AERA SIG
Studying and Self-Regulated Learning

Advances in Technology - Affordances & Constraints

Editors
Allyson Pitzel
Lauren Cabrera

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Letter From the Chairs

Michelle Taub & Aloysius Anyichie

University of Central Florida & Brandon University

Michelle Taub

Aloysius Anyichie

Dear Members of the SSRL SIG,

We are pleased to present the Fall 2025 newsletter showcasing the exceptional research by the members of our SIG related to technology and self-regulated learning. This issue highlights six studies that present cutting-edge research using multimodal and multichannel data analytics to investigate self-, co-, shared, and external-regulated learning processes across different learning contexts.

The contributions examine adherence to course design in undergraduate biology, the interplay between help seeking and GenerativeAI, using a time-series approach to model metacognitive accuracy within an intelligent tutoring system, the development of a web-based tool to support collaborative learning, middle schoolers' views on AI-based conversational agents, and a systematic review of using multimodal data analytics to measure SRL. We take pride in such a diverse SIG that highlights the outstanding research from all academic levels.

We are excited to announce our SIG hosted 2 webinars this Fall:

1. The SSRL SIG presents: *Advances in Technology – Affordances & Constraints*
   This webinar discussed the research showcased in this newsletter by having a series of panelists share their thoughts about how technology, AI and GenAI can be used to enhance SRL

2. The SSRL SIG Graduate Student Committee presented: *Translating Self-regulated Learning Research into the Classroom.*
   Panelists shared their perspectives on conducting self-regulated learning research in school-based settings and integrating self-regulated learning into the classroom

Thank you to all who joined!

Wishing everyone a great rest of the Fall semester. Thank you all for your inspiring work and continued support of our SIG!

Michelle & Aloy

Letter From the Editors

Allyson Pitzel & Lauren Cabrera

University of Alabama & University of Michigan

Allyson Pitzel

Lauren Cabrera

Welcome to our Fall 2025 edition of the SSRL SIG Newsletter! We are thrilled you are taking the time to read this issue and hope you will find the scholarly contributions valuable and insightful. This issue focuses on the intersection of educational technologies and self-regulated learning, focusing on GenerativeAI. In this fast-moving subset of the field, we wanted to highlight how this technology helps move the field forward as well as how it falls short in enhancing or replacing human factors.

We hope that as you read the contributions provided by these scholars, you will feel inspired to continue to collaborate in research practices that will serve learners, educators, practitioners, and fellow researchers within the scope of self-regulated learning.

A huge thank you to our contributors for sharing your insights and new research! Your time and experiences are greatly appreciated and make this newsletter possible!

We are always interested in your feedback on this issue and upcoming issues of the newsletter. Please feel free to send us an email if you have any suggestions for future topics.

All the best,
Allyson and Lauren
(aapitzel@ua.edu, lncab@umich.edu)

Technology Publications and SRL

"Designing Regulation: Technology-Enhanced Support for Collaborative Learning"

Nikki G. Lobczowski, Kayley Lyons

Assistant Professor, McGill University; Director, Master of Public Health, Melbourne School of Population and Global Health

Their research investigates how students regulate emotion, cognition, and motivation in collaborative learning environments, with a particular emphasis on socioemotional (Lobczowski) and motivational (Lyons) processes. With regards to technology integration, they center design-based research (DBR) to develop and study tools that scaffold social regulation of learning (SoRL), emphasizing iterative design grounded in theory and authentic classroom contexts. Their approach prioritizes building partnerships with educators and learners to co-design interventions that are responsive to users' needs. Beyond their work with *Collabucate*, they have examined socially shared metacognition, scientific discourse, and grouping effects in classroom dialogue, using mixed methods to explore how regulation strategies shape engagement and learning. Their future work aims to extend these insights by integrating adaptive technologies and collaborative design to support regulation in diverse educational contexts.

Recent Publication:

Title: Using a Design-Based Research Approach to Develop and Study a Web-Based Tool to Support Collaborative Learning

Summary: In their 2021 design-based research article in Computers & Education, they described the development and iterative refinement of *Collabucate*, a web-based tool designed to support social regulation of learning (SoRL) in collaborative learning environments. Building on Järvelä et al.'s (2015) three design principles—promoting metacognitive awareness, supporting externalization, and prompting regulatory strategy use—they introduced a fourth: explicit instruction of group-level regulation strategies. Implemented with Doctor of Pharmacy students across two cycles, Collabucate scaffolded individual and group assessments of cognitive, motivational, and emotional challenges, delivered tailored strategy instruction, and facilitated group planning through a "Take Ten" feature.

