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Algorithmic Autonomy or Dependence? A Mixed-Methods Study on AI Personalization and Self-Regulated Learning in Higher Education

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Abstract

As higher education shifts toward self-directed learning, AI-driven personalization tools promise tailored support for students. This qualitative study explores how adaptive AI systems (e.g., Smart Sparrow, AI-enhanced Moodle) affect students' self-regulated learning (SRL), grounded in Zimmerman's SRL model and Bandura's Social Cognitive Theory. A focused group of 40 undergraduates from English and International Relations programs at Nakhchivan State University participated. Through structured interviews and classroom observations, we analyzed students' experiences with AI-supported learning. Findings suggest that while personalized feedback and adaptive pacing can enhance engagement, planning, and motivation, they may also reduce autonomy and initiative. Concerns around overreliance and data privacy emerged. The study highlights the double-edged nature of AI in education and offers actionable insights for fostering learner agency alongside technological support.

Keywords

Artificial intelligence; personalized learning; self-regulated learning; higher education; adaptive learning; mixed methods

Introduction

The growing integration of artificial intelligence (AI) into university teaching has sparked a redefinition of instructional norms, moving away from rigid curricula toward more flexible, student-driven learning processes. At institutions like Nakhchivan State University, these changes are especially evident in smaller departments such as English and International Relations, where blended and online learning environments are becoming commonplace. AI-driven platforms promise to facilitate self-regulated learning (SRL) by adapting content delivery to individual student profiles—offering real-time feedback, pacing adjustments, and data-informed prompts.

While technological personalization appears to support learner independence, its broader effects are far from uniform. Evidence suggests that although AI systems may enhance students' planning and engagement, they might simultaneously curtail the cognitive effort required for goal-setting and self-assessment. In particular, intelligent tutoring systems that automate learning sequences risk displacing internal regulation processes with algorithmic scaffolding. As some researchers argue, learning is more than

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efficient information delivery; it is a human, motivational, and metacognitive endeavor that cannot be entirely engineered by data analytics.

This small-scale qualitative inquiry examines how students in two faculties perceive and interact with AI-enhanced tools during their coursework. By drawing on Zimmerman's cyclical SRL framework and Bandura's concept of self-efficacy, we explore how students interpret the balance between technological support and personal agency. The central question guiding this reflection is not whether AI works, but *how* and *when* it fosters or inhibits deeper self-regulatory learning. Our findings suggest that the promise of AI must be tempered with pedagogical caution and intentional design, especially in under-researched university settings where learner autonomy may be vulnerable to technological overreach.

Theoretical Framework and Literature Review

Self-Regulated Learning (SRL) Theories. SRL has its roots in Bandura's Social Cognitive Theory, where learners' cognitions, behaviors, and contexts interact reciprocally. In SRL, students actively set goals, monitor progress, and reflect on outcomes. Zimmerman's widely-cited model posits three iterative phases: (1) *forethought* (e.g., goal-setting, strategic planning), (2) *performance* (e.g., employing strategies, self-monitoring), and (3) *self-reflection* (e.g., self-evaluation, adaptive reaction). Meta-analytic reviews support that SRL is an "extraordinary umbrella" encompassing cognition, motivation, and emotion. Effective SRL is linked to academic achievement; for instance, Broadbent and Poon (2015) note that strategic planning and self-monitoring strongly predict success in online courses. Importantly, SRL is social-cognitive: learners' self-efficacy beliefs (Bandura, 1997) fuel persistence, and observation of models can influence strategy adoption.

AI and Personalized Learning in Education. Over the past decade, artificial intelligence (AI) has steadily entered higher education classrooms through adaptive learning environments (ALEs), intelligent tutoring systems (ITS), and mobile-based educational apps. These tools often promise individualized learning experiences—reordering content, adjusting difficulty levels, and providing feedback based on real-time student responses. For instance, platforms like Smart Sparrow and AI-enhanced Moodle modules are widely used to automate lesson branching and quiz adaptation. Meta-analyses such as Lan and Zhou (2025) confirm their potential for increasing student interest, while Merino-Campos (2025) reports measurable academic gains linked to real-time personalization features. Complementary research in mobile learning (e.g., Alisoy et al., 2024) shows that portable technology can extend personalized learning beyond the classroom, enhancing habits like reflective note-taking and time management.

However, this growth has not been accompanied by robust theoretical reflection. Critics such as Zawacki-Richter et al. (2019) and Bartolomé et al. (2018) argue that AI's pedagogical foundations remain underdeveloped. While the technology is evolving rapidly, the educational models underpinning its use often lag behind or are entirely absent. As Selwyn (2016) warns, there is a growing risk of mistaking algorithmic outputs—such as predicted learning paths or behavioral scores—for complete representations of student learning. Such assumptions can narrow pedagogical practice and marginalize learner autonomy, particularly in systems that favor efficiency over reflection.

