

# Kathryn “Katie” Cunningham

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**ACADEMIC APPOINTMENTS:**

*Assistant Professor, University of Illinois Urbana-Champaign, Urbana, IL, July 2022 – Present*

*Postdoctoral Scholar, Northwestern University, Evanston, IL, January 2021 – July 2022*

**EDUCATION:**

- Ph.D.* University of Michigan, School of Information *Defended:* December 2020  
*Major:* Information *Focus:* Computing Education *Advisors:* Mark Guzdial, Barb Ericson
- M.S.* Georgia Institute of Technology, School of Interactive Computing *Graduation:* August 2018  
*Major:* Human-Centered Computing *Focus:* Computing Education *Advisor:* Mark Guzdial
- B.S.* University of Arizona, Honors College *Graduation:* May 2013  
*Majors:* Computer Science, Molecular and Cellular Biology *Minor:* Mathematics

**RESEARCH INTERESTS:**

Using methods from *human-computer interaction* in the context of *computer science education*, my research aligns computing learning opportunities with students’ goals and identity, with a long-term aim of **broadening pathways to computing education** at the college level.

- HONORS:**
- Computing Innovation Fellow, 2021-2022
  - National Science Foundation Graduate Research Fellow, 2017-2020
  - Best Paper at SIGCSE, Position and Curricula Initiative track, 2022
  - Nominated Paper, SIGCSE Top Ten Symposium Papers of All Time Award, 2019
  - Best Paper at SIGCSE, New Curricula, Programs, Degrees, and Position Paper track, 2018
  - 2nd runner up, John Henry Award at ICER, 2017

**PUBLICATIONS (ADVISED STUDENTS UNDERLINED):**

1. J. Hur, M. M. Kang, J. Park, and **K. Cunningham**. 2025. Applying the Model of Interest Development to Understand Why Non-CS Majors Decide to Persist in or Leave Computing. In Proceedings of the 25th Koli Calling International Conference on Computing Education Research (Koli Calling '25). ACM. <https://doi.org/10.1145/3769994.3770038>
2. M. A. Demirtas, C. Zheng, M. Fowler, and **K. Cunningham**. (2025). Generating Planning Feedback for Open-Ended Programming Exercises with LLMs. In: Cristea, A.I., Walker, E., Lu, Y., Santos, O.C., Isotani, S. (eds) Artificial Intelligence in Education. AIED 2025. Lecture Notes in Computer Science, vol 15878. Springer. [https://doi.org/10.1007/978-3-031-98417-4\\_3](https://doi.org/10.1007/978-3-031-98417-4_3)
3. Y. Jain\*, M. A. Demirtas\*, and **K. Cunningham**. PLAID: Supporting Computing Instructors to Identify Domain-specific Programming Plans at Scale. To appear in Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (CHI 2025). ACM. <https://doi.org/10.1145/3706598.3713832>  
*\*Equal contribution*
4. J. Hur and **K. Cunningham**. Profiling Conversational Programmers at University: Insights into their Motivations and Goals from a Broad Sample of Non-Majors. In Proceedings of the 2024 ACM Conference on International Computing Education Research (ICER 2024). ACM. <https://doi.org/10.1145/3632620.3671123>
5. M. A. Demirtas, M. Fowler, Nicole Hu, and **K. Cunningham**. Validating, Refining, and Identifying Programming Plans Using Learning Curve Analysis on Code Writing Data. In Proceedings of the 2024 ACM Conference on International Computing Education Research (ICER 2024). ACM. <https://doi.org/10.1145/3632620.3671120>
6. M. A. Demirtas, M. Fowler, and **K. Cunningham**. Reexamining Learning Curve Analysis in Programming Education: The Value of Many Small Problems. Proceedings of the 17th International Conference on Educational Data Mining (EDM 2024). EDM. <https://doi.org/10.5281/zenodo.12729773>

