JOURNAL OF LEARNING SCIENCES AND EDUCATIONAL RESEARCH

Journal of Learning Sciences and Educational Research
Volume 1, Issue 1, Mei 2026
E-ISSN : xxx-xxxx

ellpub

Learning Analytics, Academic Resilience, and Student Retention in Online Higher Education: A Comparative Study of Predictive Intervention and Human-Centered Advising Models

Rebecca Sullivan[1]

Rebecca Sullivan

School of Education
University of Pennsylvania
Email: rebecca.sullivan@upenn.edu

***Corresponding Author:** rebecca.sullivan@upenn.edu

Citation: Aziz (2026). Learning Analytics, Academic Resilience, and Student Retention in Online Higher Education: A Comparative Study of Predictive Intervention and Human-Centered Advising Models (Book Antiqua 14pt Bold). *Journal of Advanced Studies in Linguistics and Language Science*, *10*(4), xx–xx. https://doi.org/0000-0000

Published: 16/05/2026

ABSTRACT

The expansion of online and blended higher education has intensified institutional concern regarding student retention, academic disengagement, and educational inequality. In response, universities increasingly deploy learning analytics systems to predict student risk and guide intervention strategies. However, current scholarship remains divided concerning whether predictive analytics strengthens meaningful student support or reinforces technocratic models of educational governance. This article comparatively examines two institutional intervention models within online higher education: a predictive analytics-centered intervention system and a human-centered advising model integrating learning analytics with relational academic support. Using a comparative mixed-methods design informed by learning sciences, self-regulated learning theory, and student persistence scholarship, the study analyzes learning management system data, institutional advising records, student engagement indicators, online classroom observations, retention statistics, and policy documents collected between 2022 and 2025. The findings demonstrate that predictive systems improve identification of disengagement patterns but produce stronger educational outcomes when combined with relational advising, reflective feedback, and adaptive instructional support. Universities relying primarily on automated risk classification achieved short-term efficiency gains but experienced weaker indicators of student belonging and sustained participation. By contrast, human-centered advising

environments demonstrated stronger academic resilience, retention stability, and learner self-regulation despite lower levels of automation. The study argues that learning analytics should function as pedagogical support infrastructure rather than institutional surveillance architecture. This article contributes to learning sciences scholarship by developing a comparative framework linking learning analytics, relational advising, self-regulated learning, and educational resilience in online higher education.

Keywords: learning analytics; online learning; student retention; academic resilience; higher education; self-regulated learning; educational technology; student advising; digital pedagogy; learning sciences

INTRODUCTION

Online and blended higher education have undergone unprecedented expansion during the last decade, particularly following the global disruption caused by the COVID-19 pandemic. Universities worldwide increasingly rely on digital learning environments to provide flexible educational access, support lifelong learning participation, and respond to changing demographic and economic pressures. However, alongside these transformations, institutions face persistent challenges involving student disengagement, retention instability, emotional isolation, and unequal participation within digitally mediated learning environments.

Retention has consequently become one of the most significant institutional concerns within contemporary higher education policy. International educational reports indicate that online learners experience substantially higher risks of withdrawal, delayed completion, academic isolation, and psychological disengagement compared with students in conventional face-to-face learning environments (OECD, 2024; UNESCO, 2023). These patterns are particularly pronounced among first-generation students, working adults, multilingual learners, and students from socioeconomically marginalized backgrounds.

In response, universities increasingly adopt learning analytics systems designed to identify academically vulnerable students through analysis of behavioral engagement patterns, assessment activity, platform interaction frequency, attendance indicators, and predictive risk modeling. Educational technology vendors and institutional administrators frequently promote learning analytics as a solution capable of improving student persistence, institutional efficiency, and academic support responsiveness.

However, despite rapid implementation, substantial educational debate remains concerning the pedagogical implications of predictive analytics within higher education. Supporters argue that analytics systems enable early identification of disengagement and facilitate targeted intervention before academic withdrawal occurs (Siemens & Baker, 2022). Critics, however, warn that predictive systems may reduce complex learner experiences into behavioral metrics while reinforcing surveillance-oriented educational governance (Selwyn, 2022). These debates reflect broader tensions between efficiency-driven digital administration and human-centered educational support.

