JOURNAL OF LEARNING ANALYTICS

SOLAR SOCIETY for LEARNING ANALYTICS RESEARCH

Volume 12(3), 1–7. https://doi.org/10.18608/jla.2025.9485

# Fostering Human Agency in Age of AI: A Learning Analytics Perspective

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**Abstract**

As learning analytics (LA) and artificial intelligence (AI) increasingly shape how learning processes are monitored and supported, *human agency* has emerged as a critical concern. With generative AI rapidly transforming learning practices and influencing pedagogical decision-making, safeguarding the agency of both learners and educators is becoming essential. This editorial discusses key dilemmas in designing and evaluating AI-mediated learning systems that maintain meaningful human control, foster critical engagement, and enable ethical and effective integration into learning settings. We conclude by outlining future research opportunities for the learning analytics community and reflecting on the journal's development over the past year.

**Keywords:** Learning analytics, human agency, meaningful control, generative AI, learners, teachers, institutions

**Submitted:** 23/11/2025 — **Accepted:** 23/11/2025 — **Published:** 15/12/2025

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## 1. Introduction

Generative artificial intelligence (GenAI) is reshaping how students learn and reason, how educators design instruction and assess students, and how decisions are made across educational systems (e.g., Celik et al., 2025; Fan et al., 2025; Giannakos et al., 2024; Pallant et al., 2025). Large language models (LLMs) such as GPT5 and Claude, now capable of generating immediate feedback, solving complex problems, summarizing texts, and analyzing learning traces, are introducing significant shifts in the distribution of control and autonomy within learning environments, from K–12 classrooms to higher education and workplace training. Recent evidence, for example, from Anthropic, based on the analysis of one million student conversations with Claude, demonstrates that students primarily use LLMs during higher-order cognitive tasks, such as problem-solving and creative exploration (Handa et al., 2025).

As GenAI becomes increasingly embedded in learning processes, fostering human agency within current socio-technical systems is becoming increasingly challenging across learning and educational contexts. Agency, in its basic meaning, refers to the capacity to act intentionally, make informed choices, exercise meaningful control, and shape one's own learning (Bandura, 2006; Code, 2000). Emerging empirical evidence has begun to demonstrate that the student use of GenAI technologies can undermine the cognitive and metacognitive processes essential for sustained, autonomous learning (e.g., Fan et al., 2025; Stadler et al., 2024) — processes foundational to student agency. Scholars have also raised concerns about teacher agency in the age of GenAI in education (e.g., Kahn et al., 2025), as new systems must afford teachers to drive classroom learning processes in ways that would support their professional identity and self-efficacy. With students and teachers increasingly relying on LLMs in everyday practices, there is a pressing need for 1) metacognitive support that assists learners in regulating their engagement with AI and maintains ownership of their learning processes (e.g., Xu et al., 2025), and 2) pedagogically meaningful teacher support in terms of their professional development (e.g., Tan et al., 2025).

Current educational systems already constrain learner and teacher agency through high stakes testing frames, standardized curricula, and established institutional structures. Against this backdrop, the risks of under-designing for human participation and engagement within AI-mediated teaching and learning practices are even more central. When new educational technologies are introduced into existing highly prescriptive environments, their use may unintentionally reinforce existing constraints. This is particularly prominent if these new technologies prioritize prediction, compliance, or efficiency over choice, expression, and

learning, as the latter allow for learner sensemaking, exploration, value-based judgement, and ultimately, agency. Without intentional design for practices that protect and require human agency, these technologies may shift control away from learners — narrowing their space for independent judgement, action, and even learning — and from teachers by misleading them in their instruction.

Considering these risks, clarifying how agency can be preserved becomes central for designing AI-supported learning. The *EU AI Act* (EU, 2024) — European legislation that classifies most AI-mediated learning tools as high-risk — offers risk mitigation by requiring *meaningful human oversight*. The meaning of such oversight in learning contexts remains conceptually underdeveloped and empirically understudied. Scholarly positions prior to GenAI describe hybrid systems as shifting control between teacher, learner, and technology (e.g., Molenaar, 2022) or compensating for human weaknesses while leveraging strengths (Mavrikis et al., 2021), both of which draw on earlier automation perspectives (Schneiderman, 2020). While these accounts address regulatory aspects during learning, they do not fully address how learning itself should take place *within* AI-mediated work. Parallel discussions of oversight, proposed to support the AI Act, add to the conversation. A recent white paper (European Data Protection Supervisor, 2025) defines oversight as active involvement in monitoring AI, evaluating its decisions, and retaining the ability to intervene.

