatedness Frustration and the Erosion of Real-World Support

Relatedness concerns the need to feel cared for, understood, and significant to others. The broader psychological literature also identifies belonging as a fundamental human motivation with substantial implications for adjustment and well-being (Baumeister & Leary, 1995). University students who lack reliable relationships with classmates, roommates, teachers, or family members may find it harder to regulate distress, seek assistance, and sustain commitment during setbacks. Digital communication may increase contact frequency without necessarily producing the mutual responsiveness and relational security required for genuine belonging.

Relatedness frustration can contribute to psychological lying flat in at least three ways. First, socially isolated students receive fewer opportunities for encouragement, informational support, and corrective feedback. Second, they are less likely to disclose difficulty before problems accumulate. Third, goals promoted by institutions are less likely to be internalized when students do not experience the institutional environment as respectful or caring. From an SDT perspective, people are more willing to adopt externally introduced values when those values are communicated within relationships that support autonomy and relatedness (Ryan & Deci, 2017). When students experience counseling interactions as surveillance, criticism, or administrative control, even well-intended guidance may deepen withdrawal.

2.4 An Integrated Recursive Mechanism

The three needs should not be understood as isolated causes. They form an interacting motivational system. A student who repeatedly fails an examination may experience

competence frustration; if the examination is tied to a career path chosen primarily by parents, autonomy frustration is also present; if the student expects criticism rather than understanding, relatedness frustration reduces help-seeking. These combined experiences can shift motivation from autonomous engagement toward controlled compliance and eventually amotivation—a state in which the individual sees little connection between action and valued outcomes.

The present article therefore proposes a recursive model: need frustration increases perceived uncontrollability, defensive self-protection, and social disconnection; these processes promote withdrawal; withdrawal then reduces opportunities for mastery, meaningful choice, and supportive interaction; and the resulting deprivation intensifies need frustration. This model explains why simple exhortation often fails. The student's problem is not necessarily a lack of awareness that effort is socially desirable. Rather, the motivational conditions required for effort to feel possible, self-endorsed, and worthwhile have deteriorated.

3. Practical Difficulties in Counselor Intervention

3.1 The Mismatch Between Grand Narratives and Current Motivational Capacity

University education frequently relies on ideals, role models, long-term career planning, and narratives of social responsibility. These approaches can be valuable when students possess sufficient psychological resources to identify with the goals being presented. For students experiencing competence and autonomy frustration, however, highly ambitious messages may widen the perceived gap between their current state and the expected standard. A message intended to inspire may instead communicate inadequacy. Repetition of abstract expectations without addressing students' immediate sense of helplessness can therefore produce a motivational discontinuity between institutional goals and personal action.

The problem is not the presence of long-term ideals but their timing and mode of communication. Students in a withdrawn state often require proximal, credible, and personally meaningful entry points before they can engage with distant goals. When counselors begin with persuasion rather than assessment, they may overestimate the student's readiness for change and underestimate the role of need frustration.

3.2 Defensive Resistance and Weak Helping Alliances

Students who protect self-worth through withdrawal may interpret assistance as evidence that they are being judged, monitored, or treated as a problem. As a result, they may minimize difficulties, provide socially desirable answers, or agree verbally without behavioral follow-through. This resistance should not automatically be interpreted as disrespect or unwillingness. It may be a strategy for controlling exposure in a relationship where the student anticipates criticism.

Counselors also face structural obstacles. Large caseloads, administrative demands, and short contact windows encourage problem-focused conversations that move quickly toward advice. Yet trust is especially important when a student's relatedness need has been frustrated. Without a credible sense of respect and confidentiality, techniques such as goal setting or cognitive reframing may be experienced as additional pressure rather than support.

3.3 Outcome-Dominated Evaluation and the Absence of Proximal Reinforcement

Many university evaluation systems privilege visible outcomes such as grade point average, awards, leadership positions, certificates, and employment offers. These indicators are useful for some purposes, but they are poorly suited to detecting early recovery from motivational withdrawal. A student may make meaningful progress by attending class consistently, initiating one conversation, revising part of a résumé, or completing a modest weekly plan. If these changes are invisible within the formal evaluation system, the student receives little evidence that effort is producing movement.

The exclusive use of distal outcomes can also recreate the conditions that produced competence frustration. Effective support requires process-sensitive indicators and feedback loops that make incremental change observable. Goal-setting research emphasizes that specific goals and feedback can improve performance, but goals must be accepted, appropriately challenging, and connected to workable strategies (Locke & Latham, 2002). For withdrawn students, excessively difficult goals may confirm helplessness rather than build competence.

4. An SDT-Informed Counselor Intervention Framework

4.1 Restoring Relational Safety and Supporting Relatedness

The first task is not to correct behavior but to create a relationship in which the student can discuss behavior without humiliation. Counselors should adopt a nonjudgmental, curiosity-based stance and avoid labels that imply moral failure. Questions such as “Why have you given up?” are likely to intensify defensiveness. More effective alternatives include “What has recently felt most difficult to manage?” or “When did you begin to feel that effort was no longer worthwhile?” These formulations invite contextual information and communicate that withdrawal may have understandable antecedents.

Relational support should be consistent rather than crisis-dependent. Brief, predictable, low-pressure contact can be more effective than a single intensive conversation. Counselors can also strengthen supportive microenvironments within classes and residence halls by developing low-competition, interest-based, and cooperative activities. The purpose is not to compel sociability but to create accessible opportunities for reciprocal participation. Peer support should be voluntary, bounded, and supervised to prevent labeling or unwanted disclosure.

Relatedness support also requires accurate listening. Validation does not mean endorsing permanent withdrawal or agreeing that change is impossible. It means acknowledging the student's subjective experience before proposing alternatives. This distinction allows counselors to combine acceptance with developmental expectations.

4.2 Rebuilding Competence Through Graded Mastery and Process Feedback

Competence is rebuilt through successful interaction, not through reassurance alone. Counselors should work with students to convert distant goals into manageable actions that are specific enough to complete and meaningful enough to matter. A broad objective such as "prepare for employment" might be reduced to reviewing one job description, identifying two required skills, or revising one paragraph of a résumé. The appropriate size of a task depends on the student's current functioning; the goal should be challenging enough to produce a sense of accomplishment but not so difficult that failure is highly probable.

Feedback should focus on observable strategy, effort, and change rather than global praise. Statements such as "You completed the two actions you selected despite feeling uncertain" provide information about agency and persistence. By contrast, vague praise may feel insincere, and excessive rewards may shift attention back toward external control. A simple progress record can help students see patterns across time, but it should be jointly designed and used as a reflective tool rather than a compliance ledger.

Counselors should also normalize revision. A missed task is data about task difficulty, environmental barriers, or planning quality, not proof of personal incapacity. Reviewing why a plan failed and adjusting its scale can restore perceived controllability. Over time, repeated mastery experiences can strengthen self-efficacy and weaken the expectation that effort is futile (Bandura, 1997).

4.3 Supporting Autonomy Through Choice, Rationale, and Attributional Reframing

Autonomy-supportive intervention does not mean withdrawing guidance. Research in educational settings indicates that autonomy support and structure are complementary: students benefit when adults recognize their perspectives and provide meaningful choice while also communicating clear expectations, guidance, and feedback (Jang et al., 2010). Intervention should therefore offer bounded options rather than either coercion or complete ambiguity. For example, a student might choose between two forms of class participation, several time points for follow-up, or different pathways toward the same developmental objective.

When requirements cannot be changed, counselors should provide a credible rationale and acknowledge possible negative feelings. Explaining why a task matters, how it connects to the student's own values, and what flexibility remains can facilitate internalization. A large body of intervention research indicates that autonomy-supportive practices are learnable and can improve educationally relevant outcomes (Reeve & Cheon, 2021).

Attributional reframing is also important. Counselors can help students separate a specific outcome from a global judgment of worth and examine controllable contributors such as preparation method, timing, information access, task selection, or help-seeking. The aim is not to insist that every outcome is individually controllable; structural constraints should be acknowledged realistically. Instead, the counselor and student identify the portion of the situation that remains open to influence. This preserves realism while preventing totalized helplessness.

4.4 A Stepped Implementation Process and Professional Boundaries

A practical intervention can be organized into five steps. First, identify the pattern and its functional impact without assuming a single cause. Second, formulate which psychological needs appear to be frustrated and in which contexts. Third, co-design one or

two low-burden actions that support relatedness, competence, or autonomy. Fourth, review progress using process indicators, including participation, task initiation, help-seeking, and perceived controllability. Fifth, revise the plan or coordinate additional services when the student's difficulties exceed the counselor's role.

Counselors should distinguish educational and motivational support from professional mental health treatment. Persistent functional impairment, severe emotional distress, or other significant clinical concerns require assessment and referral through appropriate university or community services. Referral should be framed as an expansion of support rather than a transfer of responsibility. The counselor may continue to provide practical and relational support while qualified professionals address clinical needs.

Intervention effectiveness should also be evaluated multidimensionally. Academic outcomes matter, but exclusive reliance on grades can conceal meaningful developmental change. Additional indicators may include basic psychological need satisfaction and frustration, autonomous motivation, engagement, help-seeking willingness, self-efficacy, goal completion, social connection, and subjective well-being. This broader evaluation system aligns the assessment of intervention with its theoretical mechanism.

5. Discussion

An SDT perspective changes the central question from "How can counselors make students stop lying flat?" to "What motivational conditions have made purposeful action difficult, and how can those conditions be repaired?" This shift does not excuse avoidance or eliminate expectations. It locates responsibility within an interaction between the student and the educational environment. Students remain active participants in change, while institutions and counselors are responsible for examining whether their practices support autonomy, competence, and relatedness.

The framework also clarifies why isolated techniques may fail. Micro-goals without autonomy can become another checklist imposed by adults. Choice without structure can overwhelm students who already feel ineffective. Emotional acceptance without opportunities for mastery may provide comfort but leave helplessness unchanged. Effective intervention therefore requires coordinated support for all three needs, with emphasis adjusted to the student's primary pattern of frustration.

Several limitations should be noted. First, "psychological lying flat" is a culturally embedded and evolving expression rather than a standardized psychological construct. Its boundaries overlap with academic disengagement, amotivation, burnout, avoidance coping, and identity-related uncertainty. Future research should develop and validate measures that distinguish attitudes, behaviors, duration, context, and functional impairment. Second, the proposed recursive model is conceptual and should be tested using longitudinal and experience-sampling designs. Third, students are unlikely to form a homogeneous group. Person-centered research may identify profiles characterized by different combinations of competence, autonomy, and relatedness frustration. Finally, counselor-led programs should be evaluated through pilot studies that assess implementation fidelity, student acceptability, unintended effects, and longer-term outcomes.

Despite these limitations, the framework offers a practical advantage: it translates a broad social label into assessable motivational processes. This allows counselors to avoid both moral condemnation and indiscriminate pathologization. It also creates specific intervention targets that can be observed, discussed, and revised.

6. Conclusion

Psychological lying flat among university students can be understood as a defensive pattern of withdrawal that emerges when action no longer feels effective, self-endorsed, or relationally supported. From the perspective of self-determination theory, frustration of

competence, autonomy, and relatedness may generate helplessness, controlled motivation, self-worth protection, and social disconnection. These mechanisms can reinforce one another and make conventional exhortation ineffective.

University counselors can respond more effectively by moving from behavioral correction toward motivational reconstruction. Nonjudgmental relationship-building supports relatedness; graded mastery and process feedback restore competence; and meaningful choice, rationale, and shared decision-making support autonomy. When combined with clear structure, multidimensional evaluation, and appropriate professional referral, these strategies provide a realistic pathway for helping students recover agency and rebuild engagement with university life and personal development.

Declarations

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Ethical Risks and Collaborative Governance in the Digital-Intelligent Transformation of Vocational Education Driven by New Quality Productive Forces

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Abstract

The development of new quality productive forces is accelerating the reorganization of industrial structures, work processes, and skill requirements in China. Vocational education is therefore under strong pressure to integrate artificial intelligence, learning analytics, big data, virtual simulation, and platform-based school-enterprise cooperation. These technologies can improve access, instructional efficiency, practical training, and responsiveness to labor-market change; however, they also redistribute information, authority, and responsibility within educational systems. This conceptual article examines the ethical risks of digital-intelligent transformation in vocational education and develops a context-sensitive governance framework. It integrates risk society theory, a socio-technical systems perspective, the complementarity of rule-based and virtue ethics, and collaborative governance. Five interconnected risk domains are identified: datafication and privacy intrusion; algorithmic bias and deficits in procedural justice; erosion of teacher and student agency; displacement of craftsmanship by narrow efficiency metrics; and asymmetries of power, data ownership, and accountability in industry-education partnerships. These risks are generated through four mutually reinforcing mechanisms: technical opacity and model uncertainty, institutional lag and fragmented responsibility, incentive and power asymmetries among stakeholders, and a culture of technological instrumentalism. On this basis, the article proposes a four-dimensional governance framework comprising value alignment, institutional regulation, technical assurance, and ethical capability development. Scenario-specific safeguards are further specified for classroom teaching, practical training and assessment, industry-education integration, and student administration. The article contributes by linking macro-level productive transformation to meso-level institutional change and micro-level educational ethics, while translating general AI principles into operational requirements for vocational education.

Keywords: new quality productive forces; vocational education; digital-intelligent transformation; artificial intelligence ethics; ethical risk; collaborative governance

1. Introduction

The concept of new quality productive forces has become a central policy vocabulary for describing innovation-led, digitalized, intelligent, and green development in China. In practical terms, the concept refers not merely to the adoption of advanced equipment but to a broader reconfiguration of production technologies, labor processes, organizational forms, and the knowledge base of economic development. The national planning framework for the 15th Five-Year Plan further places scientific and technological innovation, modern industrial systems, and the coordinated development of education, science, and talent at the center of economic transformation (National Development and Reform Commission, 2026; Zhu et al., 2026). These changes alter both the quantity and the quality of demand for technical and skilled workers.

Vocational education occupies a distinctive position in this transition because it is institutionally close to workplaces, occupational standards, apprenticeship arrangements, and regional industrial systems. Digital platforms can connect curricula to changing occupational profiles; virtual simulation can extend access to expensive or hazardous training environments; learning analytics can support timely feedback; and artificial intelligence (AI) can assist instruction, assessment, and career guidance. Recent international guidance on technical and vocational education and training (TVET) similarly emphasizes that digital transformation affects institutional governance, curriculum design, pedagogy, assessment, teacher development, and industry partnerships rather than a single technological component (International Labour Organization, 2020; UNESCO-UNEVOC, 2026).

The educational value of these technologies is nevertheless conditional. Digital systems do not enter a neutral environment: they encode assumptions about what counts as achievement, which data are relevant, how risks should be classified, and whose judgment is authoritative.

Once embedded in admission, training, evaluation, or employment recommendation, technical systems can shape students' opportunities and teachers' professional discretion. Ethical analysis must therefore extend beyond system accuracy or cybersecurity to questions of dignity, autonomy, fairness, contestability, professional formation, and the public mission of education (Floridi et al., 2018; UNESCO, 2021).

Existing research on AI ethics in education has generated important principles concerning transparency, privacy, non-discrimination, accountability, human oversight, and learner rights (Jobin et al., 2019; Wang et al., 2026; Wu et al., 2026). Yet three limitations remain when these principles are applied to vocational education. First, many frameworks are derived from general or higher education and do not fully address the practical-training orientation, safety-critical occupations, apprenticeship structures, and school-enterprise data flows that characterize vocational education. Second, risk taxonomies often list harms without explaining the causal chain that connects industrial transformation, institutional incentives, technical design, and educational outcomes. Third, governance recommendations frequently remain at the level of general principles and do not specify who must act, at which stage of the technology lifecycle, under what evidence standard, and through which remedy.

This article addresses these gaps through a conceptual and normative analysis. It asks three questions: (1) What ethical risks are distinctive or especially salient in the digital-intelligent transformation of vocational education? (2) Through which technical, institutional, strategic, and cultural mechanisms are these risks generated and amplified? (3) How can a collaborative governance system convert abstract ethical principles into scenario-specific and operational safeguards? The central argument is that ethical risks are not produced by technology alone. They emerge from the interaction between technical affordances, institutional arrangements,

stakeholder incentives, and the moral culture of vocational education. Consequently, effective governance must combine rules, technical controls, professional virtues, and cross-boundary coordination.