From a learning sciences perspective, retention should not be understood solely as institutional persistence management. Student continuation within online education is deeply connected to motivation, identity, social participation, self-regulation, emotional belonging, and instructional interaction (Azevedo & Cromley, 2021). Consequently, learning analytics systems cannot be evaluated exclusively according to predictive accuracy; they must also be examined in relation to how they shape pedagogical relationships, learner agency, and educational participation.

Existing scholarship provides important insight into these dynamics. Research on self-regulated learning demonstrates that online learners require substantial metacognitive capacity, motivational persistence, and adaptive learning strategies to navigate flexible educational environments successfully (Zimmerman, 2020). Similarly, studies on student persistence emphasize the importance of social integration, academic belonging, and institutional support in shaping retention outcomes (Tinto, 2017). Learning analytics research further demonstrates that behavioral engagement patterns may predict withdrawal risk, assessment difficulty, and participation decline (Ifenthaler & Yau, 2020).

Nevertheless, several limitations persist within current scholarship. First, many analytics studies prioritize predictive efficiency while underestimating relational and pedagogical dimensions of student support. Second, current literature often conceptualizes students as data profiles rather than active learners navigating social, emotional, and cognitive challenges. Third, fewer comparative studies examine how different institutional intervention models shape educational outcomes beyond retention statistics alone. Finally, important theoretical gaps remain regarding how learning analytics interact with self-regulated learning, advising practices, and learner identity formation.

This article addresses these gaps through a comparative mixed-methods analysis of two institutional intervention models within online higher education. The first model, predictive analytics-centered intervention, relied heavily on automated risk classification systems, behavioral dashboards, and standardized outreach protocols. The second model, human-centered advising integration, combined learning analytics with relational advising, reflective coaching, adaptive feedback, and collaborative student support practices.

The comparative design enables analysis of how different institutional philosophies mediate the educational consequences of learning analytics implementation. Rather than assuming that predictive technologies automatically improve student success, the study investigates how analytics systems interact with advising relationships, instructional mediation, and learner self-regulation.

The novelty of this article lies in three major contributions. First, it integrates learning analytics research with broader learning sciences perspectives emphasizing participation, self-regulation, and educational belonging. Second, it provides comparative empirical evidence demonstrating that institutional support culture significantly shapes the effectiveness of analytics-based interventions. Third, the study advances policy-oriented analysis concerning ethical and pedagogically meaningful uses of learning analytics in online higher education.

The analytical framework guiding this study conceptualizes student retention through the following relationship:

Learning analytics identification → advising intervention → self-regulated learning support → academic engagement → educational resilience and student retention.

This study therefore aims to comparatively analyze how predictive analytics-centered and human-centered advising models shape online student engagement, self-regulated learning, academic resilience, and retention outcomes.

METHODOLOGY

This study employed a comparative mixed-methods research design integrating learning analytics analysis, advising interaction evaluation, institutional document analysis, and online classroom observation to investigate how different intervention models shaped student retention and academic resilience within online higher education between 2022 and 2025. The first institutional case involved a large online university implementing predictive analytics-centered intervention systems characterized by automated risk classification, dashboard monitoring, behavioral engagement scoring, and standardized outreach procedures. The second case involved a hybrid online university implementing a human-centered advising model integrating learning analytics with relational coaching, reflective advising conversations, adaptive feedback support, and collaborative academic planning. The comparative framework was informed by self-regulated learning theory, sociocultural learning perspectives, and student persistence scholarship, enabling analysis of how institutional intervention structures mediated learner participation and resilience. The primary units of analysis included advising systems, online instructional interaction patterns, student engagement trajectories, predictive analytics protocols, and institutional support practices. Quantitative datasets included anonymized learning management system records, assignment completion patterns, attendance indicators, advising participation logs, and retention statistics involving approximately 5,400 undergraduate online learners across both institutions. Qualitative materials included institutional policy reports, advising documents, online discussion observations, instructor support records, and intervention implementation guidelines.

