Student Agency Scale (SAS) in the Student-Machine Network: A Conceptual Framework for Rethinking Agency and Authorship in Higher Education

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Abstract

The rapid integration of generative artificial intelligence (GenAI) into higher education has intensified concerns around authorship, academic integrity, and student learning. Yet, most institutional guidance continues to frame AI in terms of what is permitted and what is not. This paper argues that such an approach overlooks a fundamental pedagogical issue: the redistribution of agency in higher education within student machine interactions. Drawing on theories and previous works on human agency, machine agency, and human-machine networks, the paper introduces the Student Agency Scale (SAS); a conceptual framework for understanding, designing and regulating student-AI interactions within the student-machine network. The SAS positions student agency and machine agency alongside intersecting continua, allowing educators to make explicit, pedagogically grounded decisions about appropriate GenAI use across learning and assessment contexts. Rather than prescribing uniform rules, the framework supports context specific design that foregrounds human agency while acknowledging the increasing role of AI systems in educational practice.

Keywords: student agency; generative artificial intelligence; human-machine networks; higher education; academic integrity; posthuman pedagogy

Introduction

Generative AI tools now participate in learning, writing, and thought practices in higher education. Students increasingly interact with AI systems not merely as tools, but as co-participants in cognitive and creative processes. Institutions have responded by presenting options for AI systems which allow, disallow and restrict use ubiquitously across a university or school. While these categorisations are necessary, they inadequately capture the underlying distribution of agency that occurs when students and machines interact in a higher education setting.

This paper proposes a shift from compliance focused framings of AI use toward an agency centred pedagogical lens. Rather than asking whether GenAI is used by students, the central question becomes: where does agency reside within the student-machine interaction, and is this distribution guided by educational integrity?

Agency in Human and Machine Contexts

Agency is commonly understood as the capacity to act with intention and purpose (Schlosser, 2019). In humans, agency is deeply tied to autonomy, responsibility, and authorship, and is frequently treated as a defining characteristic of human development (Welzel *et al.,* 2003). Educational theory has long associated student agency with learners' capacity to exercise control, make meaningful choices, and take ownership of their learning processes (Radhakrishna, 2024).

In contrast, machines do not possess intrinsic intention or motivation. Nevertheless, contemporary AI systems exhibit a perceived or functional agency (Engen *et al.,* 2016; Shao *et al.,* 2025). For example,

they generate outputs, shape decision making and influence outcomes within sociotechnical systems (Ibid.). Human-machine network (HMN) research highlights that agency in such systems is distributed rather than singular, with human and non-human actors jointly shaping activity and meaning (Ibid; Tsvetkova et al., 2017).

Within educational contexts, students increasingly operate within a *student–machine network* (SMN), where AI systems participate in idea creation, drafting, feedback, and revision of students learning and outputs. Understanding how learning is created and continued in these environments requires us to acknowledge both the human and machine contributions while preserving and recognising the distinction between them.

From Human-Machine Networks to Student-Machine Networks

Applying HMN theory to education puts agency at the forefront of decision making in academic use of AI for both students and staff. Students do not simply 'use' AI systems, they negotiate, rely on, and delegate to it. Empirical studies of students collaborating with AI suggest that learners often attribute at least partial authorship to AI tools whilst expressing scepticism about their limitations, such as lack of contextual understanding or stylistic nuance (Han, 2025; Jiang et al., 2024). This ambivalence indicates emerging forms of *co-agency* between students and AI systems where responsibility and control are shared but unevenly distributed (Jiang et al., 2024). These dynamics challenge binary notions of authorship and raise questions about how educators might deliberately design learning environments that preserve, rather than erode, student agency. While AI cannot yet truly possess true human-like or natural agency, this *perception* of agency matters (Engen et al., 2016). Student-machine networks create new relationships where students' agency becomes distributed within AI systems; while the students themselves drive the AI system forward, the results are a shared creation between the student and AI. This challenges traditional assessment and integrity norms as until recently, agency and creation has been *uniquely* human output within educational contexts.