An interdisciplinary perspective on what effective human oversight may look like stems from Sterz et al. (2025). They propose four necessary premises: 1) *causal power* (does the human have [internal or external] means to mitigate risk); 2) *epistemic access* (does the human have enough knowledge to recognize and mitigate risks?); 3) *self-control* (are humans in charge of what they are doing?), and 4) *fitting intentions* (are humans motivated to complete the task properly?). These propositions highlight that humans do not necessarily simply have agency, competence, or motivation available to pursue the best course of action, and that simply designing systems that enable these may also not be sufficient on their own. Put in the perspective that refers to learning contexts, humans need to be supported in how they develop competence, perceive their agency, and motivate themselves to act against what may appear as the path of least resistance.

Given this context, learning analytics has a pivotal role in supporting human agency. While learning analytics has traditionally focused on defining and capturing specific proxies of learning, contemporary approaches invite a broader rethinking: not only of which indicators or proxies matter, but of how learning progress itself is conceptualized. This broader perspective aims to enable designs, including feedback practices that foreground learner growth and agency rather than their compliance with prescribed activities. In the same vein, learning analytics can remain open as to the types of activities it encourages learners to engage with. Despite the frequent focus on grades and deadlines in the course, other learning analytics indicators should be prioritized so that learners train and monitor their ability to act independently within the AI-mediated learning environments.

Learning analytics can also reveal how students engage with GenAI in their learning processes, including how they prioritize tasks, seek help, or engage with feedback, and how these behaviours reshape learning trajectories (e.g., Yan et al., 2024; Mouta et al., 2025). That is, if learners can become aware of the importance of their own skills to organize work and study, seek help and enact feedback, they can realize that these skills shape their learning trajectories in ways that offer them more choice, ultimately developing their agency in the learning process. These kinds of support offered by learning analytics can illuminate how learners and teachers attribute agency within AI-mediated contexts, and how this influences decision-making and the distribution of control in learning activities. Although GenAI tools do not inherently possess agency, they are often treated as a collaborator with agency, and having AI tools presented in this way has been shown to affect human behaviour towards them. Taken together, the affordances of learning analytics to capture, reflect, visualize, and offer feedback, while malleable, also offer an opportunity to design AI-mediated tools around human agency. This, of course, also has an implication of responsibility for the learning analytics community to explore, design, and enact these affordances in ways that enable and promote human agency.

## 2. Design Recommendations for Enhancing Human Agency with Learning Analytics

Enhancing human agency in GenAI-mediated learning and teaching practices requires more than adding analytics to existing systems; it demands a careful rethinking of how analytics shape learner and teacher abilities to act, decide, and make sense of their learning environments. Drawing on current research in learning analytics, human–AI interaction, and theoretical perspectives on agency, we outline several design recommendations that position learning analytics as an enabler, rather than a constraint, of agency.

*1. Making Human–AI Interactions Visible and Interpretable*

As learning processes increasingly involve dynamic interplay between human and AI actions and outputs, learners and educators require an understanding of how these interactions unfold. Learning analytics should, therefore, make hybrid human–AI activity (e.g., Molenaar, 2022) visible by distinguishing between learner-generated and AI-generated work (e.g., Yıldız Durak et al., 2025), tracing how contributions evolve over time, and offering interpretable representations of when and how

GenAI tools were used. Such transparency is essential not merely for monitoring but also for supporting learner and teacher sensemaking, enabling them to better understand learning pathways, identify moments of productive struggle, effort regulation, and reflect on how AI systems may have shaped the process and the outcome.

*2. Embedding Metacognitive Scaffolds that Foster Reflection and Regulation*

Because GenAI often focuses on task completion, learners risk bypassing reflective processes unless metacognition is intentionally supported (e.g., Xu et al., 2025). Learning analytics can play a critical role by prompting learners to plan their use of AI tools, monitor their reliance on them, and evaluate the quality and appropriateness of AI-generated outputs (e.g., Li et al., 2025). Rather than focusing solely on task performance, analytics should highlight strategies, decisions, and regulatory moments. In doing so, they help learners maintain a sense of ownership over their learning and cultivate deeper regulatory skills that remain essential even in increasingly prevailing AI-rich learning environments.