2. Conceptual Boundaries and an Integrated Theoretical Framework

2.1 New Quality Productive Forces as a Structural Driver

New quality productive forces can be treated analytically as a structural driver that links technological innovation to changes in work, skills, and educational organization. The concept emphasizes higher technological intensity, more efficient combinations of production factors, and development oriented toward quality rather than extensive expansion. For vocational education, its significance lies in three transmission channels. The occupational channel changes task composition and increases demand for digital fluency, problem solving, and the capacity to work with intelligent systems. The organizational channel changes how firms coordinate production, evaluate performance, and share data across supply chains. The temporal channel shortens the useful life of occupational knowledge and places institutions under pressure to update curricula more rapidly.

These pressures create a legitimate case for digital transformation, but they also produce ethical tension. When institutional responsiveness is measured primarily by speed, equipment investment, or employment indicators, educational purposes that develop slowly - judgment, responsibility, craftsmanship, and professional identity - may be treated as secondary. The concept should therefore not be used as a technological imperative that automatically legitimizes every form of automation. It is more productively understood as a demand for adaptive capacity

that must remain bounded by the educational commitment to human development and socially responsible work.

2.2 Digital-Intelligent Transformation as Socio-Technical Restructuring

Digital-intelligent transformation refers to the systematic integration of digital infrastructures and intelligent technologies into teaching, practical training, assessment, administration, and industry-education cooperation. The term is broader than digitization, which converts analogue information into digital form, and broader than isolated technology adoption. Transformation occurs when technologies alter decision rights, data flows, professional roles, organizational routines, and relationships among institutions.

A socio-technical perspective is essential because the same algorithm can produce different consequences in different institutional settings. A predictive model used as a low-stakes advisory tool may support teachers, whereas the same model used automatically to allocate internships can constrain students' opportunities. Similarly, virtual simulation can safely prepare students for high-risk operations, but it can also displace the tacit, embodied, and context-sensitive learning that occurs with real equipment and experienced instructors. Ethical assessment must therefore examine the complete system of technology, users, organizational incentives, rules, and affected communities rather than the technical artifact in isolation (Selbst et al., 2019).

2.3 Ethical Risk in Vocational Education

In this article, ethical risk is defined as the possibility that a digital-intelligent application will unjustifiably harm rights, distribute benefits and burdens unfairly, weaken human agency, undermine professional formation, or displace the public purposes of vocational education. This definition distinguishes ethical risk from three adjacent concepts. Technical failure concerns whether a system performs as specified. Legal non-compliance concerns whether conduct

violates binding rules. Educational ineffectiveness concerns whether an intervention improves learning. Ethical risk may exist even when a system is technically functional, legally permissible, and statistically effective, because the system may still be intrusive, non-contestable, or inconsistent with the cultivation of responsible professionals.

Vocational education intensifies several risks because it combines education with production-like environments. Students may work with industrial devices, enterprise platforms, biometric safety systems, or real production data. Performance assessments can affect qualification, apprenticeship placement, and employment. School-enterprise cooperation also creates complex chains of data processing and responsibility. The ethical threshold for such systems should therefore reflect both educational vulnerability and the consequences of occupational decisions.

2.4 Theoretical Integration

Four theoretical perspectives are integrated, each addressing a different analytical question. Risk society theory explains why technologically produced risks can be diffuse, cumulative, difficult to attribute, and visible only after widespread adoption (Beck, 1992). It supports anticipatory and lifecycle governance rather than reliance on post hoc remediation.

The socio-technical systems perspective explains where risk is generated. It rejects the assumption that fairness or accountability can be secured solely through technical optimization and directs attention to the institutional context in which systems are designed, procured, interpreted, and contested (Mittelstadt et al., 2016; Selbst et al., 2019).

Rule-based ethics and virtue ethics explain what governance is intended to protect. Rules establish enforceable limits concerning privacy, non-discrimination, due process, and accountability. Virtue ethics emphasizes the formation of practical wisdom, integrity, care,

responsibility, and craftsmanship. In vocational education, this complementarity is critical: rules prevent abuse, while professional virtues guide judgment in situations that cannot be fully specified in advance (Hou, 2026; Vallor, 2016; Yan & Shi, 2026).

Finally, stakeholder incentive analysis and collaborative governance explain how implementation can be sustained. Government agencies, institutions, technology providers, employers, teachers, and students possess unequal resources and different incentives. Ethical governance is credible only when roles, evidence duties, liabilities, and benefits are structured so that responsible conduct is not systematically disadvantaged. Collaborative governance research indicates that shared problem definition, institutionalized participation, trust-building, and joint capacity are necessary for cross-boundary action (Ansell & Gash, 2008; Emerson et al., 2012).

Together, these perspectives yield a causal sequence: structural pressure for rapid digitalization leads to socio-technical embedding; embedding redistributes data, authority, and evaluation; technical and institutional asymmetries activate ethical risks; and governance must intervene across values, rules, system design, and human capabilities. Table 1 summarizes this integrated model.

Table 1. Integrated Analytical Model of Ethical Risk in Digital-Intelligent Vocational Education

Analytical level	Primary driver	Risk-generating mechanism	Ethical outcome	Governance implication
Macro-structural	Industrial and labor transformation	Speed pressure and skill volatility	Narrow responsiveness metrics; mission drift	Align digitalization with human development and decent work

Analytical level	Primary driver	Risk-generating mechanism	Ethical outcome	Governance implication
Meso-institutional	Procurement, platforms, and school-enterprise cooperation	Fragmented responsibility and dependence on vendors	Accountability gaps; loss of educational autonomy	Lifecycle review, contractual duties, and joint accountability
Micro-pedagogical	Automated teaching, assessment, and recommendation	Opacity, datafication, and authority transfer	Privacy intrusion, unfairness, and weakened agency	Human oversight, contestability, and proportional use
Moral-cultural	Technological instrumentalism	Efficiency becomes the dominant value	Erosion of craftsmanship, care, and practical wisdom	Virtue formation, reflective practice, and plural evaluation

3. Ethical Risk Domains

3.1 Datafication, Privacy, and Surveillance

Data are the operational substrate of intelligent education. Learning management systems, smart classrooms, simulation platforms, wearable devices, and apprenticeship systems can collect identity information, attendance records, interaction logs, performance trajectories, location data, and, in some cases, biometric or physiological signals. The ethical problem is not collection per se but the expansion of collection beyond a clearly defined educational purpose. A system may gradually move from measuring task completion to inferring attention, emotion, employability, or disciplinary risk without a valid basis or meaningful consent.

Vocational education creates additional exposure because data may cross institutional boundaries. Student records can be combined with enterprise production data, safety monitoring, internship evaluations, or employment platforms. Once data are shared, students may have limited knowledge of secondary use, retention, model training, or commercial monetization.

Consent is especially weak when participation is functionally required for course completion or internship access. Formal acceptance under these conditions should not be treated as sufficient ethical authorization.

Datafication also transforms how students are understood. When practical ability, professional attitude, teamwork, and learning potential are compressed into standardized indicators, the record can become a substitute for the person. Data profiles may follow students across courses and placements, creating path dependency: an early low score can shape later resource allocation and reinforce the original classification. Ethical governance must therefore address purpose limitation, data minimization, retention, access rights, correction, deletion, and the prohibition of function creep, while preserving space for qualitative and contextual judgment (UNESCO, 2021, 2023).

3.2 Algorithmic Bias and Procedural Justice

Algorithms increasingly support admissions screening, adaptive learning, practical-skill assessment, internship matching, and employment recommendation. Bias can arise from unrepresentative data, historically unequal occupational patterns, proxy variables, label construction, or differences in measurement quality. For example, an employment recommendation system trained on past placements may reproduce gender segregation across manufacturing, construction, care, or service occupations. A performance model may also interpret differences in prior educational opportunity as differences in inherent potential.

Fairness cannot be reduced to a single statistical metric because vocational decisions involve contested values and context-specific trade-offs. Equal error rates, equal selection rates, and individualized accuracy can conflict. Moreover, a system can satisfy a chosen metric while preserving an unfair institutional process. The central requirement is therefore procedural as well

as distributive: affected persons should know when an automated system is materially involved, understand the main factors relevant to a decision, obtain meaningful human review, and challenge inaccurate or unjust outcomes (Mittelstadt et al., 2016; Selbst et al., 2019).

The problem is particularly acute when commercial confidentiality is invoked to deny explanation. Intellectual property protection does not eliminate the institution's duty to provide reasons for high-impact educational decisions. Procurement arrangements must require vendors to supply documentation, validation evidence, subgroup performance, known limitations, and audit access sufficient for institutional accountability. Comparative regulatory developments, including the European Union's risk-based treatment of certain AI systems used in education and vocational training, demonstrate the increasing recognition that these applications require heightened safeguards (European Parliament & Council of the European Union, 2024).

3.3 Human Agency, Professional Deskilling, and the Pedagogical Relationship

Digital tools can augment professional judgment, but over-automation can weaken the capacities they are intended to support. Teachers who routinely accept generated lesson plans, automated feedback, or system-defined training sequences may gradually lose opportunities to exercise diagnostic judgment, adapt demonstrations, and respond to unanticipated learner difficulties. This is not simply a problem of employment substitution; it is a problem of professional deskilling and responsibility displacement. When a recommendation fails, responsibility may be ambiguously transferred between the teacher, institution, and vendor.

Students face a parallel risk. Recommendation systems can reduce the need to plan learning, compare sources, or tolerate productive uncertainty. Virtual simulation can provide safe rehearsal and repeated practice, but excessive substitution for real equipment can produce a gap between screen-based proficiency and embodied occupational competence. In safety-critical

fields, students must learn how materials, tools, environments, and human teams behave under imperfect conditions. These forms of tacit knowledge cannot be fully represented by standardized interfaces.

The pedagogical relationship is also a medium of moral and professional formation. Apprenticeship and practical instruction transmit not only procedures but habits of care, responsibility, patience, communication, and judgment. If human interaction is treated as an inefficiency to be minimized, vocational education may preserve observable performance while weakening the social process through which professional identity is formed. Human oversight must therefore be substantive rather than ceremonial: teachers need authority, time, competence, and organizational support to disagree with systems and to explain their decisions.

3.4 Instrumental Rationality and the Erosion of Craftsmanship

Vocational education is often described through the ideal of integrating technical competence with moral cultivation. In this context, craftsmanship includes precision and mastery but also responsibility for quality, respect for materials and users, perseverance, honesty, and commitment to socially valuable work. Digital transformation can support these qualities when it enables reflection, feedback, and safe experimentation. It becomes ethically problematic when efficiency, speed, and measurable output are treated as exhaustive definitions of excellence.

Algorithmic management can encourage students to optimize for visible indicators rather than for the quality of practice. Standardized scoring may reward procedural conformity while overlooking innovation, context-sensitive adjustment, teamwork, and professional care. Similarly, institutional digitalization targets may prioritize hardware coverage or platform usage without evidence of educational value. The result is a form of value narrowing in which what is easily counted becomes what is educationally important.

Virtue ethics clarifies why this risk cannot be solved only by adding another compliance checklist. Craftsmanship is cultivated through repeated practice, exemplary relationships, critical reflection, and situations that require practical judgment. Governance should protect these formative conditions and evaluate technologies by whether they enlarge or diminish opportunities for responsible agency (Hou, 2026; Vallor, 2016).

3.5 School-Enterprise Asymmetry and the Public Mission of Education

Industry-education integration gives vocational education access to current technologies, occupational standards, equipment, and employment pathways. Yet the partnership also joins organizations with different mandates. Enterprises legitimately pursue productivity and commercial advantage; educational institutions have a public duty to protect learners and support long-term development. Ethical risk arises when production logic becomes the default definition of educational relevance.

Power asymmetry can appear in curriculum design, platform choice, data ownership, and evaluation standards. A dominant technology provider may make the institution dependent on proprietary infrastructure, restrict audit access, or shape curricula around its own ecosystem. Enterprises may also seek broad rights to use training data for product development. Students, who are the data subjects and primary affected group, may have little bargaining power. Ambiguous contracts then allow both parties to disclaim responsibility after a breach or harmful decision.

The public mission of vocational education requires that institutional leaders retain final authority over educational objectives, assessment validity, learner rights, and the use of student data. Partnership agreements should specify purpose, ownership, access, retention, cybersecurity duties, model training restrictions, incident response, audit rights, and exit arrangements. Ethical

collaboration does not reject enterprise participation; it structures participation so that commercial capability remains accountable to educational purposes (Zhang et al., 2026).

4. How Ethical Risks Are Generated and Amplified

4.1 Technical Opacity, Uncertainty, and Contextual Misfit

AI systems are probabilistic, data-dependent, and vulnerable to distributional change. A model validated in one institution, region, occupation, or cohort may perform differently when transferred. In vocational education, local equipment, teaching routines, linguistic practices, and labor-market conditions can materially affect performance. Technical opacity compounds this uncertainty because users may not understand why a result was produced or when the model is operating outside its reliable range.

The common response is to seek more data or greater model complexity, but this can intensify surveillance and dependence without resolving the normative problem. The appropriate question is not only whether a model predicts accurately, but whether the prediction target is educationally legitimate, whether errors are acceptable, and whether an automated intervention is necessary. NIST's AI Risk Management Framework similarly treats governance, context mapping, measurement, and risk management as interdependent rather than purely technical tasks (National Institute of Standards and Technology, 2023).

4.2 Institutional Lag and Fragmented Responsibility

Technology procurement and deployment often move faster than institutional policy. Schools may have cybersecurity rules but no process for algorithmic impact assessment, no inventory of AI applications, and no clear threshold for high-risk use. Ethics review may be confused with research ethics even though operational systems affect students outside research

projects. Responsibility is further fragmented across academic departments, information technology offices, student affairs units, legal staff, and external vendors.

Fragmentation creates predictable gaps. The purchaser assumes that the vendor has validated the system; the vendor assumes that the institution will control use; teachers assume that administrators have approved the system; and administrators assume that frontline users will identify problems. A credible governance model must assign decision rights and evidence duties before deployment, not after harm occurs.

4.3 Incentive and Power Asymmetries

Stakeholders face different incentives. Vendors benefit from rapid adoption and data access. Institutions may seek visible modernization, lower administrative costs, and improved employment metrics. Teachers may use automation to manage workload. Students may accept intrusive systems because participation affects grades or placements. These incentives do not imply misconduct, but they can systematically favor deployment over caution and make refusal costly for the least powerful participants.

An incentive-compatible system changes the payoff structure. Vendors should bear documentation, audit, remediation, and breach responsibilities. Institutions should be evaluated not only on adoption but on demonstrated educational value and rights protection. Teachers should receive time and training for oversight. Students should have protected complaint channels and meaningful alternatives when a system is not essential. Collaborative governance is effective only when participation changes decisions rather than merely legitimizing predetermined choices (Ansell & Gash, 2008; Chen & Cui, 2025).

4.4 Technological Instrumentalism and Cultural Normalization

A deeper mechanism is cultural: repeated emphasis on technological modernization can normalize the assumption that more data, more automation, and more standardization are inherently better. This assumption narrows the vocabulary through which educational quality is discussed. Concerns about privacy, autonomy, or professional judgment may then be portrayed as resistance to innovation rather than as conditions for legitimate innovation.

Cultural normalization also affects self-understanding. Teachers may interpret system outputs as more objective than their own judgment, and students may treat algorithmic profiles as fixed descriptions of ability. Ethical governance must therefore cultivate critical technological literacy: the capacity to understand what systems can and cannot know, to identify embedded values, and to preserve responsibility in human-machine collaboration (Li, 2025; UNESCO, 2023).

4.5 Recursive and Cumulative Risk

The preceding mechanisms interact through feedback loops. Data are used to classify students; classifications shape opportunities; opportunities affect later performance; and later performance is used to confirm the original classification. A similar loop can occur at the institutional level: platform adoption produces dependence, dependence reduces bargaining power, and reduced bargaining power limits access to information needed for oversight. Risks that appear minor at the level of a single decision can therefore become cumulative and structural.

This recursive model explains why periodic technical testing is insufficient. Governance must monitor downstream effects, distributional patterns, user behavior, and institutional dependency. It must also include sunset clauses and withdrawal procedures so that a system can

be suspended when its educational value is not demonstrated or when risks cannot be adequately controlled.

5. A Four-Dimensional Collaborative Governance Framework

5.1 Foundational Principles

The governance framework is guided by six principles. First, human development and learner rights take priority over technical convenience. Second, proportionality requires that data collection and automation be limited to what is necessary for a legitimate educational purpose. Third, risk-tiering requires stricter evidence and oversight when systems affect admission, assessment, qualification, placement, employment, discipline, health, or access to essential support. Fourth, contestability requires notice, reasons, correction, and appeal. Fifth, lifecycle responsibility extends from problem definition and procurement to retirement and data deletion. Sixth, inclusive participation requires the involvement of teachers, students, employers, technical experts, and ethics or legal specialists.