Affordances included increased social awareness, reduced discomfort around regulation, and just-in-time delivery of personalized strategies. The fourth principle—explicit instruction—proved especially valuable, as students reported learning new strategies they would not have otherwise considered. The technology enabled timely, context-sensitive support that aligned with students' evolving group dynamics.

Constraints included technical usability issues, limited perceived relevance for high-functioning groups, and challenges in strategy applicability. Students requested more adaptive prompts and evidence-based rationales. This study demonstrates how technology can operationalize SoRL principles while offering

tailored, actionable support for collaborative regulation—highlighting the potential of digital tools to bridge the gap between awareness and enactment in SRL.

Reference:

Lyons, K., Lobczowski, N. G., Greene, J. A., McLaughlin, J. E. (2021). Using a design-based research approach to develop and study a web-based tool to support collaborative learning. *Computers & Education, 161*. doi: 10.1016/j.compedu.2020.104064.

The nexus of AI and pedagogy: Fostering durable, regulative skills for the future

Dr. Dalila Dragnić-Cindrić

Senior Research Scientist, Center for Learning Sciences Research, Digital Promise

Dragnić-Cindrić's research centers on the critical intersection of self-regulated learning, socially shared regulation of learning, and emerging AI-driven educational technologies. As adaptive systems offer automated feedback and personalized learning paths, they fundamentally alter the classroom dynamics. She focuses on how students and collaborating peers maintain their agency and develop productive regulative skills as they navigate narrative-centered learning environments that include AI-driven agents. This is crucial because over-reliance on opaque AI can inadvertently undermine learners' ability to plan, monitor, and reflect on their learning. Dragnić-Cindrić also explores the ethical dimensions of AI in learning and concrete frameworks to help educators thoughtfully implement and customize AI-driven learning environments. Her goal is to ensure that technology empowers rather than usurps students and teachers, creating a future where learners are authentic agents and authors of their own educational journey.

Recent Publication:

Title: Integrating Youth Perspectives into the Design of AI-Supported Collaborative Learning Environments

Summary: The rapid development of generative AI technologies demands greater awareness of their benefits and pitfalls in education. This study investigated middle schoolers' views on AI-based conversational agents by conducting semi-structured focus groups. The students first discussed AI in general, then played an AI-driven, narrative-centered science game, SciStory: Pollinators, to investigate a socio-scientific issue.

Thematic analysis showed that students recognized that:

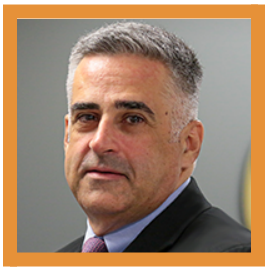
- AI can provide personalized, adaptable support based on individual needs and interests.
- AI can make learning more engaging.
- Educational AI use needs to be safe and equitable, addressing concerns about privacy, data security, and unequal access to resources.
- AI could be a helpful teacher's assistant, supporting teachers with classroom management and freeing them up to provide more individualized student support.
- AI often falls short when it tries to mimic human qualities like emotionality and intelligence, suggesting a clear distinction between the suitable roles of humans and AI in the classroom.

The students' insights reflected their desire for agency and understanding of how they could actively control their learning experience with help from both teachers and AI. Including students in the co-design of AI-based educational games supports this agency, enabling them to envision a future with more active and meaningful learning.

Reference:

Humburg, M., Dragnić-Cindrić, D., Hmelo-Silver, C.E.; Glazewski, K., Lester, J.C., Danish, J.A. (2024). Integrating Youth Perspectives into the Design of AI-Supported Collaborative Learning Environments. *Education Sciences, 14*, 1197. https://doi.org/10.3390/educsci1411119

Metacognition in the Age of AI: Modeling Self-Regulated Learning with Human Digital Twins and Simulated Learners



Roger Azevedo

Pegasus Professor, School of Modeling Simulation and Training, University of Central Florida