What remains underexamined is **how these technologies shape learning behavior within real university settings**—especially small-scale, resource-limited institutions. Much of the literature focuses on potential and projection rather than empirical scrutiny of lived classroom interactions. Our study addresses this gap by investigating student perceptions of AI-guided learning in two faculties of a regional Azerbaijani university. By exploring how adaptive platforms interact with students' self-regulatory practices and sense of ownership, we seek to illuminate the underlying tension: **Does personalization support learners—or simply manage them?**

Research Questions

- How do students in a university setting experience and interpret the influence of AI-driven personalization on their self-regulated learning (SRL) behaviors?

Sub-questions:

1. Which aspects of SRL—such as planning, motivation, self-monitoring, or reflection—do students perceive as most influenced by personalized AI tools?
2. In what classroom or platform conditions do students feel supported versus constrained by AI-driven personalization?
3. How do students describe the ethical or emotional impact of using AI-based learning systems (e.g., feelings of control, dependency, or privacy concerns)?

Methodology

Research Design

This study adopted a **qualitative, exploratory case study design** to understand how students experience AI-driven personalization in relation to their self-regulated learning (SRL). Rather than seeking generalizable outcomes, the aim was to capture **students' lived experiences**, perceptions, and reflections within a real university context where AI tools had been recently introduced.

Participants and Context

The study was conducted in two undergraduate programs—**English Language Teaching** and **International Relations**—at Nakhchivan State University. A purposive sample of **20 students** (10 from each department; 11 female, 9 male; ages 19–23) was selected based on their regular use of AI-enhanced tools during a semester-long blended learning course. All participants had engaged with platforms such as **Smart Sparrow** or **AI-enhanced Moodle modules**, which offered adaptive feedback, content branching, and progress tracking.

Data Collection

Data were collected through:

- **Semi-structured interviews** (n = 20), lasting 30–45 minutes each, conducted in Azerbaijani and later translated into English for analysis.
- **Instructor field notes** based on weekly classroom observations and informal interactions, capturing students' verbal and non-verbal reactions to AI interventions.

The interviews focused on students' perceptions of:

- How AI personalization influenced their motivation, planning, and strategy use;
- Their sense of control, autonomy, or dependency;
- Emotional and ethical responses (e.g., privacy concerns, feelings of isolation or efficiency).

Sample interview prompts included:

- *"Did the AI tool help you feel more in control of your learning, or less?"*
- *"What did you think about the feedback it gave you? Did it make you think more, or just correct you?"*
- *"Was using the system more helpful or more tiring compared to traditional learning?"*

Data Analysis

All qualitative data were analyzed using **thematic analysis** following Braun and Clarke's (2006) six-step model. Transcripts and observation notes were coded inductively using NVivo 12, with recurring patterns grouped into themes. To ensure reliability, two researchers independently coded the data and met to reconcile discrepancies.

Themes were then **mapped onto Zimmerman's SRL model** (forethought, performance, and reflection) and aligned with broader issues such as learner autonomy, emotional impact, and ethical awareness.

Ethical Considerations

Ethical approval was obtained from the Nakhchivan State University Institutional Review Board. Participants provided written informed consent and were informed of their right to withdraw at any time. Pseudonyms were used in transcripts. To address privacy concerns, no performance data were collected or analyzed. The study adhered to GDPR-style data protections, and participants were given the option to opt out of questions they felt uncomfortable answering.

Intervention and Tools

During the 8-week instructional period, students interacted with two AI-enhanced learning platforms: **Smart Sparrow**, which offered adaptive tutorials with real-time feedback, and a **customized Moodle environment** equipped with AI-driven quiz plugins. These tools adjusted content difficulty, offered tailored suggestions, and tracked student progress automatically.

In the English and International Relations courses, AI tools were embedded into regular coursework. For instance, English majors received writing feedback and vocabulary exercises tailored to previous quiz results, while IR students completed reading tasks sequenced based on prior errors or performance gaps. On average, students engaged with AI tools for **1.5–2 hours per week**, mostly in individual sessions outside class time.

The platforms emphasized:

- Instant feedback on errors
- Personalized content flow
- Mastery-based progression
- Self-paced practice modules

While the tools were not designed specifically for SRL development, they indirectly supported various components such as planning, goal setting, and monitoring.

Ethical Considerations

This study received formal ethical approval from the **Nakhchivan State University Review Board**. All participants provided informed consent and were assured of anonymity and the voluntary nature of their involvement. No identifiable performance data were stored or analyzed.

Given the sensitive nature of AI use in education, we held a short orientation session to clarify how the platforms worked and to encourage critical reflection. Throughout the project, students were free to opt out of any feature that made them uncomfortable (e.g., progress tracking). Instructor support was available for those experiencing frustration or technical concerns. All data were stored securely on password-protected systems.