These principles align with major international frameworks that emphasize human rights, transparency, fairness, accountability, safety, and human oversight, while remaining adaptable to the institutional context of Chinese vocational education (Floridi et al., 2018; OECD, 2024; UNESCO, 2021; Wu et al., 2026).

5.2 Value Alignment: Protecting Educational Purpose and Professional Virtue

Value alignment begins before technology selection. Institutions should specify the educational problem, the public value to be advanced, the rights potentially affected, and the non-technological alternatives. This prevents solutions from being defined by available products.

A proposed system should be rejected when its primary benefit is administrative visibility but its educational necessity is weak.

Professional ethics and craftsmanship should be embedded in curriculum, assessment, and system design. Assessment frameworks should include quality, safety, responsibility, collaboration, creativity, and reflective judgment rather than only speed and standardized correctness. Students should practice ethical deliberation within occupational scenarios, including data handling, AI-assisted decisions, safety trade-offs, and responsibility to clients or the public. Teachers and enterprise mentors should model how technical excellence is integrated with integrity and care.

5.3 Institutional Regulation: From General Principles to Enforceable Process

Each institution should establish a digital-intelligent governance mechanism with authority to review high-impact systems. This function may be assigned to a dedicated committee or an expanded technology ethics committee, but it must include expertise in vocational pedagogy, data protection, cybersecurity, AI evaluation, law or ethics, and student representation. The committee should maintain an application inventory and classify systems by risk.

High-risk applications should undergo an algorithmic and educational impact assessment before procurement or deployment. At minimum, the assessment should address purpose, necessity, affected groups, data sources, validity, subgroup performance, human oversight, explanation, appeal, security, vendor dependency, and exit arrangements. Decisions and reasons should be documented. Material system changes should trigger re-review.

Accountability also depends on contracts. Procurement clauses should require data minimization, prohibition of unauthorized secondary use, incident notification, audit cooperation, performance documentation, security controls, correction obligations, model update procedures,

data return or deletion, and clear allocation of liability. Institutions should avoid contracts that prevent meaningful explanation or independent evaluation.

5.4 Technical Assurance: Ethics by Design and Evidence-Based Control

Technical assurance operationalizes ethical requirements. Systems should be tested not only for average accuracy but for reliability across relevant student groups, occupations, campuses, and conditions of use. Validation should use local data where appropriate and should distinguish development, validation, and operational monitoring. Performance thresholds must reflect the consequences of error.

Data governance should include classification, access control, encryption, logging, retention schedules, de-identification where feasible, and strict controls on biometric and psychological data. Privacy-enhancing techniques can reduce exposure, but they do not replace purpose limitation or governance. For high-impact decisions, institutions should preserve audit trails that record data provenance, model version, human intervention, and the final decision.

Explainability should be matched to the user and decision. Technical staff need detailed documentation; teachers need actionable information about limitations and relevant factors; students need understandable reasons and correction routes. Human review must be capable of changing the outcome. A review process that merely confirms the automated result is not meaningful oversight.

5.5 Ethical Capability: Building Organizational and Individual Competence

Rules and tools cannot function without competent users. Ethical capability should be developed at three levels. All students need foundational data and AI literacy, including privacy, bias, verification, and responsible use. Programs should then integrate occupation-specific ethical problems, such as safety-critical automation in health care, manufacturing, transportation,

or information services. Practical training should require students to justify decisions and reflect on consequences.

Teachers and instructors need more than operational training. They must understand system limitations, data quality, appropriate reliance, bias indicators, and procedures for escalation. Administrators and procurement staff require competence in impact assessment, contracting, and accountability. Periodic exercises based on realistic incidents can test whether the institution can identify, report, and remedy problems.

6. Scenario-Specific Governance Pathways

6.1 Classroom Teaching and Adaptive Learning

In classroom teaching, AI should remain an assistive resource under teacher authority. Systems may support lesson preparation, formative feedback, accessibility, and differentiated learning, but they should not autonomously determine a student's educational trajectory. Collection of facial, emotional, or physiological data should be prohibited unless a compelling educational or safety purpose is demonstrated and less intrusive alternatives are inadequate. Students should be informed when AI-generated materials or automated analytics are used.

Recommendation systems should preserve learner choice and expose students to diverse resources rather than optimizing only for predicted engagement. Teachers should periodically review whether personalization narrows content, reinforces prior performance differences, or changes student motivation. Generated content should be verified for accuracy, occupational relevance, and safety.

6.2 Practical Training, Simulation, and Assessment

Practical training requires a balance between simulation and authentic performance. Virtual simulation is appropriate for initial familiarization, rare events, hazardous procedures, and repeated practice, but institutions should define which competencies require real equipment, workplace interaction, or direct observation. No learner should obtain a safety-critical qualification solely on the basis of simulation or automated scoring.

Automated assessment should be combined with expert qualitative judgment. Validation must include different student groups and realistic operating conditions. Students should receive criteria, error information, and an opportunity for reassessment or human review. The assessment framework should recognize adaptive problem solving, quality, safety, communication, and professional responsibility, not only standardized execution.

6.3 Industry-Education Integration and Apprenticeships

School-enterprise projects should begin with a joint ethical and educational impact assessment. A dedicated agreement should define the purpose and scope of data sharing, legal roles, security duties, intellectual property, restrictions on model training, and procedures for breach response. Student participation in non-essential data use should be genuinely voluntary and should not affect access to training.

Educational institutions must retain final authority over curriculum, assessment, qualifications, and learner protection. Enterprises should contribute occupational expertise and technology without unilaterally defining educational value. Joint governance bodies should include teachers, enterprise representatives, and student or apprentice representation, with transparent procedures for conflicts of interest and complaints.

6.4 Student Administration and Support Services

Administrative applications such as attendance, financial-aid targeting, dormitory management, career guidance, and well-being support should follow strict necessity and proportionality. Continuous, indiscriminate monitoring should not be normalized as a condition of enrollment. Data collected for safety or support should not be repurposed for discipline, ranking, or employment recommendation without a separate legitimate basis.

Systems that infer psychological state or risk require exceptional caution because false positives can stigmatize students and false negatives can create misplaced confidence. Such tools should not diagnose or trigger punitive action. They may only support trained professionals within a clearly governed care pathway, with confidentiality, human assessment, and access to appropriate services.

Table 2. Scenario-Based Ethical Governance Matrix

Scenario	High-impact uses	Primary ethical risks	Minimum safeguards	Accountable actors
Classroom teaching	Adaptive learning, behavior analytics, generative content	Intrusive data collection, narrowed learning, teacher displacement	Data minimization, teacher control, content verification, learner notice	Academic unit, teacher, IT/data office, vendor
Practical training and assessment	Simulation, automated skill scoring, safety monitoring	Invalid assessment, bias, virtual-real skill gap, automation bias	Local validation, real-practice requirements, human review, appeal	Program faculty, assessors, safety officers, vendor
Industry-education integration	Shared platforms, apprenticeships, employment matching	Commercial data use, power asymmetry, mission drift, unclear liability	Joint impact assessment, contractual controls, audit and exit rights	Institutional leadership, enterprise, legal/data officers

Scenario	High-impact uses	Primary ethical risks	Minimum safeguards	Accountable actors
Student administration	Attendance, aid, dormitory, well-being and risk prediction	Surveillance, stigma, function creep, punitive use	Necessity test, restricted access, non-punitive use, correction and deletion rights	Student affairs, data protection function, counselors, oversight committee

7. Implementation, Monitoring, and Remedy

7.1 A Lifecycle Governance Process

Operational governance can be organized as a seven-stage cycle: inventory, classify, assess, procure or design, validate, monitor, and retire. The inventory identifies every system that processes learner data or influences educational decisions. Classification determines risk based on the sensitivity of data, degree of automation, scale, and consequence. Assessment examines necessity, alternatives, evidence, and rights. Procurement embeds duties in contracts. Validation tests the system in context. Monitoring examines both technical performance and downstream educational effects. Retirement includes data deletion, migration, and review of residual obligations.

This process should be proportionate. Low-risk administrative tools may receive simplified review, while systems affecting qualification, placement, employment, discipline, or psychological support require independent scrutiny and senior authorization. Pilot deployment should be time-limited, use the smallest necessary population, and include predefined stopping criteria.

7.2 Monitoring Indicators and Independent Audit

Monitoring should combine technical, procedural, educational, and rights-based indicators. Technical indicators include error rates, subgroup performance, drift, security incidents, and system availability. Procedural indicators include completed impact assessments, documentation quality, response time to complaints, and frequency of human overrides. Educational indicators include learning quality, transfer to authentic practice, teacher workload, and effects on student motivation. Rights-based indicators include consent quality, data access requests, corrections, appeals, and evidence of unequal burden.

Institutions should publish an annual summary of high-impact systems, their purposes, responsible units, review status, and major incidents, while protecting security-sensitive information. Independent audits are appropriate where decisions have substantial consequences, vendors control critical evidence, or stakeholders contest institutional impartiality. Audit findings should lead to assigned corrective actions, deadlines, and verification rather than symbolic reporting.

7.3 Complaint, Appeal, and Remediation

Ethical governance is incomplete without remedy. Students and teachers need accessible channels to report inaccurate data, biased outcomes, privacy concerns, or inappropriate pressure to use a system. Complaints should not affect academic evaluation or employment opportunities. The institution should provide a timely explanation, human review, correction of records, and reconsideration of consequential decisions.

Remediation may require more than correcting an individual case. When a pattern is identified, the institution should suspend the relevant function, notify affected persons, reassess previous decisions, and revise the system or process. Serious incidents should trigger escalation

to senior leadership and, where applicable, external regulators. Lessons should be incorporated into training and procurement.

7.4 Organizational and Resource Conditions

Implementation requires stable resources. Institutions need designated personnel for data governance, cybersecurity, AI evaluation, and ethics coordination; faculty need workload recognition for review and oversight; and students need representation and support. Regional or sector-level resource centers can provide model policies, shared audit tools, training cases, and expert support for institutions with limited capacity.

Governance effectiveness should be included in institutional evaluation, but it should not be reduced to the number of policies or committees. The relevant outcome is whether systems are justified, documented, monitored, contestable, and capable of being changed or withdrawn. A mature institution is not one that eliminates all risk; it is one that identifies uncertainty early, distributes responsibility clearly, learns from evidence, and preserves educational agency.

8. Discussion

This article makes three theoretical contributions. First, it connects the policy discourse of new quality productive forces with a specific ethical transmission mechanism. Industrial transformation changes skill demand and creates pressure for educational digitalization; digitalization then reorganizes information, authority, and evaluation; and these changes generate ethical consequences through institutional and cultural conditions. This avoids treating macro-level policy and micro-level educational ethics as separate topics.

Second, the analysis reframes digital-intelligent risk as a socio-technical and recursive phenomenon. Privacy, bias, deskilling, value narrowing, and partnership asymmetry are not

isolated categories. They reinforce one another through data and decision feedback loops. This explains why single interventions - for example, a privacy notice or an accuracy test - cannot provide adequate governance.

Third, the framework links external regulation with internal moral formation. Vocational education cannot rely exclusively on compliance because occupational practice contains uncertainty and context-sensitive judgment. Nor can it rely exclusively on virtue because unequal power and commercial incentives require enforceable limits. The combination of rule-based protections, technical assurance, professional virtues, and collaborative governance is therefore not additive but structurally necessary.

The article also has limitations. It is conceptual and does not empirically estimate the prevalence or severity of the identified risks. The governance framework has not yet been tested across regions, institutional types, or occupational programs. Some concepts, including craftsmanship and educational public value, may require operational definitions that vary by industry. Future research should develop and validate risk assessment instruments, compare stakeholder perceptions, conduct audits of real systems, and examine how governance arrangements affect learning, equity, and professional agency over time.

Further work should also distinguish among technologies rather than treating AI as a homogeneous category. Generative systems, predictive analytics, computer vision, simulation, and automated assessment have different failure modes and evidence requirements. Comparative research can clarify which safeguards are universally necessary and which must be adapted to legal, cultural, occupational, and institutional contexts.

9. Conclusion

Digital-intelligent transformation is becoming integral to the capacity of vocational education to respond to industrial change and evolving work. Its legitimacy, however, depends on whether technology strengthens rather than displaces the educational purposes of developing competent, responsible, and autonomous professionals. The principal ethical risks are not limited to privacy breaches or biased algorithms. They include cumulative datafication, deficits in procedural justice, erosion of human judgment, narrowing of craftsmanship to measurable efficiency, and the subordination of public education to platform or production interests.

A defensible governance response must therefore be multi-dimensional. Value alignment protects educational purpose; institutional regulation assigns enforceable responsibility; technical assurance produces evidence and controls; and ethical capability enables informed human judgment. These dimensions should be applied through risk-tiered, lifecycle, participatory, and scenario-specific processes. The goal is not to slow innovation indiscriminately, but to distinguish innovation that expands human and educational capability from automation that merely transfers power while obscuring responsibility. Only under these conditions can digital-intelligent technology contribute to high-quality vocational education and to the development of new quality productive forces in a socially responsible manner.

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Childhood Trauma and Internet Addiction Among Chinese College Students With DSM-5-Based Self-Reported Tobacco Dependence: The Serial Mediating Roles of Self-Control and Aggression

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Abstract

Background: Internet addiction is frequently examined among university students, but less is known about how early adverse experiences are associated with problematic Internet use in students who already show elevated tobacco-use symptoms. Drawing on the Interaction of Person-Affect-Cognition-Execution (I-PACE) framework and self-regulation perspectives, this study tested whether self-control and aggression serially mediated the association between childhood trauma and Internet addiction among Chinese college students who met a DSM-5-based self-report screening threshold for tobacco dependence symptoms. Methods: A cross-sectional questionnaire survey was conducted with 663 Chinese college students who reported DSM-5-based tobacco-use symptoms at a score of 4 or above. Participants completed measures of childhood trauma, self-control, aggression, Internet addiction, and demographic characteristics. Pearson correlations were used to examine zero-order associations. A serial mediation model was estimated using PROCESS Model 6 with 5,000 bootstrap samples, controlling for gender and age. Results: Childhood trauma was positively correlated with Internet addiction ($r = .196$, $p < .01$) and aggression ($r = .290$, $p < .01$), and negatively correlated with self-control ($r = -.138$, $p < .01$). Self-control was strongly and negatively correlated with both aggression ($r = -.557$, $p < .01$) and Internet addiction ($r = -.511$, $p < .01$). The mediation model showed that childhood trauma negatively predicted self-control ($B = -0.083$, $p < .001$), self-control negatively predicted aggression ($B = -0.744$, $p < .001$), and aggression positively predicted Internet addiction ($B = 0.131$, $p = .001$). The direct effect of childhood trauma on Internet addiction remained significant ($B = 0.080$, $p = .009$). Bootstrap analyses indicated significant indirect effects through self-control alone, aggression alone, and the serial pathway through self-control and aggression. Conclusions: Among Chinese college students with elevated DSM-5-based tobacco-use symptoms, childhood trauma was associated with Internet addiction partly through impaired self-control and heightened aggression. Self-regulatory deficits appeared to be the dominant mechanism, whereas aggression represented a smaller but significant externalizing pathway. Because the design was cross-sectional and based on self-report measures, causal interpretation is not warranted.

Keywords: childhood trauma; self-control; aggression; Internet addiction; tobacco dependence; Chinese college students

Introduction

Problematic Internet use remains an important concern in university populations because digital platforms are deeply embedded in learning, social contact, entertainment, and emotion regulation. In this manuscript, Internet addiction refers to a maladaptive pattern of excessive or poorly controlled Internet use associated with functional impairment and difficulty disengaging from online activities, rather than to ordinary high-frequency Internet use. The construct was introduced in early clinical and empirical work on problematic Internet use, and subsequent research has continued to treat impaired control, salience, mood modification, tolerance-like escalation, withdrawal-like discomfort, and functional impairment as central features of clinically relevant problematic Internet use (Young, 1998; Wei et al., 2025). University students may be especially vulnerable because they experience greater autonomy, reduced direct parental monitoring, academic pressure, peer influence, and unrestricted access to digital platforms.