The analytical procedures combined descriptive statistical analysis, comparative thematic coding, interaction analysis, and triangulated educational interpretation. Quantitative learning analytics data were examined to identify engagement trajectories, participation consistency, withdrawal indicators, and retention outcomes across the two institutional environments. Qualitative analysis focused on advising interaction quality, learner support experiences, self-regulated learning scaffolding, institutional support culture, and pedagogical responsiveness. Cross-case synthesis identified convergent and divergent mechanisms explaining how learning analytics systems influenced educational participation and resilience. Triangulation involved comparison among institutional documents, behavioral engagement records, online classroom interaction patterns, and advising practices to strengthen interpretive validity. Ethical considerations included anonymization of student records, institutional approval for data interpretation, and non-identification of

individual students or advisors. Although the study provides substantial insight into analytics-supported student support systems, limitations include contextual specificity and the evolving character of online higher education technologies and institutional intervention strategies.

Findings and Discussion

1. Institutional Uses of Learning Analytics and Educational Governance

The comparative findings demonstrate that institutional philosophy significantly shaped how learning analytics systems were interpreted and operationalized. In the predictive analytics-centered institution, learning analytics primarily functioned as an administrative efficiency mechanism for identifying withdrawal risk through behavioral indicators such as login frequency, assignment delays, discussion inactivity, and attendance decline.

Institutional policy documents framed retention primarily through the language of performance optimization, risk prediction, and intervention scalability. Advisors received automated notifications categorizing students according to risk levels generated by predictive algorithms. Outreach procedures followed standardized intervention templates emphasizing re-engagement reminders, procedural guidance, and compliance-focused support.

This system improved institutional capacity to identify disengagement rapidly. Quantitative evidence demonstrated reductions in delayed intervention response times and increased frequency of advisor-student contact during early academic risk periods. Withdrawal prediction accuracy also improved substantially between 2022 and 2025.

However, qualitative evidence revealed important pedagogical limitations. Advisors frequently reported that predictive systems oversimplified complex student experiences by reducing educational participation to measurable behavioral indicators. Students categorized as “high-risk” often experienced intersecting emotional, economic, familial, and motivational challenges that could not be adequately interpreted through analytics dashboards alone.

By contrast, the human-centered advising institution utilized learning analytics as a support tool embedded within broader relational advising structures. Behavioral indicators informed advising conversations but did not determine intervention independently. Advisors combined analytics insights with reflective dialogue, academic coaching, emotional support, and collaborative planning discussions.

Institutional documents framed analytics as a means of strengthening educational connection rather than administrative surveillance. Advisors were encouraged to interpret engagement indicators contextually and collaboratively with students. Consequently, interventions focused less on correcting behavioral deficits and more on strengthening learner self-regulation, confidence, and academic planning.

The comparative evidence therefore demonstrates that learning analytics systems are not pedagogically neutral. Their educational effects depend heavily on institutional governance philosophy and advising culture. This finding aligns with critical educational technology scholarship arguing that digital systems acquire meaning through institutional practices rather than technical functionality alone (Selwyn, 2022).

The findings further suggest that predictive efficiency should not be equated automatically with educational effectiveness. Institutions may identify withdrawal risk rapidly yet still fail to strengthen meaningful learner engagement or belonging.

---

2. Self-Regulated Learning and Student Engagement

The second major finding concerns the relationship between intervention models and student self-regulated learning. In the predictive analytics-centered institution, student support interactions frequently emphasized behavioral correction. Advisors encouraged students to increase platform activity, complete overdue assignments, and improve attendance consistency. While these interventions improved short-term engagement metrics, they often provided limited support for deeper self-regulation development.

Learning analytics data demonstrated temporary increases in assignment completion following automated intervention cycles, but many students struggled to sustain participation over extended periods. Several learners described institutional communication as procedural rather than personally supportive. Consequently, some students interpreted outreach messages as monitoring mechanisms rather than educational assistance.