Dr. Roger Azevedo, Pegasus Professor at the University of Central Florida's School of Modeling, Simulation, and Training, conducts groundbreaking research at the intersection of learning and cognitive sciences, modeling and simulation, metacognition, and self-regulated learning (SRL). His scholarship leverages AI, multimodal data analytics, and advanced learning technologies to model, simulate, and enhance metacognition, as well as cognitive, affective, motivational, and social SRL processes. Azevedo's work explores how AI-powered pedagogical agents, human digital twins, and simulated learners can scaffold SRL processes like planning, monitoring, and reflection using multimodal data streams. These include log files, eye-tracking, physiological signals, facial expressions, audio and video recordings of learner-system interactions, and natural language. His human digital twins framework creates symbolic digital replicas of humans that can replicate and simulate human characteristics like SRL, reasoning, problem-solving, and learning in digital environments through human-machine symbiosis. He applies this approach across domains, including developing HDTs to support healthcare professionals' clinical decision-making in immersive virtual environments and designing simulations to teach learners to self-regulate during complex problem-solving, demonstrating the practical applications of his research.

Recent Publication:

Title: A Systematic Review of Self-Regulated Learning Through Integration of Multimodal Data and Artificial Intelligence

Summary: This 2025 systematic review is a significant contribution to the field as it addresses a critical gap in understanding how different data streams and modalities contribute to measuring self-regulated learning (SRL) processes across diverse learning contexts. The review pursues two main objectives: first, identifying which data streams and modalities researchers have used to capture cognitive, affective, metacognitive, and motivational (CAMM) processes underlying SRL; and second, examining how multimodal data analytics have been applied to capture the temporal and sequential characteristics of these processes across study contexts. Studies were mapped onto the Self-Regulated Learning Processes, Multimodal Data, and Analysis (SMA) grid, a two-dimensional framework with CAMM processes on one axis and multimodal data streams on the other. This framework builds on earlier work that visualized relationships between data streams and SRL measurement approaches, showing how the field has evolved from analyzing single SRL processes with one data stream using simple statistics to more sophisticated approaches examining multiple processes with multiple data streams using advanced AI techniques. The review underscores the growing importance of interdisciplinary collaboration in the field, highlighting the significant role it plays in advancing SRL measurement techniques and the field as a whole, and in turn, towards designing intelligent learning technologies to support and foster SRL in learners across tasks, domains, and contexts.

Reference:

de Mooij, S., Lämsä, J., Lim, L., Aksela, O., Athavale, S., Bistolf, I., Jin, F., Li, T., Azevedo, R., Bannert, M., Gašević, D., Järvelä, S., & Molenaar, I. (2025). A systematic review of self-regulated learning through integration of multimodal data and Artificial Intelligence. *Educational Psychology Review, 37*:54. https://doi.org/10.1007/s10648-025-10028-0

Setting New Research Priorities in the Age of AI

Stephen J. Aguilar

Associate Professor of Education, USC Rossier School of Education

Associate Director, USC Center for Generative AI and Society

Dr. Stephen J. Aguilar studies the impact of generative AI in educational settings, the digital equity gap, and learning analytics applications. Currently, he is co-leading USC's new Center for Generative AI and Society's efforts to understand when and how generative AI is used by students and instructors in post-secondary settings. He is currently writing *Authenticating Intelligence: Preventing AI from Hijacking Education* (Bloomsbury Academic Inc).

Historically, my work has revealed tensions between "what students want to see" and "what best supports adaptive SRL." Ten years ago, my focus was on how learning analytics dashboards shaped how students engage with their courses. I showed that comparative information can be maladaptive, it can discourage mastery approaches and good SRL strategies. This led me to propose equity-centered, motivation-informed design principles for LADs, so feedback supports diverse learners' expectations, values, and regulation strategies. Currently I am examining how GenAI tools shape students SRL behaviors, and what mitigates can be put in place to ensure that students do not become over reliant on GenAI.

Recent Publication:

Title: How Students and Teachers Worldwide Are Adapting to AI

Summary: My most recent report from the USC Center for Generative AI and Society examines GenAI's educational impact from multiple vantage points: student help-seeking behavior, AI-augmented writing support, and international teacher perspectives. Together, these studies show the different ways GenAI is being used in real educational settings. The first study explores how over 1,000 U.S. college students use GenAI when seeking academic help. It distinguishes between instrumental help-seeking (using AI to understand and learn) and executive help-seeking (using AI to get quick answers). Key findings suggest that students who feel confident in their abilities or have strong internet search skills are less likely to rely on GenAI. Those who avoid peer interaction or trust AI, however, more tend to seek executive help. Notably, when professors encourage thoughtful GenAI use, students are more likely to engage in learning-oriented behaviors.