Why SMSs Matter in Higher Education: Agency and Academic Integrity

Student-machine networks in higher education are worth investigating and investing in as they perform a multitude of duties: they reflect real world challenges of AI management in occupations post-education; they introduce concepts of a post-human world in which students will graduate into; and they provide a platform to teach students about the importance of human input and originality in ethical creation.

The interaction between agency and integrity relies on students recognising their own ethical self-governance. How individuals exercise their freedom responsibly in line with the values and principles that are congruent with their identity; and that of the education institute they work under. Accountability and social trust across institutions plays a role here, there are expectations on students to behave in a certain way usually exemplified through graduate attribute frameworks which set out their own values and principles unique to each institution. SMSs have the potential to both negatively and positively impact student outputs, impacting how we not only assess competence but also how we continue to communicate institutional values in the face of exponential AI advancement. This is where agency as an essential value within higher education will play an important role, anchoring the discussion of student integrity within SMNs and AI use.

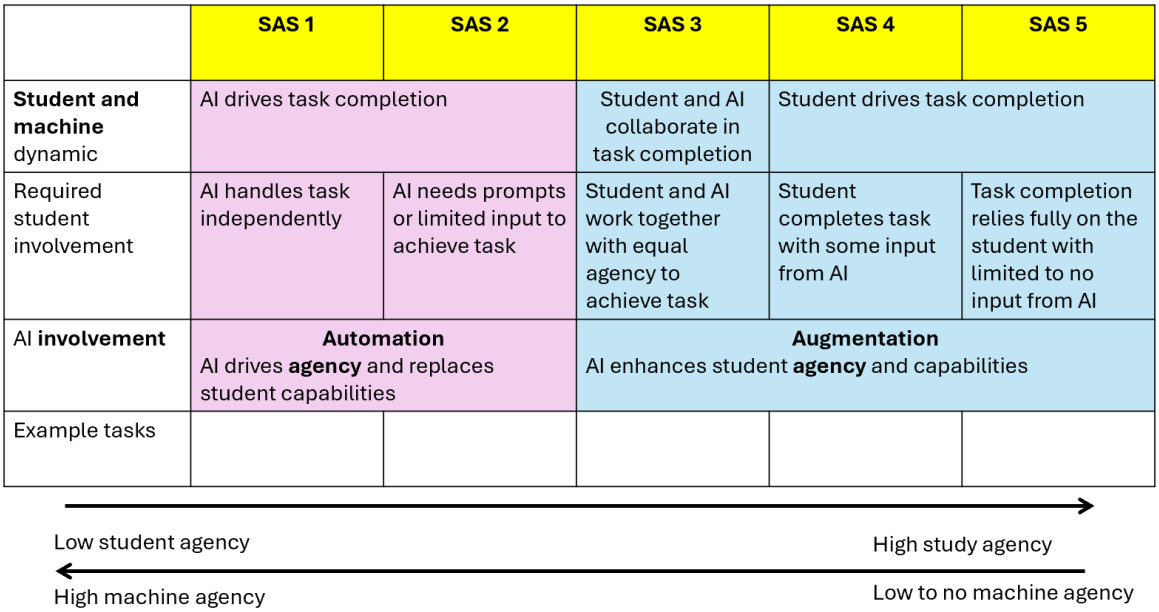
The Student Agency Scale (SAS)

This paper proposes the Student Agency Scale (SAS) as a conceptual and pedagogical tool for making agency distributions explicit within SMNs. Based on the HAS by the team at Stanford's social language and technologies lab the scale takes the main components from Shao *et al.*'s work and develops them into a pedagogically situated adaptation to be utilised within higher education (2025).

The SAS borrows from the HAS the overall layout and the inclusion of automation and augmentation as the main differentiation of AI involvement across the scale. Automation here is defined as AI in any of its forms is driving agency and replacing student capabilities; this could be for machine tasks as simple as using excel to generate pivot tables, to asking ChatGPT for a list of databases that include journals social science disciplines. Augmentation is by definition a way to complement or enhance something that has been originally created, in this case, AI will augment students original thought and creation, showing that they are, and should be the drivers of agency within the higher levels of the SAS scale. The scale itself is structured along two intersecting dimensions:

- **Student agency**: ranging from low (minimal decision-making, high reliance on automation) to high (active control, intentional judgment, reflective engagement).
- **Machine agency**: ranging from low (assistive, constrained, or post-hoc support) to high (generative, directive, or substitutive functions).