The present study focused on a subgroup of college students with elevated tobacco-use symptoms. DSM-5 and DSM-5-TR classify substance use disorders by the number of endorsed criteria, with four or five criteria corresponding to moderate severity when a structured diagnostic assessment is used (American Psychiatric Association, 2013, 2022; Hasin et al., 2013). However, the present study used self-reported DSM-5-based tobacco criteria as a screening threshold, not a clinician-administered diagnostic interview. Therefore, the sample is described as college students with elevated self-reported tobacco dependence symptoms, not as a clinically diagnosed tobacco use disorder sample. This distinction matters because tobacco-use symptoms may indicate a broader vulnerability to impaired control and dependence-prone coping, while tobacco dependence and Internet addiction remain conceptually distinct phenomena.

Childhood trauma is a plausible developmental risk factor for Internet addiction. The Childhood Trauma Questionnaire framework conceptualizes maltreatment histories across emotional abuse, physical abuse,

sexual abuse, emotional neglect, and physical neglect (Bernstein et al., 2003). A large adverse childhood experiences literature links early adversity to later mental health and addictive outcomes, suggesting that early stress exposure can shape stress regulation, reward processing, interpersonal expectations, and coping behavior (Felitti et al., 1998). More directly, recent meta-analytic evidence among students in mainland China showed a stable positive association between childhood trauma and problematic Internet use (Wang et al., 2023). Thus, childhood trauma may function as an upstream vulnerability that increases reliance on immediately rewarding or relief-oriented online activities.

The Interaction of Person-Affect-Cognition-Execution (I-PACE) model provides a clear theoretical framework for the present serial mediation model. The updated I-PACE model proposes that addictive behaviors develop and are maintained through interactions among person-level predispositions, affective and cognitive responses, and executive-control processes (Brand et al., 2019). In this framework, childhood trauma can be conceptualized as a person-level vulnerability, self-control as an executive or regulatory capacity, aggression as an affective-behavioral externalizing tendency, and Internet addiction as a maladaptive behavioral outcome. The model therefore supports a mechanism in which early adversity is translated into problematic Internet use through impaired self-regulation and maladaptive behavioral responses.

Self-control was specified as the first mediator because it is closely tied to impulse inhibition, delay of gratification, resistance to temptation, and persistence toward long-term goals (Tangney et al., 2004). Meta-analytic evidence indicates that lower self-control is consistently associated with higher Internet addiction among students, supporting its role as a central regulatory factor in problematic Internet use (Li et al., 2021). In trauma-exposed students, weaker self-control may increase vulnerability to immediate online rewards and reduce the ability to disengage from online activities despite negative consequences. Given the strong negative correlation between self-control and Internet addiction in the present data, self-control was expected to be the dominant indirect pathway.

Aggression was specified as the second mediator because it captures an externalizing tendency that may follow impaired self-regulation and contribute to dysregulated Internet use. The General Aggression Model conceptualizes aggression as emerging from person and situational inputs through affective, cognitive, and arousal-related routes (Anderson & Bushman, 2002). Childhood trauma may increase anger, hostility, and hostile attributional patterns, while lower self-control may reduce the ability to inhibit aggressive impulses or manage frustration (Buss & Perry, 1992; Lv et al., 2013). In digital environments, aggressive tendencies may be linked to interpersonal conflict, emotional arousal, retaliatory communication, or maladaptive online coping, making aggression a theoretically meaningful downstream mechanism.

The present study tested a serial mediation model in which childhood trauma predicted Internet addiction through self-control and aggression among Chinese college students meeting a DSM-5-based self-report tobacco symptom threshold. Based on the I-PACE model, self-regulation theory, general aggression theory, and prior meta-analytic evidence, we hypothesized that: (1) childhood trauma would be positively associated with Internet addiction; (2) childhood trauma would be negatively associated with self-control and positively associated with aggression; (3) self-control would be negatively associated with aggression and Internet addiction; and (4) self-control and aggression would serially mediate the association between childhood trauma and Internet addiction (Anderson & Bushman, 2002; Brand et al., 2019; Li et al., 2021; Wang et al., 2023).

Methods

Design and Participants

This study used a cross-sectional questionnaire design. The analytic sample consisted of 663 Chinese college students who completed all study variables and who met the inclusion criterion of scoring 4 or above on a DSM-5-based self-report screening measure of tobacco dependence symptoms. When

symptoms are assessed as criteria counts, four or five DSM-5 substance-use criteria correspond to moderate severity; however, because the present study relied on self-report screening rather than clinician-administered diagnostic interviews, the sample is described as students with elevated DSM-5-based self-reported tobacco dependence symptoms rather than clinically diagnosed tobacco use disorder (American Psychiatric Association, 2013, 2022; Hasin et al., 2013).

All cases had complete data for gender, age, and source region. The sample included 497 men (75.0%) and 166 women (25.0%). Participants ranged in age from 18 to 30 years (M = 20.44, SD = 1.51). Regarding pre-university long-term residence, 275 participants (41.5%) were from urban/town areas and 388 participants (58.5%) were from rural areas.

Measures

DSM-5-based tobacco dependence symptom screening. Participants completed a self-report measure based on the 11 DSM-5 tobacco-use symptom criteria, which cover impaired control, social impairment, risky use, and pharmacological features such as tolerance and withdrawal (American Psychiatric Association, 2013, 2022; Hasin et al., 2013). Participants scoring 4 or above were retained for analysis. This variable was used only to define the analytic sample and was not treated as a focal mediator or outcome.

Childhood trauma. Childhood trauma was assessed using the Childhood Trauma Questionnaire-Short Form (CTQ-SF), a 28-item measure that assesses emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect, with additional minimization/denial validity items (Bernstein et al., 2003). Chinese-language psychometric evidence supports the use of the CTQ-SF among undergraduates and related samples (He et al., 2019; Zhao et al., 2005). Higher total scores indicated greater exposure to childhood trauma.

Self-control. Self-control was assessed using a 19-item Chinese self-control scale adapted from trait self-control research (Tangney et al., 2004; Tan & Guo, 2008). Items are typically rated on a Likert-type

response scale and summed so that higher scores indicate stronger self-regulatory capacity. In the mediation model, self-control was specified as the first mediator because it represents a proximal regulatory capacity relevant to impulse inhibition and disengagement from immediately rewarding online activities.

Aggression. Aggression was assessed using a Chinese college-student version of the Buss-Perry Aggression Questionnaire (BPAQ), which was developed from the original Aggression Questionnaire (Buss & Perry, 1992; Lv et al., 2013). Higher scores indicate greater aggressive tendency. Aggression was specified as the second mediator because it represents an externalizing behavioral tendency that may follow impaired self-control and contribute to dysregulated Internet use.

Internet addiction. Internet addiction was assessed using a self-report total score based on Young's Internet Addiction Test framework, with higher scores indicating more severe problematic Internet use (Young, 1998). Recent Chinese undergraduate evidence supports the continued psychometric evaluation and use of Young's Internet Addiction Test in Chinese university populations (Wei et al., 2025). Internet addiction was specified as the outcome variable.

Covariates. Gender and age were included as covariates in all mediation equations. Source region was described demographically but was not included as a covariate because the supplied PROCESS output included only gender and age.

Table 1

Measures, Scoring Direction, and Source References

Measure	Operationalization	Scoring direction	Main source reference(s)
DSM-5-based tobacco symptom screening	11 self-reported DSM-5 tobacco-use criteria; score >= 4 used for sample inclusion	Higher scores = more tobacco-use symptoms	American Psychiatric Association, 2013, 2022; Hasin et al., 2013
Childhood trauma	CTQ-SF total score	Higher scores = greater childhood trauma	Bernstein et al., 2003; He et al., 2019; Zhao et al., 2005
Self-control	19-item Chinese self-control scale	Higher scores = stronger self-	Tangney et al., 2004; Tan & Guo,

	total score	control	2008
Aggression	Chinese college-student BPAQ total score	Higher scores = greater aggression	Buss & Perry, 1992; Lv et al., 2013
Internet addiction	Young's Internet Addiction Test total-score framework	Higher scores = more severe problematic Internet use	Young, 1998; Wei et al., 2025

Note. Reliability coefficients for the restricted analytic sample should be reported after verifying the original dataset. The mediation results above are unchanged by this reporting table.

Statistical Analysis

All analyses were conducted using IBM SPSS Statistics and PROCESS macro version 4.1. Descriptive statistics summarized demographic characteristics. Pearson correlation coefficients examined zero-order associations among focal variables. The serial mediation model was tested using PROCESS Model 6, with childhood trauma as the independent variable, self-control as the first mediator, aggression as the second mediator, and Internet addiction as the dependent variable. Gender and age were entered as covariates. Indirect effects were evaluated using 5,000 bootstrap samples and 95% bootstrap confidence intervals, following the regression-based conditional process framework described by Hayes (2022). An indirect effect was considered statistically significant when the bootstrap confidence interval did not include zero.

Because the data were cross-sectional, the serial mediation model was interpreted as a theoretically specified indirect-effect model rather than evidence of temporal or causal ordering. The terms predict and effect are used in the statistical sense of regression modeling and do not imply causal inference. This interpretive restriction is important because cross-sectional mediation can support compatibility with a theoretical mechanism but cannot establish temporal precedence or causal process.

Results

Participant Characteristics

The final sample included 663 Chinese college students with DSM-5-based self-reported tobacco dependence symptoms at or above the study threshold. Demographic characteristics are shown in Table 2.

Table 2

Demographic Characteristics of the Sample (N = 663)

Characteristic	n	%
Gender: Male	497	75.0
Gender: Female	166	25.0
Source region: Urban/town	275	41.5
Source region: Rural	388	58.5
Age, years: M (SD)	20.44	1.51
Age range	18-30	

Note. Percentages are based on valid cases. Age was calculated from the frequency distribution supplied in the analysis output.

Zero-Order Correlations

The zero-order correlations among the focal variables were consistent with the proposed model (Table 3). Childhood trauma was positively associated with aggression and Internet addiction and negatively associated with self-control. Self-control showed a strong negative association with both aggression and Internet addiction. Aggression was positively associated with Internet addiction.

Table 3

Pearson Correlations Among Focal Study Variables

Variable	1	2	3	4
1. Childhood trauma	—			

2. Self-control	-.138**	—		
3. Aggression	.290**	-.557**	—	
4. Internet addiction	.196**	-.511**	.399**	—

Note. N = 663. ** p < .01, two-tailed.

Serial Mediation Model

The conceptual serial mediation model is presented in Figure 1. The adjusted path model is presented in Figure 2.

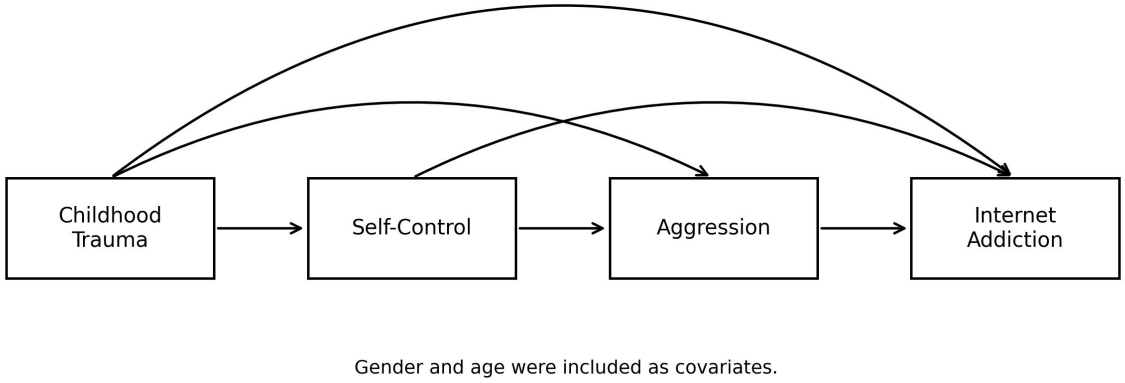

Figure 1. Conceptual serial mediation model.

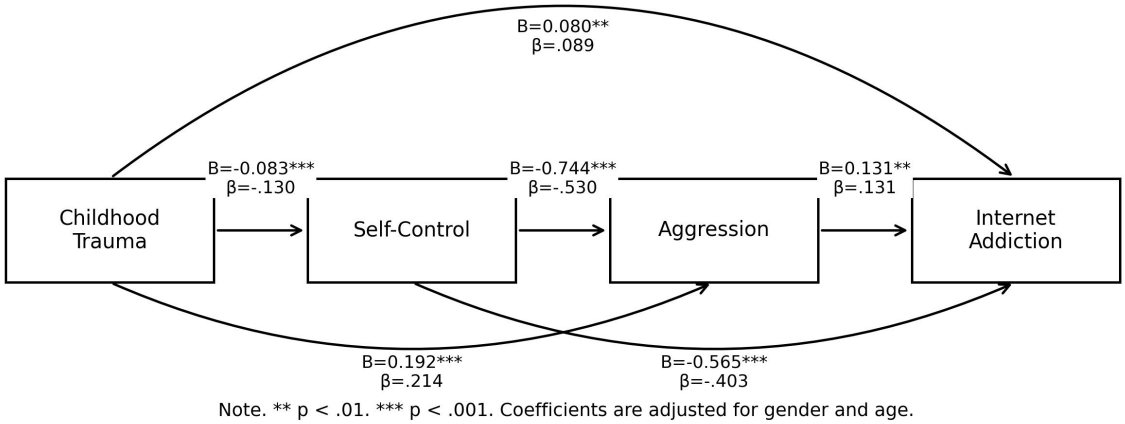

Figure 2. Adjusted path coefficients for the serial mediation model.

Table 4

Regression Results for the Serial Mediation Model

Outcome	Predictor	B	SE	t	p	95% CI	β
Self-control	Childhood trauma	-0.083	0.024	-3.434	< .001	[-0.130, -0.036]	-.130
Self-control	Gender	-4.969	0.890	-5.581	< .001	[-6.717, -3.221]	-.211
Self-control	Age	0.344	0.256	1.345	.179	[-0.159, 0.847]	.051
Aggression	Childhood trauma	0.192	0.028	6.757	< .001	[0.136, 0.248]	.214
Aggression	Self-control	-0.744	0.045	-16.374	< .001	[-0.833, -0.654]	-.530
Aggression	Gender	-0.029	1.062	-0.028	.978	[-2.114, 2.056]	-.001
Aggression	Age	0.361	0.299	1.207	.228	[-0.226, 0.948]	.038
Internet addiction	Childhood trauma	0.080	0.030	2.626	.009	[0.020, 0.140]	.089
Internet addiction	Self-control	-0.565	0.056	-10.117	< .001	[-0.675, -0.455]	-.403
Internet addiction	Aggression	0.131	0.040	3.250	.001	[0.052, 0.211]	.131
Internet addiction	Gender	4.256	1.101	3.865	< .001	[2.094, 6.418]	.129
Internet addiction	Age	0.816	0.310	2.629	.009	[0.206, 1.425]	.086

Note. Gender and age were included as covariates. B = unstandardized coefficient; β = standardized coefficient; CI = confidence interval.

Table 5

Model Summary for Regression Equations

Outcome	R	R^2	MSE	F	df	p
Self-control	.260	.068	97.726	15.902	3, 659	< .001
Aggression	.598	.358	132.769	91.626	4, 658	< .001
Internet addiction	.558	.311	142.755	59.356	5, 657	< .001

In the first regression equation, childhood trauma significantly and negatively predicted self-control. In the second equation, childhood trauma positively predicted aggression, whereas self-control negatively

predicted aggression. In the final equation, childhood trauma, self-control, and aggression all significantly predicted Internet addiction. The direct effect of childhood trauma on Internet addiction remained significant after inclusion of the mediators, indicating partial mediation.

Table 6

Direct and Indirect Effects of Childhood Trauma on Internet Addiction

Effect pathway	Effect	Boot SE	95% Boot CI	Completely standardized effect	95% Boot CI
Direct: CT -> IA	0.0799	0.0304	[0.0202, 0.1397]	0.0891	—
Total indirect effect	0.0801	0.0196	[0.0423, 0.1198]	0.0893	[0.0480, 0.1318]
CT -> SC -> IA	0.0468	0.0147	[0.0192, 0.0781]	0.0522	[0.0214, 0.0857]
CT -> AGG -> IA	0.0252	0.0099	[0.0073, 0.0459]	0.0281	[0.0081, 0.0513]
CT -> SC -> AGG -> IA	0.0081	0.0040	[0.0017, 0.0172]	0.0090	[0.0019, 0.0190]

Note. CT = childhood trauma; SC = self-control; AGG = aggression; IA = Internet addiction. Bootstrap samples = 5,000. All confidence intervals are 95% percentile bootstrap confidence intervals.