*3. Prioritizing Choice, Customization, and Learner Control*

Learning analytics systems frequently risk becoming overly prescriptive, guiding learners toward predefined "optimal" behaviours. To enhance agency, analytics interfaces should instead provide meaningful opportunities for learners to make choices: selecting which data to view, determining how feedback is presented, and choosing among multiple actionable pathways (see e.g., Paulsen & Lindsay, 2024). By designing for flexibility rather than compliance, analytics reinforce learner roles as decision-makers who can tailor insights to their own goals, contexts, and preferences.

*4. Supporting Teacher Sensemaking and Professional Judgement*

Teacher agency is equally crucial in GenAI-mediated learning settings (e.g., Jia & Pun, 2025; Kahn et al., 2025) and traditional learning settings. Analytics that provide decontextualized metrics or automated recommendations can inadvertently undermine professional judgement, narrowing the space for teacher interpretation and consequently, decision-making. By contrast, analytics that foreground uncertainty, articulate underlying assumptions, and allow teachers to situate insights within their pedagogical goals can strengthen professional agency. When analytics serve as interpretive tools rather than prescriptive systems, they enable teachers to integrate AI-generated insights into informed instructional decision-making that will improve student learning conditions.

*5. Designing for Dialogic Engagement with Analytics*

Rather than acting as systems that push learners or teachers toward specific actions, analytics can be designed as *dialogic partners*, i.e., systems that invite questioning, exploration, and alternative interpretations (see e.g., Cheng et al., 2025). This involves supporting bi-directional engagement, allowing stakeholders to probe the reasoning behind analytics outputs, examine alternative pathways, and articulate their own interpretations. Such dialogic designs shift analytics from a position of authority to one of partnership, fostering agency through inquiry and shared meaning-making.

*6. Ensuring Value-Sensitive and Context-Aware Design*

Because agency is shaped by institutional, cultural, and curricular structures, analytics must be grounded in the values and lived settings of the communities they serve (Prieto et al., 2025; Viberg et al., 2023). Value-sensitive design involves engaging learners, teachers, and other stakeholders in the co-design of analytics tools, ensuring that local priorities, such as equity, inclusion, wellbeing, or disciplinary norms, are reflected in system behaviour. Context-aware analytics (e.g., Ahn et al., 2019) also make constraints explicit, helping stakeholders understand how feedback relates to broader institutional structures rather than treating data as neutral or universal. In doing so, analytics can help protect against the amplification of structural constraints and support agency in learning contexts where it is already constrained.

*7. Fostering Agency at Subjective, Intersubjective, and Collective Levels*

Agency operates across multiple interacting levels: the individual learner, the relationships among learners and teachers, and the broader collective or institutional context (e.g., Mouta et al., 2025). Learning analytics should therefore be designed not only to strengthen individual self-regulation and autonomy, but also to support negotiation and collaboration within learning communities and to inform system-level practices that privilege human agency as a core value. Attending these layers ensures that analytics do not simply redistribute control toward AI systems but instead reinforce the sociotechnical conditions that enable agency for all stakeholders.

*8. Designing for Long-Term Development rather than Short-Term Efficiency*

Although GenAI tools make it easy to complete tasks quickly, the long-term consequences for learning must remain central. Analytics that prioritize immediate performance risks over-optimize for efficiency at the expense of conceptual understanding, strategy development, or resilience. By incorporating indicators of long-term growth, such as evolving competencies, problem-solving approaches, and continuous reflective practices, learning analytics can help learners and teachers monitor competence development over time. This perspective encourages them to view AI as a resource for sustained intellectual autonomy rather than a shortcut to task completion.

Together, these recommendations reframe learning analytics as systems that expand the space of human agency by strengthening transparency, metacognition, learner choice, teacher judgement, dialogic interaction, value-sensitive design, multi-level agency, and long-term growth. In an era where GenAI is becoming deeply intertwined with learning and teaching

processes, designing *with* and *for* agency at the centre ensures that LA remains a tool for empowerment, supporting learners and educators as active individuals of their own learning trajectories.

## 3. Journal Statistics

Below we present the information about the journal's development over the last year.