Figure 1: Student Agency Scale (SAS) in the Student Machine Network (SMN)



As student agency increases, machine agency decreases. The SAS scale gives visual reference to how the SMN can operate within higher education contexts, with a nod to the existing literature and research on HMN. It provides a guide for students and educators on how we can frame conversations around SMN through a different lens, providing space for negotiation rather than a strict allow or restrict mentality. Blind reliance in the use of AI pushes student practice toward automation (low SAS), however, deliberate and phased interaction maximises augmentation of students own abilities (high SAS).

Rather than prescribing a single 'correct' position, the SAS enables educators and students to locate specific tasks, assessments, or activities within this space. Different pedagogical goals can be adjusted to different configurations of the SAS. For example, early stage drafting support such as suggesting ideas and defining terms can be assisted through a higher machine agency, whereas summative assessments that require high student agency must ensure that machine roles are constrained and defined by the educator.

Pedagogical Applications

The SAS is not a psychometric tool and it is not a compliance tool, it is meant to be used flexibly and in different contexts. For example:

1. **As a learning scaffold**: to help students understand agency, authorship, and responsibility in AI mediated work.
2. **As a course-level design tool**: to map where and *why* GenAI is permitted, restricted, or discouraged across learning activities.
3. **As a feedback or feedforward instrument**: enabling educators to discuss with students whether the observed distribution of agency aligns with learning intentions.

By reframing AI guidance in terms of agency rather than exclusion, the SAS supports transparent dialogue about academic integrity while recognising the realities of contemporary learning practices.

Implications for Academic Integrity

An agency-based approach reframes academic integrity not as the absence of AI use, but as the alignment between declared learning outcomes and actual distributions of agency. Practices such as AI-use logs, reflective statements, and portfolio style assessments can be understood as mechanisms to help make agency visible rather than merely policing student behaviour.

The SAS approach has integrity built in, it appeals to our human characteristic of agency in determination of our own education journey and helps students and staff chart the lines between integrity driven automation of low agency tasks and unethical use of AI for high agency creation which should be driven by the students themselves.

SAS supports categorical allow and disallowed actions of AI but ground them in agency rather than suspicion. This in turn supports integrity agency connection of students own self-governance in higher education.

Towards a Posthuman Pedagogy of Agency

What we must avoid in this posthuman pedagogy is celebration of the achievements of AI without critical consideration of their pitfalls. This includes the creation of inequities within and outside the classroom, and AI's ethically dubious environmental and labour impacts. We also must recognise the human error in the design of most GenAI technology – its convincing theatre and resulting perceived perception of agency and validity. We must remind students and ourselves that GenAI is simply an echo chamber of its imputed human data, human bias and will ultimately include human mistakes.

Conclusion

As GenAI becomes embedded in higher education, simplistic binaries of use versus misuse are no longer pedagogically sufficient. The Student Agency Scale offers a conceptual framework for understanding student-AI interaction as a distributed system of agency, authorship, and responsibility. By making these distributions explicit, educators can design learning experiences that harness the benefits of GenAI while preserving the fundamentally human capacities that higher education seeks to cultivate.

Further work

This preprint presents the Student Agency Scale as a conceptual and pedagogical framework rather than a validated measurement instrument. Future work will explore its application across different disciplinary contexts, levels of study, and assessment designs, including how students and educators interpret and negotiate agency within student-machine networks over time. Further research may also

examine the relationship between the SAS and existing measures of student agency, academic integrity practices, and learning outcomes, as well as its potential use as a reflective or dialogic tool in AI-mediated education. This work will be essential for refining the framework and evaluating its value in supporting pedagogically grounded, ethically informed uses of generative AI in higher education.

The future of higher education depends not on preventing AI use but on intentionally shaping the distribution of agency within student-machine networks towards augmentation of human driven capabilities.

This manuscript is shared as a preprint to invite discussion and feedback for a working paper. The framework and terminology introduced here may be refined in subsequent peer-reviewed publications.

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