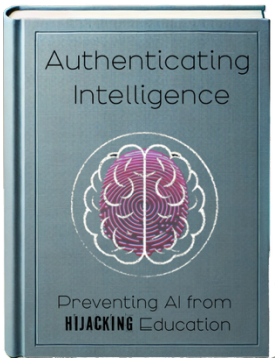
These findings are important to explore for SRL researchers. Our work shows that higher instrumental internet help-seeking was associated with higher instrumental GenAI help-seeking, suggesting that students who seek instrumental help from internet search engines are also more likely to seek instrumental help from GenAI tools. This finding may imply that students who already had instrumental help-seeking habits toward internet search engines applied these habits to GenAI tools. Higher internet help-seeking self-efficacy was also associated with lower instrumental GenAI help-seeking, suggesting that students with a higher perceived ability to seek help from the internet are less likely to seek instrumental help from GenAI tools. This finding points to the idea

that students who feel capable of seeking help from the internet may be less willing to seek instrumental help from GenAI tools, perhaps because they have not yet fully adopted GenAI tools as a source of help compared to the internet.

Reference:

Aguilar, S. J., Nye, B., Swartout, W.R., Macias, A., Xing, Y., Xiu, R. (2025, August). How Students and Teachers Worldwide Are Adapting to AI. https://doi.org/10.35542/osf.io/wr6n3_v3

Additional Information:



Authenticating Intelligence: Preventing AI from Hijacking Education:
https://stephenaguilar.com/authenticating-intelligence

Newsletter:
https://stephenaguilar.com/newsletter

Graduate Student, Faculty Mentor, and Postdoctoral Student Publications

Message From the Graduate Student Committee

Dear Members of the SIG:

I am excited to introduce you to the 2025-2026 SSRL SIG Graduate Student Committee. The goal of the SSRL SIG Graduate Student Committee is to provide programming and support for our graduate student members. The Committee plans to facilitate one webinar this Fall (see information below) and one webinar this Spring (Date and topic to be announced). Our committee members include: Stephanie Greenquist-Marlett (co-chair), Vida School; Michael Berro, University of North Carolina-Chapel Hill; Bridget Daleiden, University of Nevada, Las Vegas; Willow Alston-Socha, NC State University; and Claire Consadine, Old Dominion University.

We recently facilitated our Fall 2025 webinar titled *Translating Self-regulated Learning Research into the Classroom*. Panelists shared their perspectives on conducting self-regulated learning research in school-based settings and integrating self-regulated learning into the classroom. We were so excited to learn from Lauren Cabrera (University of Michigan - Dearborn), Randi Kearney (Vida School), and Ashley Garretson (Vida School)! Reach out to Anna Brady (abrady@georgiasouthern.edu) if you'd like access to the webinar recording.

Sincerely,

Anna Brady

Georgia Southern University

Applying Technology and SRL: New Research from Graduate Students, Faculty Mentors, and Postdoctoral Scholars

Design Matters: Students' Adherence to High Structure Course Design Activities Their Academic Success

Michael Berro

Matt Bernacki

Jeffery Greene

PhD Candidate, The University of North Carolina at Chapel Hill; Associate Professor, The University of North Carolina at Chapel Hill; Associate Dean for Research and Faculty Development, McMichael Professor, The University of North Carolina at Chapel Hill

When individuals engage in learning tasks that involve technology, their interactions with the digital assets that instructors and designers provide produce traces of their learning processes. The CLICK Lab at UNC Chapel Hill, which is affiliated with the School of Education's Center for Learning Analytics, use (1) the event logs that educational software produce to capture time-stamped events conducted by consenting research participants (2) the insights offered by instructors about their course and task designs, and (3) assumptions from psychological theories of learning to study learning processes along with other measures to examine digital engagement behaviors reflecting cognitive strategies and SRL processes and their learning outcomes. This article adapts those metrics to design a feature that aligned with instructors' intended learning progressions for each lesson of an undergraduate biology course and measures how learners' adherence to active learning structure predicted their course performance and achievement outcomes.

Recent Publication:

Title: Design Matters: Students' Adherence to High-Structure Course Design Activities Predicts Their Academic Success.