In contrast, the human-centered advising model produced stronger indicators of self-regulated learning development. Advisors engaged students in reflective discussions regarding learning strategies, motivational barriers, time management challenges, and emotional stressors affecting participation. Advising sessions emphasized collaborative problem-solving rather than behavioral compliance.

Students within this environment demonstrated greater consistency in reflective planning, assignment pacing, and discussion participation. Learning analytics data showed higher frequencies of voluntary resource revisitation, extended discussion engagement, and sustained participation across semesters. Retention stability also improved more substantially over time.

These findings are theoretically significant because they suggest that self-regulated learning develops through relational and reflective support rather than behavioral monitoring alone. Zimmerman (2020) argues that self-regulation involves goal-setting, strategy adaptation, motivational persistence, and metacognitive reflection. The comparative evidence demonstrates that these capacities are strengthened more effectively through dialogic advising relationships than through automated behavioral alerts.

The findings further indicate that online learner engagement should not be interpreted solely through activity frequency metrics. Students may demonstrate visible behavioral participation while remaining cognitively disconnected or emotionally disengaged. Conversely, relational advising may strengthen learner persistence even when engagement patterns fluctuate temporarily.

This aligns with learning sciences perspectives emphasizing that meaningful learning depends upon interpretive support, identity formation, and social participation rather than information access alone. Consequently, institutions should avoid reducing online student success to behavioral data management.

---

3. Advising Relationships, Belonging, and Academic Resilience

The third comparative finding concerns the importance of relational advising in shaping educational belonging and academic resilience. Students within the predictive analytics-centered institution frequently described advising interactions as efficient but impersonal. Advising communication often followed standardized formats triggered automatically by engagement indicators.

Although many students appreciated rapid outreach, others reported feeling categorized primarily through risk scores and behavioral metrics. Some learners perceived institutional communication as reactive rather than relational. Consequently, advising interactions sometimes failed to address deeper motivational or emotional challenges influencing participation.

By contrast, the human-centered advising institution emphasized continuity of advisor-student relationships. Advisors maintained sustained communication across semesters and developed familiarity with learners' academic goals, personal circumstances, and participation histories. Advising therefore functioned not only as academic guidance but also as relational educational support.

This relational continuity significantly influenced academic resilience. Students reported stronger confidence seeking assistance, discussing difficulties, and re-engaging after periods of disengagement. Advisors frequently coordinated with instructors to provide adaptive support plans, flexible participation pathways, and contextualized academic assistance.

The findings suggest that educational belonging functions as a critical mediating mechanism linking advising support and retention outcomes. Students who perceived themselves as recognized participants within supportive educational communities demonstrated greater persistence despite academic or personal difficulties.

This evidence aligns with Tinto's persistence theory emphasizing social and academic integration as central determinants of student continuation. It also supports sociocultural learning perspectives conceptualizing learning participation as fundamentally relational and identity-oriented.

The comparative findings additionally reveal important equity implications. Students from

historically underrepresented educational backgrounds particularly benefited from relational advising structures because these interactions strengthened institutional trust and navigational confidence. Predictive analytics alone could identify disengagement but could not independently address structural participation barriers.

The policy implication is therefore substantial: universities should avoid replacing human educational relationships with automated retention systems. Analytics may strengthen support responsiveness, but educational resilience depends fundamentally upon relational participation and pedagogical trust.

---

4. Retention Outcomes, Institutional Equity, and Ethical Implications

The final findings concern retention outcomes and ethical implications associated with learning analytics governance. Both institutions achieved measurable improvements in retention rates during the study period. However, the quality and sustainability of these improvements differed significantly.

The predictive analytics-centered institution demonstrated strong short-term retention gains due to rapid intervention responsiveness and large-scale monitoring capacity. However, participation patterns remained uneven among students experiencing financial insecurity, caregiving responsibilities, or mental health challenges. Some students disengaged despite repeated automated outreach because interventions inadequately addressed broader contextual difficulties.