**Table 1:** Journal Publication Statistics 2020–2025

| | 2020–2021 | 2021–2022 | 2022–2023 | 2023–2024 | 2024–2025 |
|---|---|---|---|---|---|
| Received during the year | 93 | 115 | 159 | 169 | 247* |
| Accepted during the year | 33 | 29 | 22 | 43 | 39** |
| Declined (desk reject) | 56 | 70 | 101 | 77 | 179 |
| Declined rate (desk reject) | 63% | 76% | 64% | 64% | 84% |
| Declined (after review) | 22 | 15 | 22 | 32 | 47 |
| Declined rate (after review) | 14% | 12% | 14% | 20% | 14% |

*Notes: Papers received during one calendar year may be accepted or rejected in the following calendar year. Some papers received in 2024 were still under review when these figures were generated on 16 November 2025. *Represents the number of papers submitted from 1 January to 16 November 2025 (highest number of submissions per year to date). **Represents the number of papers accepted from 1 January to 16 November 2025 (includes those submitted last year but accepted this year).*

The year started with a special issue on *Generative AI and Learning Analytics*, edited by Hassan Khosravi, Antonette Shibani, Jelena Jovanovic, Zachary A. Pardos, and Lixiang Yan. The ten papers published in this issue investigated how AI-powered tools and methods enhance student engagement, inform LA methodologies, and provide adaptive feedback and interventions to improve learning outcomes. In addition, this issue also published ten regular research papers, making it the largest issue published to date.

The second issue of the year contained a special section too, on the topic of *Human Creativity and Learning Analytics*, focused on the unique role that Learning Analytics plays in studying human creativity, especially to answer: "What is creativity?", "How can it be measured?", and "Why is creativity related to the context we study?" This special issue, edited by Arnon Hershkovitz, Davide Fossati, and Nilufar Baghaei, contains six papers. In addition, this issue published 12 regular research papers on a diverse set of topics, ranging from course load analytics interventions and multimodal collaboration analytics to interpretable predictive analytics, student-facing dashboards for online and distance learning, AI regulation, and the role of machine learning models in student performance prediction.

Finally, the current issue and the last of the year, is a regular issue containing seven research papers on a variety of topics related to explainability, transparency and fairness (Liu et al., 2025; Sepp, 2025; Cheng et al., 2025), predictive analytics (Yu et al., 2025; Michos et al., 2025), the use of learning analytics for identification of at risk students (Dai et al., 2025) and a systematic review of the use augmented reality enhanced learning analytics in education (Singh et al., 2025).

**Table 2.** Details of Papers Published in 2025 by Issue

| | Research Papers | Special Section Papers | Contributing Authors | Countries Represented |
|---|---|---|---|---|
| Volume 12.1 | 10 | 10 | 99 | 14 |
| Volume 12.2 | 6 | 12 | 61 | 13 |
| Volume 12.3 | 7 | – | 28 | 3 |

**Table 3.** Country of Residence of 170 JLA Authors of Papers Published in 2025

| Country | Authors | Country | Authors |
|---|---|---|---|
| Australia | 31 | Korea | 1 |
| Brazil | 1 | Mexico | 2 |
| Chile | 1 | Netherlands | 9 |
| China | 2 | Norway | 9 |
| Columbia | 2 | Poland | 1 |
| Finland | 5 | Singapore | 8 |
| Germany | 3 | Switzerland | 3 |
| Great Britain | 13 | South Africa | 1 |
| Hong Kong | 1 | Spain | 7 |
| Israel | 6 | USA | 62 |
| Italy | 2 | | |

## Declaration of Conflicting Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this paper.

## Funding

The authors declared no financial support for the research, authorship, and publication of this article.

## Acknowledgments

To all the colleagues who have contributed to the journal's publications this year.

## References

Ahn, J., Campos, F., Hays, M., & DiGiacomo, D. (2019). Designing in context: Reaching beyond usability in learning analytics dashboard design. *Journal of Learning Analytics, 6*(2), 70–85. https://doi.org/10.18608/jla.2019.62.5a

Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on Psychological Science, 1*(2), 164–180. https://doi.org/10.1111/j.1745-6916.2006.00011.x

Celik, I., Kontkanen, S., Laru, J., & Dalyanci, A. A. (2025). Co-constructing adaptive lesson plans with GenAI: Pre-service teachers' Intelligent-TPACK and prompt engineering strategies. *Computers & Education, 241*, 105485. https://doi.org/10.1016/j.compedu.2025.105485

Cheng, Y., Fan, Y., Li, X., Chen, G., Gašević, D., & Swiecki, Z. (2025). Asking generative artificial intelligence the right questions improves writing performance. *Computers and Education: Artificial Intelligence, 8*, 100374. https://doi.org/10.1016/j.caeai.2025.100374