Summary: Discipline-based education researchers have explored several pedagogical shifts in STEM courses, such as using high structure course designs that integrate active learning pedagogies. The article examined the effects of students' adherence to these designs on undergraduates' achievement in an introductory biology course. Digital traces of students' engagement with activities for each course lesson allowed an investigation of learners' adherence to this heavily externally-regulated design approach and additional self-regulated learning processes. Specifically, the article examined learners' *completion* of course activities and their *sequential adherence* (the instructors' intended order of completion) to determine (1) whether learners who adhered to high structure lesson designs would perform better and (2) and whether personal characteristics of the learner (first-generation status and prior knowledge of course topics) moderated the relationship between adherence and performance. For most performance outcomes, completion of activities positively predicted academic outcomes. Sequential adherence to course activities was associated with additional benefits beyond simple completion, particularly when enacted in earlier lessons. First-generation learners with higher prior knowledge benefited more from completing lessons and doing so in sequentially adherent fashion. In future research, collecting data about learners' adherence to and why they deviate from course structure can reveal details about their self-regulatory processes.

Reference:

Berro, M. A., Ott, L., Garland, A., Evans, M., Hogan, K. A., Plumley, R. D., Kuhlmann, S. L., Yu, L., Bernacki, M. L., & Greene, J. A. (2025). Design matters: Students' adherence to high-structure course design activities predicts their academic success. *Journal of Educational Psychology.* Advance online publication. https://doi.org/10.1037/edu0000970

Modeling the Dynamics of Metacognition and Engagement in Advanced Learning Technologies:

Megan Wiedbusch

Postdoctoral Scholar, School of Modeling, Simulation, and Training, University of Central Florida

Dr. Megan Wiedbusch is a postdoctoral scholar at the University of Central Florida in the School of Modeling, Simulation, and Training working with Dr. Roger Azevedo. Her program of research focuses on theory-driven multimodal measurement, analysis, and modeling metacognition and engagement dynamics with advanced learning technologies (e.g., virtual reality, intelligent tutoring systems, game-based learning environments, human digital twins) in both authentic (e.g., classroom-based) and lab-based educational and training contexts. She utilizes a variety of quantitative and qualitative methodological and analytical techniques (time series analysis, non-linear dynamical modeling, inferential and non-parametric statistics, machine learning, etc.) to assess how (and why) humans learn optimally with various emerging technologies including high-fidelity mannequins, simulators, virtual reality, holographic displays, and hypermedia. These techniques are largely informed by the rich streams of multimodal data (facial expressions of emotions, physiology, concurrent verbalizations, human-computer interaction, eye movements, etc.) captured before, during, and after learning and problem-solving activities.

Recent Publication:

Title: Modeling the Dynamics and Autoregressive Tendencies of Metacognitive Judgment Accuracy During Complex Learning

Summary: My recent article in the *International Journal of Artificial Intelligence in Education - Modeling the Dynamics and Autoregressive Tendencies of Metacognitive Judgment Accuracy during Complex Learning* -introduces an individualized time-series approach to modeling metacognitive accuracy within an intelligent tutoring system. This study moved beyond aggregate analyses by using autoregressive models for each individual to capture the recursive, temporally dependent nature of learners' self-regulation. I have also (co)authored papers in *Metacognition & Learning*, *Frontiers in Psychology*, and *British Journal of Educational Technology* that integrate multimodal learning analytics with SRL theory to explain how learners' emotional and cognitive states evolve in virtual and game-based environments. Across over 30 conference papers (AIED, ISLS, ETRA, LAK, AERA, EARLI), my work advances a methodological shift toward modeling SSRL as a complex, dynamic system, ultimately bridging theoretical models with computational simulation and adaptive design. Future work seeks to simulate and model the dynamics of SSRL as emergent phenomena within complex learning systems multimodal learning analytics, generative AI, and digital-twin modeling to predict and visualize how metacognitive and affective states co-evolve during learning. This approach will inform adaptive scaffolds capable of responding to a learner's changing regulatory state in real time. Building on my recent time-series and complex-systems work, I plan to develop computational models that simulate regulatory feedback loops across multiple time scales from micro-level interactions to macro-level learning outcomes. Ultimately, this research will inform the design of next-generation ALTs that dynamically adapt to individuals and teams, enhancing human-AI collaboration and fostering resilient, collaborative self-regulated learners.

Reference:

Wiedbusch, M., Dever, D., Delgado, T., & Azevedo, R. (2025). Modeling the dynamics and autoregressive tendencies of metacognitive judgment accuracy during complex learning. *International Journal of Artificial Intelligence in Education*. https://doi.org/10.1007/s40593-025-00522-5.

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Advances in Technology - Affordances & Constraints

AERA SIG Studying and Self-Regulated Learning