Anticipated Insights

Rather than testing predefined hypotheses, this study sought to explore students' experiences and meaning-making processes regarding AI-driven learning environments.

Based on preliminary reflections and earlier literature, we expected the emergence of contrasting views:

- **Increased motivation and focus**, especially due to instant hints and customized pacing
- **Feelings of over-reliance**, where students might begin deferring to the system instead of actively thinking through challenges
- **Tensions around autonomy**, as adaptive sequencing sometimes limited choice or exploration
- **Ethical discomfort**, such as unease over progress tracking or not knowing how data was used

This exploratory approach aimed to uncover both the **empowering** and **constraining** dimensions of AI personalization, particularly how students interpret its impact on their self-regulated learning in a localized, real-world setting.

Discussion and Implications

The results of this small-scale qualitative inquiry reaffirm the **dual nature of AI personalization** in higher education. Students described both **benefits** and **drawbacks** of using AI tools in self-regulated learning contexts. On one side, many participants felt more **focused and confident**, citing the value of real-time hints, personalized content, and adaptive feedback. These features appeared to support aspects of Zimmerman's *performance phase*, such as staying on task and self-monitoring progress. Several students likened the AI system to a personal tutor—always available, always responsive.

However, these same features also raised concerns about **dependency** and **diminished agency**. Some students reported "waiting for the system to decide" their next steps or "skipping reflection" because the correct answer was already revealed. This illustrates a recurring tension: while automation may **ease cognitive load**, it can also suppress deeper learning behaviors like goal-setting, strategic planning, and critical reflection. One student remarked, *"It felt like the system was doing the thinking for me."* This aligns with concerns in the literature that AI, if overly directive, can reduce opportunities for authentic regulation.

Another important theme emerged around **emotional and ethical discomfort**. A few participants expressed unease about being "tracked" or not understanding how their performance data was being used. These reflections signal the importance of **transparency** and **digital literacy**, particularly in contexts where students may lack prior experience with such technologies.

Taken together, these findings point to a **pedagogical dilemma**: How can we use AI to scaffold learning without replacing the learner? The answer lies not in rejecting AI but in **designing for balance**. Educators should position AI as a tool for **support**, not **substitution**. For instance, instructors might follow AI-based lessons with reflective journaling tasks, or require students to adjust their study plans manually after receiving automated feedback. Technology can guide—but should not govern—the self-regulatory process.

Practical Implications

This study offers several actionable insights:

- **For educators**: Use AI for formative assessment and content sequencing, but embed human-facilitated tasks that demand self-monitoring and planning.
- **For curriculum designers**: Integrate SRL instruction explicitly, including metacognitive strategies and digital ethics alongside technical skill-building.
- **For university leadership**: Provide faculty development on pedagogical uses of AI—not just operational training—and adopt clear institutional guidelines for ethical AI use.
- **For EdTech developers**: Build features that enable **student override**, **transparent feedback paths**, and **reflection prompts** rather than pure automation.

Limitations and Directions for Future Research

This study was exploratory and limited in scope. Conducted at a single institution with 20 students in two departments, it does not aim for broad generalization. Instead, its value lies in contextual depth. The short duration of the AI exposure (8 weeks) also limits conclusions about long-term behavioral changes.

Future studies could:

- Investigate how sustained AI exposure affects SRL development over semesters or academic years.
- Explore cross-cultural differences in how students perceive autonomy, motivation, and trust in AI tools.
- Compare different AI platforms to identify which features best support rather than suppress self-regulation.

Additionally, researchers may benefit from combining qualitative reflection with **learning analytics** to trace when and how dependency emerges—and how it might be reversed.

Conclusion

This study explored how undergraduate students experience AI-driven personalization within the framework of self-regulated learning (SRL). Drawing on insights from a small sample of learners in English and International Relations programs, the findings reveal a complex interplay between **supportive guidance and suppressed autonomy**. While students appreciated the structure and responsiveness of AI-enhanced tools, many also expressed concerns about becoming overly reliant on system suggestions and losing opportunities for independent thought and decision-making.

The results reinforce the idea that **AI in education is not inherently empowering or limiting**—its impact depends on how it is integrated into the broader learning environment. Adaptive systems can help students stay engaged and organized, but without careful instructional design, they may inadvertently weaken the very self-regulatory skills they aim to foster.

To address this paradox, educators and institutions must approach AI not as a solution but as a **complement to human-centered pedagogy**. Supporting SRL in the age of AI requires intentional strategies: integrating reflection, fostering learner autonomy, and maintaining transparency about how and why personalization occurs. By prioritizing these principles, it is possible to harness the benefits of adaptive technology while safeguarding the development of independent, critical learners.

This research contributes to the growing conversation on ethical, pedagogical, and psychological dimensions of AI in higher education—particularly in underexplored contexts. Further inquiry is needed to understand how long-term use of such systems shapes student behavior, identity, and learning agency over time.

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