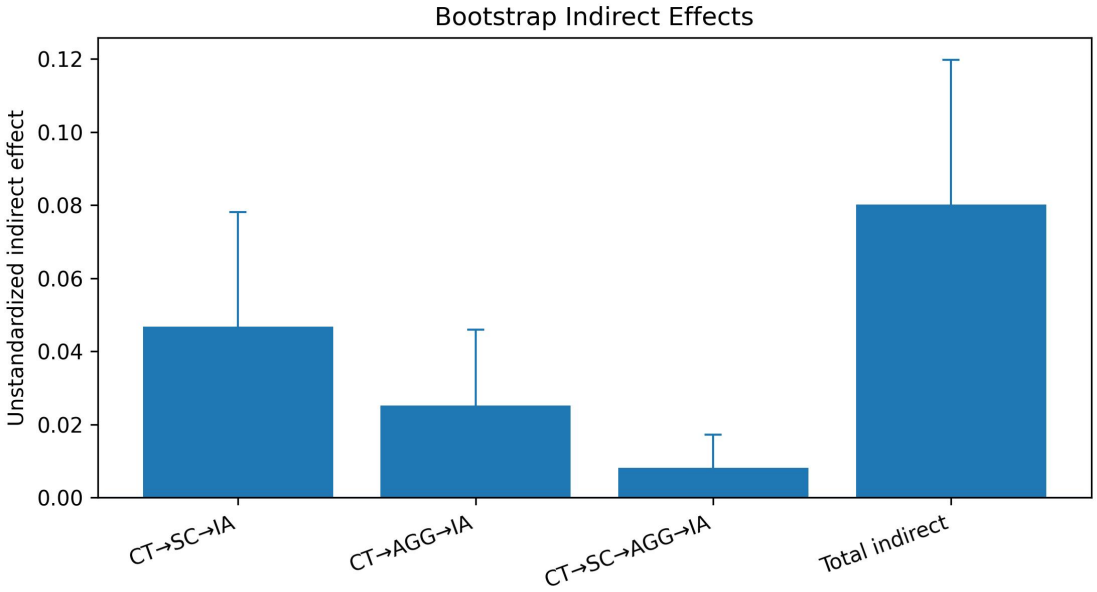

Figure 3. Bootstrap indirect effects with 95% confidence intervals.

Discussion

This study examined whether self-control and aggression explained the association between childhood trauma and Internet addiction among Chinese college students who met a DSM-5-based self-report threshold for tobacco dependence symptoms. The findings supported the proposed serial mediation model. Childhood trauma was associated with lower self-control and higher aggression, and both mediators were associated with Internet addiction. Importantly, the indirect effects through self-control alone, aggression alone, and the serial path from self-control to aggression were all statistically significant. These findings are consistent with the I-PACE model, which emphasizes the interaction of person-level vulnerability, affective-cognitive responses, and executive-control processes in addictive behaviors (Brand et al., 2019).

The most substantial indirect pathway was the path through self-control. This finding suggests that self-regulatory capacity is the central explanatory mechanism in the present model. Students reporting greater childhood trauma may have weaker capacity to inhibit impulses, delay gratification, maintain long-term goals, or disengage from immediately rewarding online activities. This interpretation aligns with trait self-control theory and evidence that self-control predicts broad adjustment outcomes (Tangney et al., 2004). It is also consistent with meta-analytic evidence showing that lower self-control is robustly associated with higher Internet addiction among students (Li et al., 2021). In the present sample, self-control was the strongest proximal correlate of Internet addiction among the focal mediators.

The aggression pathway was also significant. Childhood trauma positively predicted aggression, and aggression positively predicted Internet addiction. This result suggests that trauma-related risk may also operate through externalizing tendencies. The General Aggression Model proposes that aggressive behavior is shaped by person factors, situational inputs, affective arousal, cognition, and appraisal processes (Anderson & Bushman, 2002). Childhood trauma may contribute to anger, hostility, interpersonal conflict, and threat-oriented interpretations, whereas reduced self-control may weaken inhibition of aggressive impulses (Buss & Perry, 1992; Lv et al., 2013). Within online environments,

these tendencies may contribute to dysregulated use through conflictual communication, emotional arousal, or avoidant coping. However, the aggression pathway was weaker than the self-control pathway, so aggression should be interpreted as an additional mechanism rather than the primary explanatory route.

The serial pathway from childhood trauma to Internet addiction through self-control and aggression was statistically significant but small in magnitude. This result is theoretically informative but should not be overstated. It suggests that one route from early adversity to problematic Internet use may involve weakened self-control, followed by increased aggression, followed by greater Internet addiction symptoms. The small effect size indicates that aggression explains only part of how regulatory weakness is translated into Internet-addiction risk. A more defensible interpretation is that self-control carries most of the mediated association, whereas aggression adds a narrower externalizing channel.

The findings should also be interpreted in the context of the tobacco-symptom-defined sample. Substance-use symptoms and problematic Internet use are distinct, and DSM-5 does not classify generalized Internet addiction as a formal substance-related diagnosis (American Psychiatric Association, 2013, 2022). Nevertheless, both tobacco-use symptoms and problematic Internet use involve impaired control, repetitive reward seeking, and difficulty disengaging from harmful behavior. Studying Internet addiction within a group of students with elevated tobacco-use symptoms therefore helps clarify whether early trauma and self-regulation mechanisms remain relevant in a dependence-prone subgroup. The present results suggest that self-control is a useful intervention target in this risk context.

Several practical implications follow. First, screening for childhood trauma and self-control deficits may help identify students at risk for problematic Internet use, especially in populations with elevated tobacco-use symptoms. Second, interventions should not focus only on reducing screen time. They should also address underlying self-regulatory difficulties, emotional reactivity, hostile cognition, and adaptive coping. Third, aggression management may be useful, but the current results suggest that self-control enhancement should be prioritized as the core intervention target. Programs involving goal setting, delay

of gratification, impulse monitoring, emotion regulation, and replacement coping strategies may be especially relevant (Li et al., 2021; Tangney et al., 2004).

Several limitations should be noted. First, the cross-sectional design prevents causal inference. Although the model was specified on theoretical grounds, alternative temporal arrangements are possible; for example, Internet addiction may worsen self-control over time, and aggression may both precede and follow problematic Internet use. Longitudinal or experimental designs are needed to test temporal ordering. Second, all variables were based on self-report, which may introduce common-method bias and social desirability effects. Third, the DSM-5-based tobacco measure was used as a self-report screening threshold rather than a structured clinical diagnosis. Fourth, the sample was predominantly male, which may limit generalizability. Fifth, reliability coefficients and full scale-level descriptive statistics should be verified and reported in the final submission. Sixth, because generalized Internet addiction remains a debated construct and is not identical to Internet gaming disorder, future studies should distinguish generalized Internet addiction, social media addiction, smartphone addiction, and gaming disorder more explicitly.

In conclusion, childhood trauma was associated with Internet addiction among Chinese college students with elevated DSM-5-based tobacco-use symptoms, and this association was partially mediated by self-control and aggression. The results identify self-control as the dominant mediating pathway and aggression as a smaller but significant externalizing mechanism. The findings support a trauma-informed and self-regulation-focused account of Internet addiction in a substance-use-risk college population while requiring cautious interpretation because the data are cross-sectional and based on self-report measures.

Declarations

Informed consent: All participants provided informed consent before participating in the questionnaire survey.

Availability of data and materials: The datasets analyzed during the current study are available from the corresponding author on reasonable request, subject to institutional and ethical restrictions.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: YanBingna contributed to study conception and design. YanBingna collected the data. [Insert author initials] performed the statistical analysis. YanBingna drafted the manuscript. All authors reviewed and approved the final manuscript.

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Perceived Social Support and Internet Gaming Disorder Symptoms among Chinese College Students: The Serial Mediating Roles of Loneliness and Self-Control

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Abstract

Background: Internet gaming disorder (IGD) symptoms among college students have attracted sustained research attention, but less is known about the sequential interpersonal and self-regulatory mechanisms through which social support may relate to IGD. Drawing on the Interaction of Person-Affect-Cognition-Execution (I-PACE) model and compensatory Internet-use perspectives, this cross-sectional study examined whether loneliness and self-control serially mediated the association between perceived social support and IGD symptoms in Chinese college students. Methods: A total of 509 Chinese college students completed an online self-report questionnaire. Participants were 18 to 30 years old (M = 20.27, SD = 1.45); 360 were men (70.7%) and 149 were women (29.3%). Perceived social support, loneliness, self-control, and IGD symptoms were assessed using self-report scales; all four measures showed good to excellent internal consistency (Cronbach's alpha = .874-.952). Gender, age, and pre-college residence were entered as covariates. Serial mediation was tested using PROCESS Model 6 with 5,000 bootstrap samples. Results: Perceived social support was negatively associated with loneliness (B = -0.392, p < .001). Loneliness was negatively associated with self-control (B = -0.528, p < .001) and positively associated with IGD symptoms (B = 0.137, p < .001). Self-control was negatively associated with IGD symptoms (B = -0.135, p < .001). The direct effect of perceived social support on IGD symptoms was nonsignificant after the mediators were included (B = -0.008, p = .732). The total indirect effect was significant (Effect = -0.086, 95% bootstrap CI [-0.113, -0.060]), including the loneliness pathway and the serial pathway through loneliness and self-control. The indirect path through self-control alone was not significant. Conclusions: Lower perceived social support may be associated with higher IGD symptoms primarily through greater loneliness and, secondarily, through the sequential pathway from

loneliness to lower self-control. These findings support an interpersonal-self-regulatory account of IGD symptoms among Chinese college students. Because the data were cross-sectional and based on self-report, causal and clinical interpretations should be avoided.

Keywords: Internet gaming disorder; perceived social support; loneliness; self-control; Chinese college students; serial mediation

Introduction

Internet gaming disorder (IGD) has been described in DSM-5 Section III as a condition requiring further study and has become an important topic in behavioral addiction research. Although gaming is normative and nonpathological for many students, a subset of individuals report impaired control, persistence despite negative consequences, and functional interference related to gaming. For college students, the transition to greater autonomy, increased academic pressure, and changing social networks may create conditions in which gaming becomes a salient strategy for regulation, escape, or social compensation. Therefore, research on IGD symptoms in nonclinical college populations should focus not only on symptom severity but also on modifiable interpersonal and self-regulatory mechanisms.

The Interaction of Person-Affect-Cognition-Execution (I-PACE) model provides a useful framework for studying IGD and other specific Internet-use disorders. The model proposes that relatively stable person-level factors interact with affective and cognitive responses and executive-control processes in the development and maintenance of addictive online behaviors. Within this framework, perceived social support can be viewed as an interpersonal resource that shapes affective states such as loneliness, whereas self-control reflects an executive-regulatory capacity that may constrain or amplify excessive gaming. This framework is especially

appropriate for the present model because it links social context, subjective emotional experience, self-regulation, and behavioral symptoms in a coherent sequence.

Perceived social support refers to the degree to which individuals believe that support is available from family, friends, and significant others. Stronger perceived support is generally associated with better psychological adjustment, whereas low social support is linked to loneliness, distress, and poorer adaptation. For college students, perceived social support may be particularly important because it protects against the social disconnection that can emerge during adjustment to university life. When offline support is insufficient or perceived as unavailable, students may be more likely to rely on online activities, including gaming, to obtain stimulation, social contact, and mood regulation.

Loneliness is a subjective experience of perceived discrepancy between desired and actual social relationships. It is conceptually distinct from objective social isolation: students may be socially surrounded yet still experience loneliness when relationships do not meet their emotional or belongingness needs. Loneliness has been repeatedly linked to problematic Internet use and gaming-related problems. Compensatory Internet-use theory suggests that individuals may turn to online activities to compensate for unmet psychosocial needs; however, such compensation can become maladaptive when online engagement replaces rather than supplements offline adjustment.

Self-control is a central regulatory capacity that enables individuals to inhibit impulses, delay gratification, and act consistently with long-term goals. Lower self-control has been associated with multiple forms of maladaptive behavior, including problematic digital media use and addictive behavior. In the context of gaming, low self-control may make it harder for

students to stop playing, regulate time online, resist immediate rewards, or disengage from competitive and immersive game environments. The current model therefore places self-control closer to IGD symptoms than loneliness: loneliness may increase vulnerability, while self-control may determine whether that vulnerability translates into dysregulated gaming behavior.

The present study examined a serial mediation model in which perceived social support was expected to relate to lower IGD symptoms through lower loneliness and higher self-control. The model tested three specific indirect pathways: perceived social support -> loneliness -> IGD symptoms; perceived social support -> self-control -> IGD symptoms; and perceived social support -> loneliness -> self-control -> IGD symptoms. We hypothesized that perceived social support would be negatively associated with loneliness, loneliness would be negatively associated with self-control and positively associated with IGD symptoms, and self-control would be negatively associated with IGD symptoms.

Methods

Participants and Procedure

Participants were 509 Chinese college students recruited through an online questionnaire. The study focused on a normal college-student population rather than a clinically diagnosed sample. All participants completed the questionnaire voluntarily and provided informed consent before responding. The analytic dataset contained no missing values for the variables reported in this manuscript. The sample included 360 men (70.7%) and 149 women (29.3%). Participants ranged in age from 18 to 30 years (M = 20.27, SD = 1.45). In terms of ethnicity, 341 participants were Han Chinese (67.0%) and 168 were from ethnic minority groups (33.0%). Detailed demographic information is shown in Table 1.

Measures

Perceived social support. Perceived social support was assessed using a self-report social support scale. Higher scores indicated greater perceived availability of social support. If the exact instrument was the Multidimensional Scale of Perceived Social Support or a Chinese adaptation, replace this generic description with the validated instrument name and citation. In the present sample, the scale demonstrated excellent internal consistency (Cronbach's alpha = .952).

Loneliness. Loneliness was assessed using a self-report loneliness measure, with higher scores indicating greater subjective loneliness. If the UCLA Loneliness Scale or its Chinese adaptation was used, specify the exact version and cite the original and Chinese validation studies. In the present sample, the scale demonstrated good internal consistency (Cronbach's alpha = .875).

Self-control. Self-control was assessed using a self-report self-control scale. Higher scores indicated stronger regulatory capacity. The Self-Control Scale developed by Tangney et al. (2004) is commonly used in this area; before submission, verify whether this was the exact version used and add the Chinese validation citation. In the present sample, the scale demonstrated good internal consistency (Cronbach's alpha = .874).

Internet gaming disorder symptoms. IGD symptoms were assessed using a self-report scale designed to capture gaming-related problems. Because the present sample was nonclinical and recruited online, the outcome should be described as IGD symptoms rather than a clinical diagnosis. In the present sample, the scale demonstrated excellent internal consistency (Cronbach's alpha = .920).

Statistical Analysis

Internal consistency was evaluated using Cronbach's alpha. Descriptive statistics and Pearson correlations were first examined. The serial mediation model was tested using the PROCESS macro for SPSS, version 4.1, Model 6. Perceived social support was entered as the independent variable, loneliness as the first mediator, self-control as the second mediator, and IGD symptoms as the dependent variable. Gender, age, and pre-college residence were entered as covariates. Indirect effects were evaluated with 5,000 bootstrap samples and 95% percentile bootstrap confidence intervals. An indirect effect was considered statistically significant when its 95% bootstrap confidence interval did not include zero. Because the design was cross-sectional, the mediation model was interpreted as a statistical indirect-effect model rather than evidence of temporal or causal mediation.

Results

Demographic Characteristics

The sample consisted of 509 Chinese college students. Men accounted for 70.7% of the sample and women accounted for 29.3%. The mean age was 20.27 years (SD = 1.45). Most participants were Han Chinese (67.0%), with the remaining 33.0% representing several ethnic minority groups. Details are reported in Table 1.

Table 1

Demographic characteristics of the sample

Characteristic	Category	n	%
Gender	Male	360	70.7

	Female	149	29.3
Age	M (SD)	20.27 (1.45)	Range: 18-30
Ethnicity	Han Chinese	341	67.0
	Ethnic minority	168	33.0
	Miao	45	8.8
	Tujia	39	7.7
	Bouyei	22	4.3
	Dong	22	4.3
	Gelao	11	2.2
	Yi	8	1.6
	Other minority groups	21	4.1

Note. Other minority groups included Manchu, Mongolian, Hui, Bai, Li, Shui, Dongxiang, and Mulam participants.

