Self-Directed Learning in Online Laboratory
Sungeun An, Scott Bunin, Stephen Buckley, Willventchy Celestin, Andrew Hornback, Vrinda Nandan, Spencer Rugaber, Ashok Goel
Design & Intelligence Laboratory, School of Interactive Computing, Georgia Institute of Technology

Background
Self-directed online learning has become increasingly prevalent in recent years.

Autonomy
Learning without any instructor, syllabus, or mandate

Learner-Centered
Informal learning by asking, answering, and learning at the discretion of the learners outside classroom settings

VERA, Online Laboratory
VERA supports self-directed online learning through ecological modeling.

- Enables learners to construct conceptual models of ecological systems and run interactive model simulations, which allows learners to explore ecological systems and perform what-if experiments
- Retrieves species information from EOL (Smithsonian’s Encyclopedia of Life) to populate the conceptual models. EOL provides direct access to VERA through its website.

Learning Analytics in VERA
VERA has been publicly available since 2018 and has attracted many self-directed learners around the world.

Research Question
How can we understand how people learn in a self-directed manner using their log data in VERA?

Data
Behaviors and Outcomes
No Learning Goals, Demographics, nor Assessments

Method
We analyzed the modeling behaviors of 315 learners and 822 instances of learner-generated models.

Findings
Large-scale domain knowledge helped learners build more complex ecological conceptual models (An et al., 2020 at AIED)

More successful students engaged in more productive behaviors (e.g., less repetition, systematic search) (An et al., 2021 at ITS)

More engaged learners display the full cycle of exploratory behavior consisting of model construction, parameterization, and simulation (An et al, 2022 at AIED)

Acknowledgements
Funding for the original VERA project was provided by NSF Grant #1636848 BD
Spokes: SPOKE: SOUTH: Collaborative: Using Big Data for Environmental Sustainability: Big Data + AI Technology = Accessible, Usable, Useful Knowledge!