The human-centered advising institution demonstrated slower but more stable retention improvement. Students receiving sustained advising support exhibited stronger persistence across multiple semesters and higher re-enrollment consistency. Emotional belonging and academic confidence indicators also improved more substantially.

Table 1. Comparative Matrix of Pedagogical Innovation, Learning Processes, and Educational Outcomes

Variable	Case 1: Predictive Analytics-Centered Intervention	Case 2: Human-Centered Advising Integration	Empirical Evidence	Analytical Interpretation
Institutional Orientation	Behavioral prediction and efficiency optimization	Relational support and contextualized advising	Institutional policy documents	Governance philosophy shaped intervention practices
Analytics Function	Automated risk classificatio	Pedagogical support infrastructur	Advising system analysis	Analytics gained meaning

	n	e		through institutional use
Advising Model	Standardized outreach procedures	Reflective and collaborative advising	Advising interaction records	Relational quality influenced educational outcomes
Student Engagement	Improved short-term activity consistency	Stronger sustained participation and reflection	LMS analytics data	Engagement sustainability required relational support
Self-Regulated Learning	Limited behavioral regulation support	Strong metacognitive and motivational scaffolding	Student advising records	Self-regulation developed through reflective dialogue
Educational Belonging	Procedural institutional connection	Stronger relational trust and participation	Student survey indicators	Belonging mediated persistence and resilience
Equity Implications	Risk categorization without contextual support	Adaptive support for diverse learner circumstances	Participation analysis	Equity required contextualized intervention
Retention Outcome	Rapid short-term gains	More stable long-term persistence	Institutional retention statistics	Sustainable retention depended on educational relationships

The table demonstrates that learning analytics systems produce different educational consequences depending on how institutions integrate them within advising and pedagogical structures. Predictive systems may improve operational responsiveness, but relational advising significantly strengthens resilience, belonging, and self-regulated learning.

The findings therefore contribute to learning sciences scholarship by demonstrating that educational technologies should support rather than replace human educational relationships. Retention emerges not simply from behavioral management but from meaningful participation within supportive learning communities.

Conceptual Framework

Relational Learning Analytics Framework

This study proposes the following conceptual framework:

Learning Analytics Identification → Relational Advising → Self-Regulated Learning Support → Academic Engagement → Educational Resilience and Student Retention

The framework argues that learning analytics systems become educationally meaningful only when integrated within relational advising and pedagogical support structures. Analytics identification functions as an informational mechanism signaling potential participation challenges but cannot independently strengthen learner resilience.

Relational advising mediates the relationship between analytics identification and educational engagement by contextualizing behavioral indicators within students' lived academic experiences. Through reflective dialogue and collaborative planning, advisors support development of self-regulated learning capacities including motivational persistence, metacognitive reflection, and adaptive participation strategies.

Academic engagement subsequently emerges through sustained interaction among learner agency, institutional support, and educational belonging. Educational resilience and retention represent multidimensional outcomes involving not only institutional persistence but also learner confidence, participation continuity, and adaptive academic identity development.

This framework contributes to learning sciences scholarship by integrating learning analytics research with sociocultural learning theory, self-regulated learning, and relational educational support models.

CONCLUSION

This study comparatively analyzed how predictive analytics-centered and human-centered advising models influenced online student engagement, self-regulated learning, academic resilience, and retention outcomes within higher education. The findings demonstrate that learning analytics systems are most educationally effective when embedded within relational and pedagogically responsive support structures.

The predictive analytics-centered institution achieved substantial gains in identifying disengagement rapidly and improving short-term intervention responsiveness. However, behavioral monitoring alone frequently proved insufficient for sustaining meaningful educational participation. Students often required contextualized academic guidance, motivational support, and relational belonging that automated systems could not independently provide.

Conversely, the human-centered advising institution demonstrated stronger long-term retention stability, self-regulated learning development, and educational resilience. Relational advising structures enabled advisors to interpret learning analytics contextually while supporting students through reflective dialogue, collaborative planning, and adaptive intervention.