Percentages are based on N = 509.

Correlations among Core Variables

All four focal measures showed good to excellent internal consistency, with Cronbach's alpha values ranging from .874 to .952. The correlation matrix supported the proposed model. Perceived social support was negatively correlated with loneliness and IGD symptoms and positively correlated with self-control. Loneliness was positively correlated with IGD symptoms and negatively correlated with self-control. Self-control was negatively correlated with IGD symptoms.

Table 2

Reliability coefficients and Pearson correlations among the focal variables

Variable	Cronbach's alpha	1	2	3	4
1. Perceived social support	.952	-			
2. Loneliness	.875	-.544**	-		
3. Self-control	.874	.263**	-.448**	-	
4. IGD symptoms	.920	-.202**	.335**	-.354**	-

Note. Cronbach's alpha values are reported in the alpha column. IGD = Internet gaming disorder. ** $p < .01$, two-tailed.

Serial Mediation Analysis

The first regression equation showed that perceived social support significantly and negatively predicted loneliness, B = -0.392, SE = 0.027, $p < .001$. The model explained 29.9% of the variance in loneliness. In the second equation, loneliness significantly and negatively predicted self-control, B = -0.528, SE = 0.059, $p < .001$, whereas the direct path from perceived social support to self-control was nonsignificant after loneliness and covariates were included, B = 0.031, $p = .466$. This model explained 22.7% of the variance in self-control. In the final equation, loneliness positively predicted IGD symptoms, B = 0.137, SE = 0.034, $p < .001$, and self-control negatively predicted IGD symptoms, B = -0.135, SE = 0.024, $p < .001$. The direct effect of perceived social support on IGD symptoms was nonsignificant after the two mediators

were entered, B = -0.008, p = .732. This model explained 16.8% of the variance in IGD symptoms. The complete regression results are presented in Table 3.

Table 3

Regression results for the serial mediation model

Outcome	Predictor	B	SE	t	p	95% CI	β
Loneliness	Perceived social support	-0.392	0.027	-14.559	< .001	[-0.445, -0.339]	-.544
	Gender	0.940	0.724	1.298	.195	[-0.483, 2.362]	.049
	Age	0.147	0.228	0.647	.518	[-0.300, 0.595]	.024
	Residence	0.029	0.048	0.609	.543	[-0.065, 0.123]	.023
Self-control	Perceived social support	0.031	0.043	0.729	.466	[-0.053, 0.115]	.034
	Loneliness	-0.528	0.059	-8.960	< .001	[-0.644, -0.412]	-.420
	Gender	-3.429	0.960	-3.572	< .001	[-5.314, -1.543]	-.141
	Age	-0.545	0.302	-1.808	.071	[-1.137, 0.047]	-.071
	Residence	-0.086	0.063	-1.353	.177	[-0.210, 0.039]	-.053
IGD symptoms	Perceived social support	-0.008	0.023	-0.342	.732	[-0.053, 0.037]	-.017
	Loneliness	0.137	0.034	3.991	< .001	[0.070, 0.204]	.209
	Self-control	-0.135	0.024	-5.581	< .001	[-0.182, -0.087]	-.259
	Gender	-0.364	0.525	-0.692	.489	[-1.396, 0.668]	-.029
	Age	0.172	0.164	1.053	.293	[-0.149, 0.493]	.043
	Residence	-0.022	0.034	-0.644	.520	[-0.089, 0.045]	-.026

Note. N = 509. IGD = Internet gaming disorder. Residence refers to pre-college residence. Gender, age, and residence were entered as covariates.

Table 4

Model summary for each regression equation

Outcome	R	R^2	MSE	F	df	p
Loneliness	.547	.299	54.844	53.803	4, 504	< .001
Self-control	.477	.227	96.048	29.573	5, 503	< .001

IGD symptoms	.410	.168	28.058	16.892	6, 502	< .001

Note. All regression equations were statistically significant.

Table 5

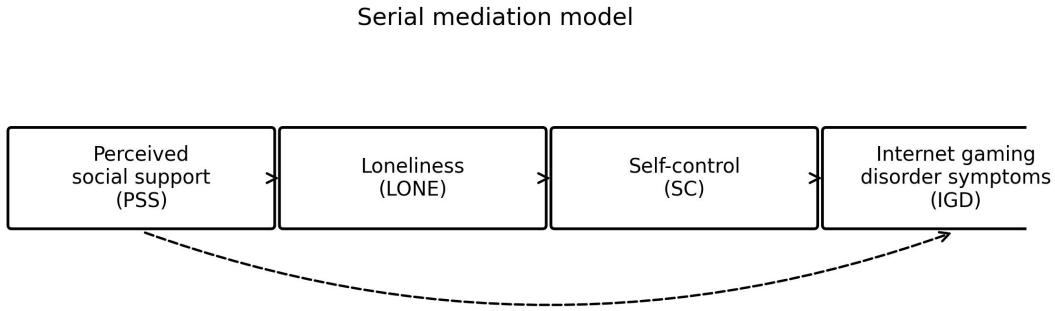
Direct and indirect effects of perceived social support on IGD symptoms

Effect path	Effect	Boot SE	95% Boot CI	Completely standardized effect	95% Boot CI
Direct effect: PSS -> IGD	-0.008	0.023	[-0.053, 0.037]	-.017	-
Total indirect effect	-0.086	0.014	[-0.113, -0.060]	-.182	[-.237, -.127]
PSS -> Loneliness -> IGD	-0.054	0.013	[-0.080, -0.028]	-.114	[-.169, -.059]
PSS -> Self-control -> IGD	-0.004	0.006	[-0.017, 0.007]	-.009	[-.035, .014]
PSS -> Loneliness -> Self-control -> IGD	-0.028	0.006	[-0.041, -0.016]	-.059	[-.087, -.035]

Note. Bootstrap samples = 5,000. CI = confidence interval. Indirect effects were significant when the 95% bootstrap confidence interval did not include zero.

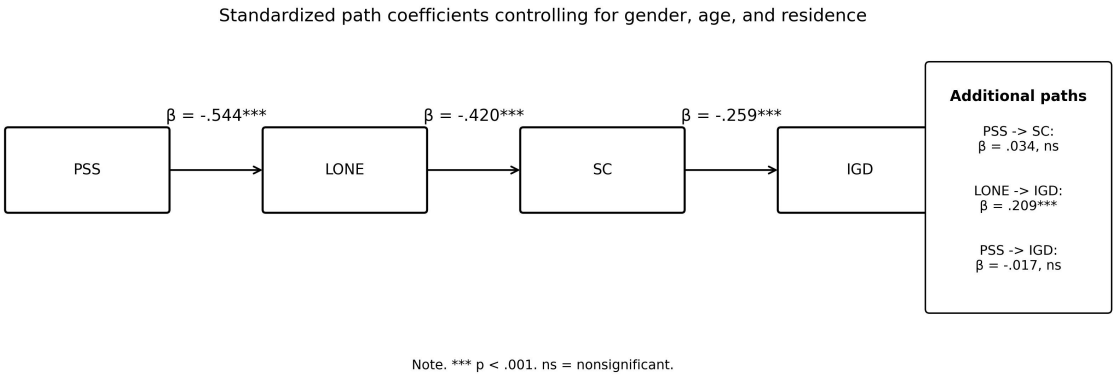
Bootstrap results showed that the total indirect effect of perceived social support on IGD symptoms was significant, Effect = -0.086, Boot SE = 0.014, 95% Boot CI [-0.113, -0.060]. Two specific indirect effects were significant. First, perceived social support was indirectly associated with lower IGD symptoms through lower loneliness, Effect = -0.054, 95% Boot CI [-0.080, -0.028]. Second, the serial indirect pathway through loneliness and self-control was significant, Effect = -0.028, 95% Boot CI [-0.041, -0.016]. The indirect path through self-control alone was not significant, Effect = -0.004, 95% Boot CI [-0.017, 0.007].

Figure 1. Conceptual serial mediation model.



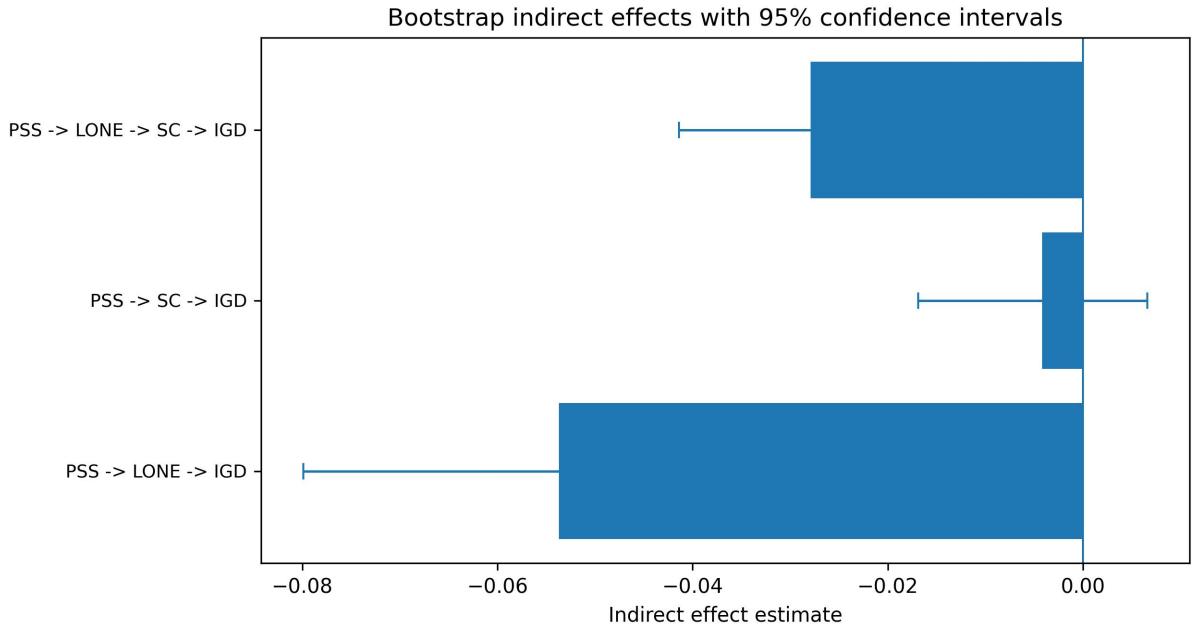
Note. PSS = perceived social support; LONE = loneliness; SC = self-control; IGD = Internet gaming disorder symptoms.

Figure 2. Standardized path coefficients in the final mediation model.



Note. Additional direct paths are displayed in the coefficient panel. Gender, age, and residence were controlled but are not displayed.

Figure 3. Bootstrap indirect effects and 95% confidence intervals.



Note. Confidence intervals crossing zero indicate nonsignificant indirect effects.

Discussion

This study examined whether loneliness and self-control serially mediated the association between perceived social support and IGD symptoms among Chinese college students. The results supported the main interpersonal-self-regulatory pathway. Higher perceived social support was associated with lower loneliness, loneliness was associated with lower self-control and higher IGD symptoms, and self-control was associated with lower IGD symptoms. The direct effect of perceived social support on IGD symptoms was nonsignificant after loneliness and self-control were included, whereas the total indirect effect and two specific indirect effects were significant.

The strongest indirect pathway was the loneliness pathway. Students reporting lower perceived social support tended to report greater loneliness, which in turn was associated with more severe IGD symptoms. This finding is consistent with the view that IGD-related behaviors can serve compensatory functions when offline interpersonal needs are not sufficiently met. Gaming environments may provide rapid access to social interaction, achievement, identity expression, and emotional escape. These short-term rewards may be particularly attractive to lonely students, even when gaming becomes excessive or interferes with academic and daily functioning.

The significant serial pathway further suggests that loneliness may be linked to IGD symptoms partly because it undermines self-control. Loneliness is not merely a social state; it can involve negative affect, attentional bias toward social threat, rumination, and reduced motivation for effortful regulation. Under these conditions, students may find it more difficult to resist immediate gaming rewards or disengage from online gaming contexts. This interpretation is compatible with the I-PACE model, which highlights the interaction of affective responses and executive-control processes in addictive online behaviors.

The nonsignificant indirect pathway through self-control alone is theoretically important. Perceived social support did not directly predict self-control once loneliness was included. This pattern suggests that social support may not translate into self-regulatory capacity automatically; rather, its relevance for self-control may depend on whether support reduces loneliness or improves emotional connectedness. In other words, social support may protect against IGD symptoms less by directly increasing self-discipline and more by reducing loneliness, which then supports better self-regulation.

The findings have practical implications for college mental-health work. Interventions for IGD symptoms should not focus only on reducing gaming time or strengthening individual willpower. For students with low perceived social support, interventions may need to address loneliness, belongingness, and offline relationship quality. Programs that combine social connectedness training, peer support, and self-control strategies may be more effective than approaches targeting gaming behavior alone. At the same time, because this study was cross-sectional, intervention implications should be tested in longitudinal or experimental designs before strong practical claims are made.

Several limitations should be noted. First, the cross-sectional design prevents causal inference. Although the tested order is theoretically grounded, alternative models are possible; for example, IGD symptoms may increase loneliness or reduce perceived social support over time. Second, all measures were self-reported, which may introduce common-method bias and response-style effects. Third, the sample was recruited online and had a relatively high proportion of male students; this may limit generalizability. Fourth, the present manuscript is based on scale-level outputs provided for analysis. The final submission should include exact scale names, Chinese versions, item numbers, response anchors, scoring procedures. Finally, IGD symptoms were assessed as self-reported symptom severity in a normal college population; the findings should not be interpreted as evidence about clinically diagnosed gaming disorder.

Despite these limitations, the study provides a coherent model linking interpersonal resources to IGD symptoms through loneliness and self-control. The results suggest that loneliness is the central psychological bridge between low perceived social support and IGD symptoms, while self-control further explains part of this association. The findings add to the

literature by integrating social support, loneliness, and executive self-regulation within a serial mediation framework among Chinese college students.

Conclusion

Among Chinese college students, lower perceived social support was associated with higher IGD symptoms through greater loneliness and the serial pathway from loneliness to lower self-control. The findings support an interpersonal-self-regulatory explanation of IGD symptoms and suggest that loneliness may be a key target for future prevention and intervention research.

Declarations

Informed Consent

All participants provided informed consent before completing the online questionnaire.

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Conflict of Interest

The author(s) declare no conflict of interest.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request, subject to ethical and privacy restrictions.

Authors' Contributions

Qingqing Yang contribution statement according to the target journal requirements. For example: Conceptualization, data curation, formal analysis, methodology, writing-original draft, and writing-review and editing.

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Generative Artificial Intelligence and Student Agency: Reclaiming Questioning, Knowledge Construction, and Responsibility in Education

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Abstract

Generative artificial intelligence (GenAI) has rapidly entered educational practice as a tool for explanation, drafting, feedback, assessment support, and personalized learning assistance. Much of the early debate has focused on whether GenAI improves efficiency or threatens academic integrity. This article argues that the deeper educational question is whether GenAI use preserves or erodes student agency. From an educational perspective, agency is not reducible to student choice, motivation, or technical competence; it refers to learners' capacity to pose meaningful questions, construct knowledge through disciplined inquiry, regulate their own learning, exercise judgment, and assume responsibility for their intellectual work. Drawing on educational theory, self-regulated learning, knowledge-building pedagogy, cognitive offloading, and recent research on AI-assisted learning, this article develops a conceptual account of how GenAI may both support and weaken student agency. It identifies three core risks: the displacement of question-formation by prompt optimization, the substitution of fluent AI output for knowledge construction, and the diffusion of responsibility in authorship and judgment. The article then proposes an agency-preserving pedagogy of GenAI use built around six principles: problem-posing before prompting, process transparency, critical verification, scaffolded rather than substitutive assistance, assessment redesign, and teacher-guided ethical reflection. The central claim is that GenAI should not be treated as either a threat to be banned or an efficiency tool to be adopted uncritically. Its educational value depends on whether it is embedded in learning environments that strengthen students' epistemic, metacognitive, dialogic, and responsible agency.

Keywords: generative artificial intelligence, student agency, student subjectivity, knowledge construction, AI literacy, educational technology

Introduction

Generative artificial intelligence has changed the conditions under which students read, write, search, summarize, translate, solve problems, and receive feedback. Unlike earlier digital tools that primarily stored, transmitted, or organized information, GenAI systems can produce coherent text, simulate dialogue, generate examples, revise drafts, and respond adaptively to user prompts. For educators, this creates a genuine instructional opportunity. Students can receive immediate explanations, compare alternative answers, practice argumentation, and overcome some barriers associated with blank-page anxiety or unequal access to tutoring. Recent education guidance therefore treats AI literacy and responsible use as emerging competencies rather than marginal technical skills (UNESCO, 2023, 2024a, 2024b).