Cheng, A., Pei, B., Liu, C. (2025). Balancing Act: Early, Fair, and Accurate Identification of At-Risk Students. *Journal of Learning Analytics, 12*(3), 47–65. https://doi.org/10.18608/jla.2025.8761

Code, J. (2020). Agency for learning: Intention, motivation, self-efficacy and self-regulation. *Frontiers in Education, 5*, Article 19. https://doi.org/10.3389/feduc.2020.00019

Dai, W., Lin, J., Ji-Yoon, F., Tsai, Y., Srivastav, N., LeBodic, P., Gašević, D., & Chen, G. (2025). Learning Analytics for Early Identification of At-Risk Students and Feedback Intervention. *Journal of Learning Analytics, 12*(3), 102–125. https://doi.org/10.18608/jla.2025.8735

European Data Protection Supervisor. (2025, September 23). TechDispatch #2/2025 — Human oversight of automated decision-making: Active involvement and meaningful intervention. https://www.edps.europa.eu/data-protection/our-work/publications/techdispatch/2025-09-23-techdispatch-22025-human-oversight-automated-making_en

EU. (2024). *Regulation (EU) 2024/1689 on artificial intelligence* (Artificial Intelligence Act). Official Journal of the European Union. European Parliament and Council. https://op.europa.eu/en/publication-detail/-/publication/d79f3e5d-41bc-11f0-b9e2-01aa75ed71a1/language-en

Fan, Y., Tang, L., Le, H., Shen, K., Tan, S., Zhao, Y., Shen, Y., Li, X., & Gašević, D. (2025). Beware of metacognitive laziness: Effects of generative artificial intelligence on learning motivation, processes, and performance. *British Journal of Educational Technology, 56*(2), 489–530. https://doi.org/10.1111/bjet.13544

Giannakos, M., Azevedo, R., Brusilovsky, P., Cukurova, M., Dimitriadis, Y., Hernandez-Leo, D., … Rienties, B. (2024). The promise and challenges of generative AI in education. *Behaviour & Information Technology*, *44*(11), 2518–2544. https://doi.org/10.1080/0144929X.2024.2394886

Handa, K., Bent, D., Tamkin, A., McCain, M., Durmus, E., Stern, M., Schiraldi, M., Huang, S., Ritchie, S., Syverud, S., Jagadish, K., Vo, M., Bell, M., & Ganguli, D. (2025). *Anthropic education report: How university students use Claude.* Anthropic. https://www.anthropic.com/news/anthropic-education-report-how-university-students-use-claude

Jia, W., & Pun, J. (2025). Exploring EMI teachers' agency in addressing language-related challenges with ChatGPT: A multiple case study. *Computer Assisted Language Learning*, 1–29. https://doi.org/10.1080/09588221.2025.2511061

Kahn, P., Carrigan, M., Smith, P., Murtagh, L., Liu, R., & Song, F. (2025). Teacher agency and generative artificial intelligence: Teaching in higher education as a responsive, cultural activity. *Learning, Media and Technology*, 1–12. https://doi.org/10.1080/17439884.2025.2575993

Li, T., Nath, D., Cheng, Y., Fan, Y., Li, X., Raković, M., Khosravi, H., Swiecki, Z., Tsai, Y.-S., & Gašević, D. (2025). Turning real-time analytics into adaptive scaffolds for self-regulated learning using generative artificial intelligence. In *Proceedings of the 15th International Learning Analytics and Knowledge Conference* (LAK '25) (pp. 667–679). ACM. https://doi.org/10.1145/3706468.3706559

Liu, Z., Xing, W., Jiao, X., & Li, C. (2025). Exploring Fairness and Explainability in LLM-Generated Support for Online Learning Discussion Forums. *Journal of Learning Analytics, 12*(3), 8–33. https://doi.org/10.18608/jla.2025.8885

Mavrikis, M., Cukurova, M., Di Mitri, D., Schneider, J., & Drachsler, H. (2021). A short history, emerging challenges and co-operation structures for artificial intelligence in education. *Bildung und Erziehung, 74*(3), 249–263. https://doi.org/10.13109/buer.2021.74.3.249

Michos, K., Schmit, M., & Petko, D. (2025) Learning Analytics in Schools: Is Digital Data Use Influenced by Teacher-Level or School-Level Factors? *Journal of Learning Analytics, 12*(3), 87–101. https://doi.org/10.18608/jla.2025.8567