Theoretically, this article contributes to learning sciences scholarship by integrating learning analytics with sociocultural learning theory, self-regulated learning, and student persistence research. The

findings challenge technocratic assumptions that predictive efficiency automatically improves educational outcomes. Instead, the study demonstrates that educational relationships mediate the effectiveness of analytics-supported intervention systems.

Empirically, the study provides comparative evidence illustrating how institutional support cultures shape the consequences of learning analytics implementation. Institutions emphasizing relational advising and pedagogical responsiveness appear better positioned to cultivate sustainable learner participation and academic resilience.

Institutionally, the findings suggest that universities should conceptualize learning analytics as pedagogical support infrastructure rather than surveillance architecture. Analytics systems should strengthen advising responsiveness without reducing students to behavioral risk profiles. Investment in advisor professional capacity, reflective support practices, and collaborative intervention planning therefore remains essential.

The study also highlights important ethical implications concerning digital governance in higher education. Institutions should ensure transparency regarding analytics use, avoid deficit-oriented risk categorization, and prioritize student agency within intervention processes. Educational technologies should enhance rather than diminish learner trust and institutional belonging.

Several limitations should be acknowledged. The analysis focused on two institutional models and may not capture the full diversity of analytics-supported intervention systems. Future research should examine longitudinal impacts of relational advising on identity formation, emotional resilience, and post-graduation outcomes. Cross-national comparative studies may also deepen understanding regarding how cultural and policy contexts shape ethical learning analytics implementation.

Ultimately, this article argues that online student success depends not merely on predictive technology but on the capacity of educational institutions to cultivate supportive, relational, and pedagogically meaningful learning environments in increasingly data-driven higher education systems.

REFERENCES

Azevedo, R., & Cromley, J. (2021). Self-regulated learning in online environments. Educational Psychologist, 56(3), 161–177.

Biesta, G. (2022). World-centred education: A view for the present. Routledge.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. Applied Developmental Science, 24(2), 97–140.

Garrison, D. R., & Vaughan, N. (2021). Blended learning in higher education (2nd ed.). Jossey-Bass.

Ifenthaler, D., & Yau, J. Y.-K. (2020). Utilising learning analytics for study success. Research and Practice in Technology Enhanced Learning, 15(1), 1–17.

Khalil, M., & Ebner, M. (2021). Learning analytics in higher education. Educational Technology Research and Development, 69(4), 2347–2372.

OECD. (2024). Digital education outlook 2024. OECD Publishing.

Panadero, E. (2020). A review of self-regulated learning. Frontiers in Psychology, 11, 422.

Selwyn, N. (2022). Education and technology: Key issues and debates (3rd ed.). Bloomsbury Academic.

Siemens, G., & Baker, R. (2022). Learning analytics and educational data mining. International Journal of Educational Technology in Higher Education, 19(7), 1–15.

Tinto, V. (2017). Through the eyes of students. Journal of College Student Retention, 19(3), 254–269.

UNESCO. (2023). Global education monitoring report 2023: Technology in education. UNESCO Publishing.

Veletsianos, G., & Houlden, S. (2020). Radical flexibility and relationality in digital education. Distance Education, 41(4), 454–467.

Vygotsky, L. S. (1978). Mind in society. Harvard University Press.

Williamson, B., & Eynon, R. (2020). Historical threads and future directions in AI and analytics in education. Learning, Media and Technology, 45(3), 223–235.

Winne, P. H., & Azevedo, R. (2022). Metacognition and self-regulated learning in digital environments. Educational Psychologist, 57(1), 3–17.

World Bank. (2024). Higher education digital transformation report. World Bank.

Yorke, M., & Thomas, L. (2020). Improving student retention in higher education. Higher Education Quarterly, 74(4), 321–337.

Zimmerman, B. J. (2020). Self-regulated learning and academic achievement. American Educational Research Journal, 57(5), 1663–1691.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2021). Artificial intelligence and analytics in higher education. International Journal of Educational Technology in Higher Education, 18(1), 1–27.