Yet educational technologies rarely enter schools and universities as neutral instruments. They reorganize attention, redefine effort, reshape assessment, and alter the relation between learners, teachers, knowledge, and institutions. The question is therefore not simply whether GenAI can improve learning efficiency. It clearly can, under some conditions. The more fundamental question is what kind of learner is being formed when students learn with systems that can answer before they have fully questioned, compose before they have fully reasoned, and polish before they have fully struggled with meaning.

This article argues that the central educational issue raised by GenAI is student agency. The term agency is often used loosely to mean autonomy, freedom of choice, or active participation. In a stronger educational sense, however, student agency involves the capacity to define problems, pursue inquiry, regulate learning strategies, evaluate evidence, revise understanding, and take responsibility for judgments and actions (Bandura, 2001; Emirbayer & Mische, 1998; Zimmerman, 2002). Education is not merely the transfer of correct answers. It is the formation of

persons capable of asking better questions, participating in shared knowledge practices, and acting with judgment in uncertain situations (Biesta, 2015, 2017; Dewey, 1938).

The current debate often moves between two inadequate positions. One position treats GenAI as a productivity accelerator and assumes that faster writing, quicker feedback, and personalized explanations are educational goods in themselves. The other position treats GenAI mainly as a threat to academic integrity and responds by banning or policing its use. Both positions capture part of the truth but miss the deeper pedagogical problem. The value of GenAI depends less on the tool itself than on the educational relations and tasks within which it is used. A student who uses GenAI to interrogate assumptions, test counterarguments, and revise a self-generated explanation may become more agentic. A student who uses the same tool to bypass question formation, outsource reasoning, and submit polished but unexamined text may become less agentic.

The purpose of this theoretical article is to develop a framework for understanding and preserving student agency in GenAI-mediated education. The article first clarifies the meaning of student agency from an educational perspective. It then analyzes the affordances of GenAI as a learning support and the mechanisms through which agency may be weakened. Finally, it proposes a pedagogy of agency-preserving GenAI use, with implications for curriculum, assessment, teacher practice, and institutional norms. The argument is deliberately educational: the concern is not any external agenda, but the preservation of the learner as a questioning, meaning-making, responsible subject.

From Tool Adoption to Educational Subjectivity

Educational debates about technology often begin with adoption. Institutions ask which tools should be allowed, which platforms should be purchased, and which policies should

regulate use. These questions are necessary but insufficient. An educational perspective begins with a different question: What forms of learning and personhood does a technology make easier, and what forms does it make harder? This question moves beyond technological determinism. GenAI does not automatically improve or damage education. It becomes educationally significant through the practices, norms, assessments, and relationships into which it is inserted (Fawns, 2022; Selwyn, 2019).

Student subjectivity refers to the learner's position as a person who does not merely receive instruction but participates in the formation of meaning. In classical educational theory, the student is not a passive container of information. Dewey (1916, 1938) argued that learning emerges through experience, inquiry, and reflective reconstruction. Vygotsky (1978) emphasized that cognitive development occurs through mediated activity and social interaction. Freire (1970) criticized educational models that reduce learners to recipients of deposited knowledge. Although these traditions differ, they share a basic premise: education becomes genuine when learners participate in meaning-making rather than merely consuming answers.

GenAI challenges this premise because it can produce the appearance of meaning-making without requiring the learner to undertake the corresponding intellectual work. A generated essay may display coherence without personal understanding. A generated explanation may sound plausible without being critically examined. A generated research question may be grammatically elegant but disconnected from the learner's own puzzlement. The danger is not simply cheating. The deeper danger is a split between performance and formation: students may learn to produce artifacts that resemble learning while the capacities that education is supposed to cultivate remain underdeveloped.

This distinction matters because educational success should not be defined solely by output quality. If a tool enables students to submit cleaner prose but reduces their ability to generate questions, tolerate uncertainty, evaluate evidence, and revise their thinking, then the tool has improved performance while weakening education. Conversely, if GenAI is used to make reasoning visible, stimulate comparison, invite critique, and support revision, it can become a scaffold for deeper learning. The same technology can either externalize thinking in a productive way or replace thinking in a harmful way. The pedagogical issue is therefore not whether GenAI is present, but how agency is distributed between student, teacher, technology, and task.

Conceptualizing Student Agency in GenAI-Mediated Learning

Student agency is a multidimensional educational construct. It includes motivation and choice, but it cannot be reduced to either. A student may choose to use a tool frequently and still be unagentic if the tool determines the direction, substance, and evaluation of the work. Conversely, a student may work within clear instructional constraints and still be highly agentic if those constraints require independent judgment, self-regulation, and responsibility. Agency is not the absence of guidance; it is the capacity to act meaningfully within mediated conditions (Bandura, 2001; Emirbayer & Mische, 1998).

Four dimensions of agency are especially relevant to GenAI-mediated education. The first is epistemic agency: the capacity to ask questions, identify gaps in understanding, seek evidence, distinguish warranted claims from plausible assertions, and contribute to knowledge construction (Bereiter, 2002; Scardamalia & Bereiter, 2006). The second is metacognitive agency: the capacity to monitor one's own understanding, select strategies, evaluate progress, and adjust effort (Winne & Hadwin, 1998; Zimmerman, 2002). The third is dialogic agency: the capacity to participate in conversation with teachers, peers, texts, and tools in ways that extend rather than

close inquiry. The fourth is responsible agency: the capacity to own one's intellectual decisions, disclose assistance appropriately, and remain accountable for claims made in one's work.

These dimensions clarify why GenAI use can be educationally ambiguous. A student who asks GenAI to produce an answer may show technical skill in prompt writing but little epistemic agency if the student has not formulated the problem or evaluated the response. A student who asks GenAI to challenge a draft argument, identify missing evidence, or simulate opposing viewpoints may strengthen agency because the tool becomes part of a reflective inquiry cycle. The difference lies not in the presence of AI assistance but in whether the student remains the author of the question, the judge of the evidence, and the responsible owner of the final claim.

This account also avoids a romantic view of unaided learning. Human learning has always been mediated by tools, language, books, teachers, peers, diagrams, calculators, and institutional routines. The relevant contrast is not between pure human cognition and contaminated technological cognition. Salomon et al. (1991) and Perkins (1993) showed that intelligent activity is often distributed across persons and artifacts. The problem is not cognitive distribution itself. The problem emerges when distribution becomes displacement: when tools no longer extend the learner's capacity but substitute for the learner's participation in inquiry, judgment, and responsibility.

Table 1

Distinguishing AI-Enhanced Efficiency From Agency-Preserving Learning

Dimension	AI-enhanced efficiency	Agency-preserving learning
Question formation	The tool generates topics, questions, and directions for the learner.	The learner first articulates problems, uncertainties, and purposes before using AI as a conversational support.
Knowledge construction	The tool produces summaries, explanations, or essays that are accepted as outputs.	AI outputs are treated as provisional materials to be compared, verified, challenged, and revised.
Metacognition	The learner uses AI to reduce effort without monitoring understanding.	The learner uses AI to identify gaps, test comprehension, and plan next steps.
Authorship	Responsibility for claims becomes ambiguous because the output appears ready-made.	The learner records how AI was used and remains accountable for final judgments.
Teacher role	The teacher becomes a detector of misuse or manager of platform access.	The teacher designs tasks, scaffolds judgment, and cultivates responsible inquiry.

The Educational Affordances of Generative AI

A critical account of GenAI should not deny its educational affordances. Several features make it potentially valuable for learning. First, GenAI can provide immediate explanatory support. Students who are hesitant to ask questions in class may use conversational systems to

request clarification, examples, analogies, or alternative explanations. This can lower the threshold for participation and support learners who need repeated explanation. Second, GenAI can support formative feedback. It can respond to drafts, identify structural weaknesses, suggest counterarguments, and help students compare different ways of explaining an idea. Feedback is one of the most powerful influences on learning when it clarifies goals, current performance, and next steps (Hattie & Timperley, 2007; Nicol & Macfarlane-Dick, 2006).

Third, GenAI can support differentiation. Students vary in background knowledge, language proficiency, pace, and confidence. Adaptive explanation and low-stakes practice can help some learners enter tasks that would otherwise feel inaccessible. Fourth, GenAI can function as a simulation partner. Students can ask it to play the role of a critic, interviewer, historical figure, patient, client, or peer reviewer. Such uses may expand opportunities for rehearsal, argumentation, and perspective-taking. Fifth, GenAI can help teachers design examples, generate practice materials, and anticipate misconceptions. These teacher-facing affordances are important because the quality of student agency depends partly on the quality of task design and feedback structures.

However, affordances are not outcomes. The existence of a possible educational use does not guarantee educational value. The same capacity that provides immediate explanation can encourage premature closure. The same drafting capacity that helps students overcome a blank page can make it easier to avoid struggling with structure, evidence, and voice. The same personalization that supports access can also narrow learning if students receive frictionless explanations without exposure to disagreement, difficulty, or collective inquiry. Educational value requires pedagogical mediation.

Research on AI in higher education has repeatedly warned that technology-centered approaches often underrepresent pedagogical theory and educator judgment. Zawacki-Richter et al. (2019) found that research on AI applications in higher education had limited critical reflection on risks and weak connections to educational theory. More recent work on AI assistance and student agency has similarly shown that the impact of AI cannot be evaluated only by task performance; it must also be examined in relation to learners' control, self-regulation, and engagement with feedback (Darvishi et al., 2024). This is why the central question is not whether GenAI can help students produce better work, but whether it helps them become better learners.

Three Mechanisms Through Which GenAI May Erode Student Agency

The risks of GenAI are often framed around plagiarism, hallucination, data privacy, or bias. These risks are real and deserve attention (Bender et al., 2021; Floridi & Cowls, 2019; UNESCO, 2023). Yet from an educational perspective, the most serious risks are formative. They concern the kinds of habits and dispositions that repeated tool use may cultivate. Three mechanisms are especially important: the weakening of question formation, the substitution of fluent output for knowledge construction, and the diffusion of responsibility.

The first mechanism is the erosion of question formation. Good learning begins not with answers but with problems. Deweyan inquiry starts from doubt, disturbance, or felt difficulty; knowledge grows through attempts to define and resolve problematic situations (Dewey, 1938). GenAI can invert this sequence. Because students can obtain polished responses quickly, they may come to treat learning as the optimization of prompts rather than the development of questions. Prompting is not the same as questioning. A prompt can be an instruction to the machine; an educational question is an expression of intellectual need, uncertainty, and direction.

When students ask AI to propose research questions before they have encountered a real problem, the learner's own puzzlement may be bypassed.

This does not mean prompt design is trivial. Well-designed prompts can be intellectually demanding. The issue is whether prompt design is grounded in prior inquiry. A student who asks, "What are three weaknesses in my explanation of cognitive load theory?" has already taken a position that can be examined. A student who asks, "Write an essay about cognitive load theory" may receive a complete answer without entering the problem space. The difference is not technical; it is pedagogical. Agency-preserving GenAI use requires students to formulate initial questions, assumptions, and provisional claims before seeking AI assistance.

The second mechanism is the substitution of fluent output for knowledge construction. GenAI systems are powerful producers of plausible language. This creates what may be called a fluency illusion: the appearance of understanding generated by smooth, coherent text. Students may mistake readability for validity, coverage for comprehension, and polish for thought. Research on cognitive offloading shows that people frequently use external tools to reduce cognitive demands (Risko & Gilbert, 2016). Offloading is not inherently harmful; writing notes, drawing diagrams, and using calculators can all support learning. But offloading becomes educationally risky when the learner no longer engages in the core cognitive operations the task was designed to develop.

The problem is intensified in writing. Academic writing is not merely a vehicle for reporting completed thought; it is a method of thinking. Students clarify ideas by organizing paragraphs, searching for evidence, revising claims, and confronting contradictions. If GenAI produces structure, wording, and transitions before students have wrestled with these tasks, writing may become a performance artifact rather than a process of understanding. The

educational loss is not only that the student did less work. It is that the student lost the opportunity to form judgment through work.

The third mechanism is the diffusion of responsibility. GenAI complicates authorship. Students may integrate machine-generated phrases, arguments, examples, and citations into their work. Even when no explicit plagiarism occurs, responsibility can become unclear. Who is accountable for a false claim? Who decided that an argument was valid? Who selected the evidence? Responsible agency requires that students stand behind the claims they submit. This does not prohibit assistance. Scholars routinely use dictionaries, editors, peers, databases, and software. The difference is that GenAI can contribute not only language but also reasoning-like structures. Therefore, responsible use requires explicit reflection on how the tool shaped the work and where the learner exercised judgment.

These three mechanisms are mutually reinforcing. If students do not form their own questions, they are more likely to accept AI-generated structures. If they accept generated structures, they are less likely to examine evidence. If they do not examine evidence, responsibility for the final claim becomes thin. Over time, learning may shift from inquiry to curation, from construction to selection, and from responsibility to compliance. This is the central agency risk.

The Paradox of Personalization

Personalization is one of the most attractive promises of AI in education. GenAI can adapt explanations to a student's level, produce examples in familiar domains, translate complex material, and offer unlimited practice. These functions can support access and reduce frustration. However, personalization also contains a paradox. If personalization means that learning environments respond to students in ways that support their growth, it can enhance agency. If

personalization means that systems continuously remove difficulty, ambiguity, and friction, it can weaken agency.

Learning requires an appropriate relation between support and struggle. Cognitive load theory reminds educators that unnecessary load can overwhelm learners, especially novices (Sweller, 1988). At the same time, research on guided instruction cautions against assuming that learners benefit from being left entirely to discover complex knowledge without support (Kirschner et al., 2006). The issue is not whether support is good or bad. The issue is whether support is calibrated and gradually withdrawn. A scaffold is educational when it enables learners to do what they could not yet do alone and then fades as competence develops. A substitute is anti-educational when it permanently performs the learner's task.

GenAI personalization easily slides from scaffold to substitute because the tool can keep assisting without natural limits. A human teacher can observe hesitation, press for explanation, ask why, and decide when to withdraw support. AI assistance, unless deliberately designed and pedagogically constrained, may continue to provide answers whenever requested. Students may therefore develop dependence not because they lack ability, but because the learning environment rewards immediate completion more than disciplined independence.

This paradox suggests that agency-preserving education must distinguish between access, assistance, and autonomy. Access means students are not excluded from learning because of language, prior knowledge, disability, or resource gaps. Assistance means they receive support that makes participation possible. Autonomy means they increasingly internalize strategies and judgments. GenAI can contribute to all three, but only if tasks require students to move beyond received output toward explanation, verification, transfer, and self-assessment.

Toward an Agency-Preserving Pedagogy of Generative AI

If GenAI can both support and erode agency, the educational response should not be prohibition alone or adoption alone. The more defensible response is pedagogical design. An agency-preserving pedagogy treats GenAI as a scaffold, interlocutor, and object of critique rather than as a substitute author or automatic authority. Six principles are proposed.

First, problem-posing should precede prompting. Before students use GenAI, they should articulate their own question, confusion, hypothesis, or position. In writing tasks, this may mean submitting a research problem and initial claim before AI consultation. In problem-solving tasks, it may mean predicting a solution strategy before requesting hints. In reading tasks, it may mean identifying unclear concepts before asking for explanation. This principle preserves the learner's ownership of the inquiry. GenAI then responds to a student-initiated problem rather than replacing the problem with a generated task.

Second, AI use should be process-transparent. Students should document when, why, and how they used GenAI. This need not become a bureaucratic burden. A short AI-use log can ask: What did I ask? What did the tool provide? What did I accept, reject, or revise? What evidence did I use to verify the output? Such documentation supports metacognition and responsible agency. It also shifts academic integrity from a purely punitive concern to a learning practice.

Third, students should learn critical verification. GenAI outputs should be treated as claims, not answers. Students should compare outputs with course readings, empirical evidence, peer discussion, and teacher feedback. This is especially important because large language models can generate inaccurate or fabricated information while maintaining confident style (Bender et al., 2021; Kasneci et al., 2023). Verification tasks can include source checking, argument mapping,

error analysis, and comparison of multiple AI-generated responses. The goal is not to teach students distrust for its own sake, but to cultivate judgment.