Molenaar, I. (2022). Towards hybrid human–AI learning technologies. *European Journal of Education, 57*(4), 542–555. https://doi.org/10.1111/ejed.12527

Mouta, A., Pinto-Llorente, A. M., & Torrecilla-Sánchez, E. M. (2025). "Where is agency moving to?": Exploring the interplay between ai technologies in education and human agency. *Digital Society*, 4, 49. https://doi.org/10.1007/s44206-025-00203-9

Pallant, J. L., Blijlevens, J., Campbell, A., & Jopp, R. (2025). Mastering knowledge: The impact of generative AI on student learning outcomes. *Studies in Higher Education*, 1–22. https://doi.org/10.1080/03075079.2025.2487570

Paulsen, L., & Lindsay, E. (2024). Learning analytics dashboards are increasingly becoming about learning and not just analytics: A systematic review. *Education and Information Technologies*, *29*(11), 14279–14308. https://doi.org/10.1007/s10639-023-12401-4

Prieto, L. P., Viberg, O., Yip, J. C., & Topali, P. (2025). Aligning human values and educational technologies with value-sensitive design. *British Journal of Educational Technology 56*(4), 1295–1310. https://doi.org/10.1111/bjet.13602

Schneiderman, B. (2020). Human-centered artificial intelligence: Reliable, safe & trustworthy. arXiv. https://arxiv.org/abs/2002.04087

Sepp, S. (2025). Towards More Transparency in Learning Analytics: Sharing Information with University Students Increases their Awareness of Data Collection Practices. *Journal of Learning Analytics, 12*(3), 34–46. https://doi.org/10.18608/jla.2025.8713

Singh, M. Bangay, S., & Sajjanhar, A. (2025) Augmented Reality Enhanced Analytics for Education: a Systematic Review. *Journal of Learning Analytics, 12*(3), 126–155. https://doi.org/10.18608/jla.2025.8447

Stadler, M., Bannert, M., & Sailer, M. (2024). Cognitive ease at a cost: LLMs reduce mental effort but compromise depth in student scientific inquiry. *Computers in Human Behavior, 160*, 108386. https://doi.org/10.1016/j.chb.2024.108386

Sterz, S., Baum, K., Biewer, S., Hermanns, H., Lauber-Rönsberg, A., Meinel, P., & Langer, M. (2024). On the quest for effectiveness in human oversight: Interdisciplinary perspectives. In *FAccT '24: Proceedings of the 2024 ACM Conference on Fairness, Accountability, and Transparency* (pp. 2495–2507). ACM. https://doi.org/10.1145/3630106.3659051

Tan, X., Cheng, G., & Ling, M. H. (2025). Artificial intelligence in teaching and teacher professional development: A systematic review. *Computers and Education: Artificial Intelligence, 8*, 100355. https://doi.org/10.1016/j.caeai.2024.100355

Viberg, O., Jivet, I., & Scheffel, M. (2023). Designing culturally aware learning analytics: A value-sensitive perspective. In *Practicable learning analytics* (pp. 177–192). Springer International Publishing. https://doi.org/10.48550/arXiv.2212.09645

Xu, X., Qiao, L., Cheng, N., Liu, H., & Zhao, W. (2025). Enhancing self-regulated learning and learning experience in generative AI environments: The critical role of metacognitive support. *British Journal of Educational Technology, 56*(5), 1842–1863. https://doi.org/10.1111/bjet.13599

Yan, L., Martinez-Maldonado, R., & Gašević, D. (2024). Generative artificial intelligence in learning analytics: Contextualising opportunities and challenges through the learning analytics cycle. In *Proceedings of the 14th Learning Analytics and Knowledge Conference* (pp. 101–111). ACM. https://doi.org/10.1145/3636555.363685

Yildiz Durak, H., Eğin, F., & Onan, A. (2025). A comparison of human-written versus AI-generated text in discussions at educational settings: Investigating features for ChatGPT, Gemini and BingAI. *European Journal of Education, 60*(1). https://doi.org/10.1111/ejed.70014

Yu, L., Ha lpin, P. F., Bernacki, M. L., Ren, S., Plumley, R. D., & Greene, J. A. (2025) Interpreting Predictive Learning Sequences in a College Math Course through a Self-Regulated Learning Framework. *Journal of Learning Analytics, 12*(3), 66–86. https://doi.org/10.18608/jla.2025.8865