Fourth, AI assistance should be scaffolded and faded. In early stages, students may use GenAI for vocabulary clarification, example generation, or low-stakes practice. As competence develops, tasks should require more independent planning, drafting, and justification. Teachers can create staged assignments in which AI is permitted for some phases and restricted in others. For example, AI may be used to critique a student's outline but not to write the first draft; or it may be used after an initial in-class attempt, not before. The sequencing matters. Agency grows when learners experience assistance as a means to independence.

Fifth, assessment should move from product-only evaluation to process-and-judgment evaluation. If grades focus only on final polished outputs, GenAI will predictably be used to optimize products. Assessment should therefore include oral defense, draft histories, reflective memos, annotated bibliographies, in-class synthesis, peer discussion, and explanation of revisions. These practices do not eliminate AI use. They make visible the learner's understanding, decisions, and responsibility. Assessment should ask not only "What did the student submit?" but also "How did the student inquire, judge, revise, and justify?"

Sixth, GenAI should become an object of inquiry, not only a learning aid. Students should examine how AI responses are generated, why outputs may be biased or incomplete, and how design choices influence knowledge practices. This aligns with emerging AI competency frameworks that emphasize responsible use, human judgment, and critical understanding rather than mere operational skill (UNESCO, 2024a, 2024b). When students study the tool itself, they are less likely to treat it as an invisible authority. They learn to see AI as a fallible participant in a broader ecology of knowledge.

Table 2

Agency Risks and Pedagogical Responses in GenAI-Supported Learning

Agency risk	Typical classroom manifestation	Pedagogical response
Question displacement	Students ask AI to generate topics or thesis statements before identifying their own problem.	Require a pre-AI problem statement, hypothesis, or question memo.
Fluency illusion	Students accept coherent AI text as evidence of understanding.	Use verification tasks, error analysis, and comparison with course sources.
Cognitive over-offloading	Students use AI to plan, draft, explain, and revise without doing the core intellectual work.	Sequence AI access after initial independent attempts and fade support across tasks.
Responsibility diffusion	Students cannot explain why claims are included or how AI shaped the final work.	Require AI-use logs, reflective memos, and oral defense of key claims.
Assessment distortion	Grades reward polished products more than inquiry and judgment.	Assess process, reasoning, revision history, and transfer across contexts.
Teacher role reduction	Teachers become primarily detectors of AI misuse.	Position teachers as designers of inquiry, feedback, and ethical judgment.

The Teacher's Role: From Detection to Pedagogical Judgment

The rise of GenAI has placed teachers in a difficult position. They are expected to prevent misuse, redesign assessment, teach AI literacy, support learning, and maintain fairness, often without sufficient time or institutional support. A narrow response turns teachers into detectors of misconduct. This role is educationally inadequate. Detection may be necessary in some contexts, but it cannot be the foundation of a GenAI pedagogy.

An agency-preserving approach positions teachers as designers of conditions for judgment. Teachers decide which tasks require unaided effort, which tasks benefit from AI-supported exploration, and which tasks should explicitly analyze AI output. They help students understand when assistance is appropriate, how to verify claims, and why responsibility cannot be delegated to a tool. They also maintain the human dimensions of education that AI cannot replace: interpreting students' developing understanding, responding to emotional and social contexts, modeling intellectual humility, and inviting learners into communities of inquiry.

This teacher role is consistent with the broader tradition of scaffolding. In Vygotskian terms, learning occurs through mediated participation in activities that learners gradually appropriate (Vygotsky, 1978). In cognitive apprenticeship, expert processes are modeled, coached, and gradually transferred to learners (Collins et al., 1989). GenAI can participate in this ecology, but it cannot replace pedagogical judgment. The teacher must decide how AI assistance is related to the educational purpose of the task. Without this judgment, AI use is likely to be governed by convenience rather than formation.

Teachers also need institutional protection from contradictory expectations. Institutions cannot simultaneously demand strict prohibition, encourage innovation, maintain traditional assessment unchanged, and provide no time for redesign. Faculty development should therefore

move beyond tool demonstrations. Teachers need support in designing AI-integrated assignments, evaluating process evidence, discussing academic integrity constructively, and addressing uneven student access. The goal is not to make every teacher a technical expert. It is to support teachers as educational professionals capable of making defensible judgments about when, how, and why GenAI should be used.

Assessment Redesign and the Recovery of Responsibility

Assessment is where the tension between efficiency and agency becomes most visible. When assessment rewards final products that can be generated or heavily improved by AI, students have strong incentives to outsource. This does not mean that all traditional writing assignments are obsolete. It means that product-only assessment is no longer sufficient as evidence of learning. The educational response should be to recover responsibility by making thinking processes more visible.

Several assessment practices are useful. First, staged assignments can require students to submit research questions, annotated sources, outlines, draft excerpts, peer feedback, AI-use logs, and final reflections. Second, oral or written defenses can ask students to explain why they made specific choices. Third, in-class writing or problem-solving can provide evidence of unaided competence. Fourth, revision-based assessment can reward the quality of improvement rather than only the quality of final prose. Fifth, comparative analysis tasks can ask students to critique AI-generated responses using course concepts. These practices do not merely police AI. They create conditions in which students must demonstrate agency.

Assessment redesign also requires clearer distinctions among assistance, collaboration, and authorship. Students should know whether AI may be used for brainstorming, grammar correction, feedback, coding support, translation, source discovery, or drafting. These categories

should not be treated as morally identical. For example, using AI to generate possible counterarguments for critique differs from submitting AI-generated analysis as one's own reasoning. A mature academic integrity framework should specify permitted, limited, and prohibited uses in relation to the learning outcomes of each task.

The principle is simple: the closer AI assistance comes to performing the central learning outcome, the stronger the need for transparency, restriction, or redesign. If the outcome is grammar accuracy, AI proofreading may perform the outcome. If the outcome is conceptual argumentation, AI-generated argument structures may perform the outcome. If the outcome is critical evaluation of AI, then AI output becomes appropriate evidence for analysis. The same tool use can therefore be acceptable in one task and unacceptable in another. This is not inconsistency; it is alignment between means and educational purpose.

Curriculum Implications: AI Literacy as Educational Formation

AI literacy is often interpreted as knowing how to use tools effectively. That interpretation is too narrow. In an agency-preserving curriculum, AI literacy includes technical, epistemic, ethical, and metacognitive dimensions. Students should understand what GenAI can do, but also how it can mislead; how to prompt, but also when not to prompt; how to use assistance, but also how to remain responsible for judgment.

A curriculum for student agency should include at least four components. The first is functional understanding: students learn the basic capacities and limitations of GenAI systems, including their dependence on training data and probabilistic text generation. The second is epistemic evaluation: students learn to verify claims, identify unsupported assertions, compare sources, and recognize the difference between plausible language and justified knowledge. The third is metacognitive regulation: students learn to decide when AI use supports their learning

and when it reduces necessary struggle. The fourth is ethical responsibility: students learn norms of disclosure, authorship, fairness, and respect for others' intellectual labor.

These components should not be isolated in a single technology module. They should be integrated across disciplines. In writing courses, students can critique AI-generated essays for evidence and voice. In science courses, they can test AI explanations against empirical models. In teacher education, they can design lessons that use AI as a scaffold while protecting student reasoning. In humanities courses, they can examine how language, authorship, and interpretation change when texts are machine-generated. The aim is to form learners who can use AI without surrendering inquiry.

This approach also avoids a simplistic digital native assumption. Students may use AI frequently without understanding it critically. Familiarity is not literacy. A student can be skilled at generating outputs and weak at evaluating them. Therefore, AI literacy must be linked to the broader educational goals of critical thinking, self-regulated learning, disciplinary reasoning, and responsible participation in knowledge communities.

Equity, Access, and the Uneven Distribution of Agency

Although this article avoids a policy-centered argument, equity remains educationally relevant. GenAI may reduce some learning barriers while intensifying others. Students with limited access to tutoring, language support, or academic feedback may benefit substantially from AI assistance. At the same time, students with stronger prior knowledge may be better positioned to evaluate AI outputs, detect errors, and use assistance strategically. Without pedagogical guidance, GenAI could therefore widen differences in agency rather than simply democratize learning.

The key issue is not access to the tool alone. Access without critical capacity can produce dependence. Access with guided inquiry can produce empowerment. Students who already possess strong disciplinary understanding can use GenAI to extend thinking; students with weaker foundations may accept fluent errors. This suggests that educators should not assume that open access automatically equals educational fairness. Fairness requires instruction in verification, transparent norms, and task designs that support all learners in becoming more capable users.

There is also a risk that institutions with fewer resources will adopt AI as a substitute for human teaching, while more privileged contexts use it as an enrichment tool under expert guidance. Such differentiation would be educationally harmful. The agency-preserving position is clear: GenAI should augment human teaching and learner inquiry, not replace the relational and professional work through which students become responsible knowers. Efficiency should not become an excuse for thinning the educational encounter.

A Normative Framework for Responsible Educational Use

The preceding analysis can be summarized in a normative framework. GenAI use is educationally defensible when it satisfies three conditions. First, it preserves the learner's ownership of the problem. The student should be able to explain what question is being pursued and why it matters. Second, it preserves the learner's participation in knowledge construction. The student should engage in interpretation, evidence evaluation, and revision rather than merely selecting from generated outputs. Third, it preserves the learner's responsibility for judgment. The student should be able to disclose assistance, justify claims, and accept accountability for the final work.

These conditions can guide teachers and institutions more effectively than blanket rules. A ban may be appropriate for tasks designed to assess unaided performance. Open use may be appropriate for tasks designed to teach critique of AI outputs. Limited use may be appropriate for drafting, feedback, or language support. The educational question is always: Does this use strengthen or weaken the capabilities the task is meant to cultivate?

This framework also rejects the assumption that AI use is automatically innovative. Innovation in education is not the introduction of a new tool; it is the improvement of learning conditions in relation to worthwhile aims. A classroom saturated with GenAI but poor in questioning, dialogue, and judgment is not advanced. A classroom that uses GenAI sparingly but thoughtfully to sharpen inquiry may be more genuinely innovative. Educational progress should be measured by the growth of student agency, not by the quantity of technological integration.

Discussion

This article has argued that GenAI should be understood through the lens of student agency. The central issue is not whether AI can generate useful outputs, because it can. Nor is the central issue whether misuse is possible, because it is. The deeper question is whether educational practice can integrate GenAI in ways that preserve students as questioners, knowledge builders, self-regulated learners, and responsible authors.

The analysis contributes to educational theory in three ways. First, it reframes GenAI from a tool-adoption problem to a subject-formation problem. This reframing prevents educators from equating efficiency with learning. Second, it distinguishes between cognitive distribution and cognitive displacement. Learning has always depended on tools and social mediation, but tools become educationally problematic when they replace the learner's participation in the central operations of inquiry. Third, it offers a practical framework for pedagogy: problem-posing before

prompting, process transparency, critical verification, scaffolded assistance, assessment redesign, and teacher-guided ethical reflection.

The implications for research are substantial. Empirical studies should examine not only achievement outcomes or attitudes toward AI, but also changes in question quality, self-regulation, epistemic judgment, authorship awareness, and transfer of learning. Researchers should ask whether AI-supported students can perform independently after scaffolds are withdrawn. They should examine whether different forms of AI feedback enhance or reduce learner control. They should also investigate disciplinary differences. The agency risks in writing, programming, mathematics, language learning, and clinical reasoning may not be identical.

The implications for practice are equally clear. Teachers should not respond to GenAI by simply adding detection software or by allowing unrestricted use. They should redesign tasks so that students must show their reasoning, justify their choices, and reflect on AI assistance. Institutions should support this redesign rather than placing the burden entirely on individual teachers. Students should be taught that responsible AI use is not a matter of hiding or displaying tool use, but of remaining intellectually accountable for learning.

This article has limitations. It is a theoretical analysis rather than an empirical study. Its claims should be tested in classroom research across educational levels, disciplines, and cultural contexts. It also treats GenAI broadly, though specific systems differ in design, reliability, transparency, and educational affordances. Finally, the concept of agency itself requires careful operationalization if it is to guide empirical assessment. Future research should develop valid measures of student agency in AI-mediated learning and examine how pedagogical designs affect agency over time.

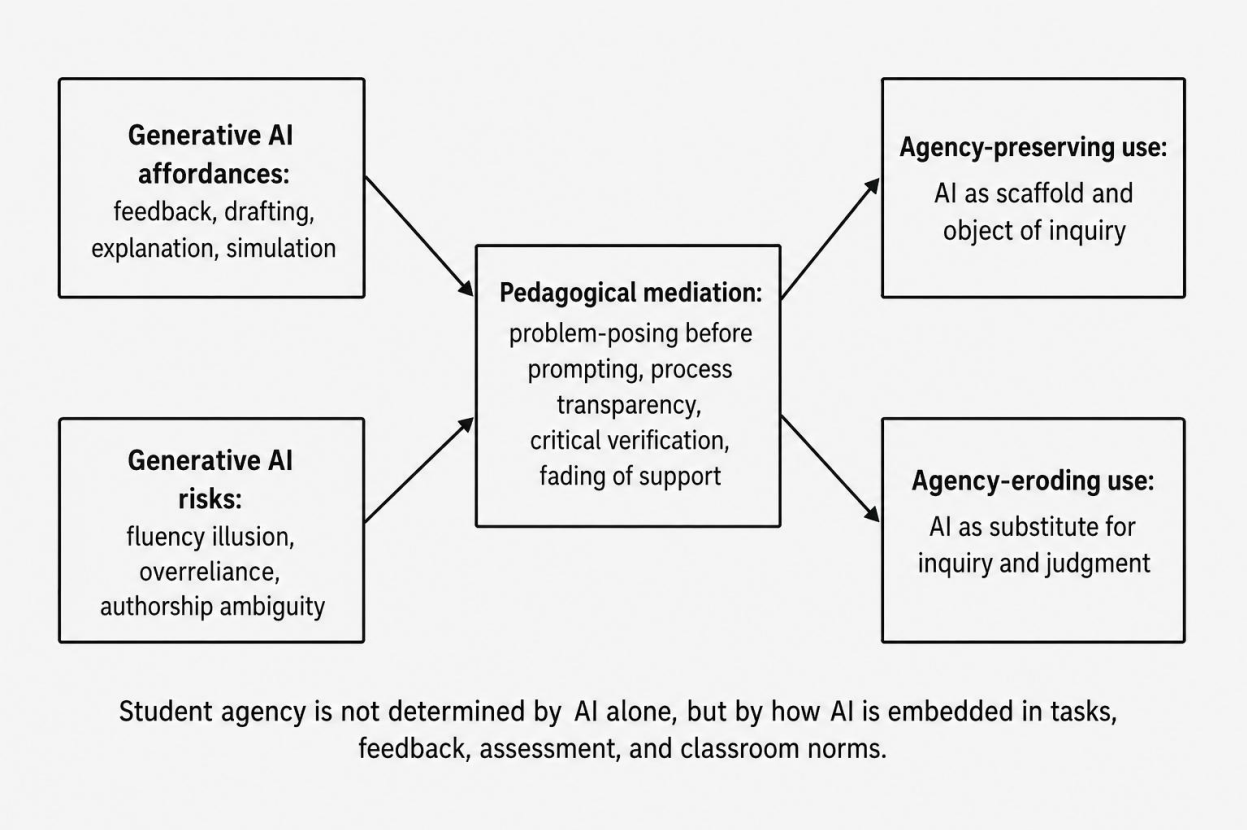
Conclusion

Generative AI forces education to clarify what it means by learning. If learning is defined as the production of correct or polished outputs, then GenAI will appear mainly as a powerful productivity tool. If learning is understood as the formation of questioning, understanding, judgment, and responsibility, then GenAI becomes more ambiguous. It can support learning when it functions as a scaffold for inquiry; it can erode learning when it substitutes for the learner's own intellectual work.

The educational task is therefore not to defend an obsolete model of unaided learning, nor to surrender education to technological efficiency. The task is to design learning environments in which students use GenAI without losing themselves as agents. Students should learn to ask before prompting, think before accepting, verify before citing, revise before submitting, and take responsibility before claiming authorship. In this sense, the future of education with GenAI depends less on the intelligence of machines than on the seriousness with which educators protect and cultivate the agency of learners.

Figure 1

A Pedagogical Framework for Agency-Preserving GenAI Use



Note. The framework emphasizes that GenAI does not determine learning outcomes by itself. Student agency depends on pedagogical mediation, task design, assessment, and classroom norms.

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