7. **H. Chen, A. Li**, G. Challen, and **K. Cunningham**. Implementation of Split Deadlines in a Large CS1 Course. In Proceedings of the 55th ACM Technical Symposium on Computer Science Education V. 1 (SIGCSE 2024). ACM. <https://doi.org/10.1145/3626252.3630873>
8. **K. Cunningham**, M. C. Parker, and **J. Zhang**. The Landscape of Computer Science Education Courses: A Syllabi Analysis. In Proceedings of the 23rd Koli Calling International Conference on Computing Education Research (Koli Calling 2023). ACM. <https://doi.org/10.1145/3631802.3631831>
9. M. Hassan, **K. Cunningham**, C. Zilles. Evaluating Beacons, the Role of Variables, Tracing, and Abstract Tracing for Teaching Novices to Understand Program Intent. In Proceedings of the 2023 ACM Conference on International Computing Education Research (ICER 2023). ACM. <https://doi.org/10.1145/3568813.3600140>
10. Z. Li, S. Yang, **K. Cunningham** and A. Alawini. Assessing Student Learning Across Various Database Query Languages. In Proceedings of the 2023 IEEE Frontiers in Education Conference (FIE 2023). IEEE. <https://doi.org/10.1109/FIE58773.2023.10343409>
11. S. Yang, Z. Li, G. L. Herman, **K. Cunningham** and A. Alawini. Uncovering Patterns of SQL Errors in Student Assignments: A Comparative Analysis of Different Assignment Types. In Proceedings of the 2023 IEEE Frontiers in Education Conference (FIE 2023). IEEE. <https://doi.org/10.1109/FIE58773.2023.10343207>
12. J. Gorson, **K. Cunningham**, M. Worsley, E. O'Rourke. Using Electrodermal Activity Measurements to Understand Student Emotions While Programming. In Proceedings of the 2022 ACM Conference on International Computing Education Research (ICER 2022). ACM. <https://doi.org/10.1145/3501385.3543981>
13. **K. Cunningham**, A. Feng, Y. Qiao, E. O'Rourke. Bringing "High-level" Down to Earth: Gaining Clarity in Conversational Programmer Learning Goals. In the Proceedings of the 53rd ACM Technical Symposium on Computer Science Education (SIGCSE 2022). ACM. <https://doi.org/10.1145/3478431.3499370>  
*Best Paper, Position and Curricula Initiative track*
14. L. Margulieux, P. Denny, **K. Cunningham**, M. Deutsch, and B. R. Shapiro. When Wrong is Right: The Instructional Power of Multiple Conceptions. In Proceedings of the 17th ACM Conference on International Computing Education Research (ICER 2021). ACM. <https://doi.org/10.1145/3446871.3469750>
15. **K. Cunningham**, B. Ericson, R. Agrawal Bejarano, and M. Guzdial. Avoiding the Turing Tarpit: Learning Conversational Programming by Starting from Code's Purpose. In CHI Conference on Human Factors in Computing Systems (CHI 2021). ACM. <https://doi.org/10.1145/3411764.3445571>
16. **K. Cunningham**, R. Agrawal Bejarano, M. Guzdial, B. Ericson. "I'm not a computer": How Identity Informs Value and Expectancy During a Programming Activity." Proceedings of the 2020 International Conference of the Learning Sciences (ICLS 2020). ISLS. <https://doi.dx.org/10.22318/icls2020.705>
17. B. Ericsson, A. McCall, **K. Cunningham**. Investigating the Affect and Effect of Adaptive Parsons Problems. In Proceedings of the 19th Koli Calling International Conference on Computing Education Research (Koli Calling 2019). ACM. <https://doi.org/10.1145/3364510.3364524>
18. C. Szabo, N. Falkner, A. Petersen, H. Bort, **K. Cunningham**, P. Donaldson, A. Hellas, J. Robinson, J. Sheard. Review and Use of Learning Theories within Computer Science Education Research: Primer for Researchers and Practitioners. In Proceedings of the Working Group Reports on Innovation and Technology in Computer Science Education (ITiCSE-WGR 2019). ACM. <https://doi.org/10.1145/3344429.3372504>
19. **K. Cunningham**, S. Ke, M. Guzdial, B. Ericson. Novice Rationales for Sketching and Tracing, and How They Try to Avoid It. In Innovation and Technology in Computer Science Education (ITiCSE 2019). ACM. <https://doi.org/10.1145/3304221.3319788>
20. M. Lara, **K. Cunningham**, B. Su. Breaking into Tech: Job Placement Experience and Perceptions of Alumni from a Three-year Computer Science Program. 2019 Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT 2019). IEEE. <https://doi.org/10.1109/RESPECT46404.2019.8985777>
21. S. Narayanan, **K. Cunningham**, S. Arteaga, W. J. Welch, L. Maxwell, Z. Chawinga, B. Su. Upward Mobility for Underrepresented Students: A Model for a Cohort-Based Bachelor's Degree in Computer Science. In Proceedings of the 49th ACM Technical Symposium on Computer Science Education (SIGCSE 2018). ACM. <https://doi.org/10.1145/3159450.3159551>

*Best Paper, New Curricula, Programs, Degrees, and Position Paper track  
SIGCSE Top Ten Symposium Papers of All Time Award - Nominated Paper*

22. **K. Cunningham**, S. Blanchard, B. Ericson, M. Guzdial. "Using Tracing and Sketching to Solve Programming Problems: Replicating and Extending an Analysis of What Students Draw." In Proceedings of the 2017 ACM Conference on International Computing Education Research (ICER 2017). ACM.  
<https://doi.org/10.1145/3105726.3106190>  
*2nd runner up, John Henry Award*

**POSTERS, EXTENDED ABSTRACTS, AND WORKSHOPS (ADVISED STUDENTS UNDERLINED):**

1. M. A. Demirtaş, C. Zheng, and **K. Cunningham**. 2025. Detecting Programming Plans in Open-ended Code Submissions. In Proceedings of the 56th ACM Technical Symposium on Computer Science Education V.2 (SIGCSE TS 2025). <https://doi.org/10.1145/3641555.3705166>
2. J. Hur, M. M. Kang, and **K. Cunningham**. 2025. Patterns of Major Switching and Persistence in Computing among Students with Disabilities. In Proceedings of the 56th ACM Technical Symposium on Computer Science Education V.2 (SIGCSE TS 2025). <https://doi.org/10.1145/3641555.3705226>
3. **K. Cunningham**, C. M. Lewis, G. L. Herman, C. Zilles, A. Alawini. Preparing Computer Science Education PhD Students: Our Process. In Proceedings of the 2023 ACM Conference on International Computing Education Research V.2 (ICER '23 V2). <https://doi.org/10.1145/3568812.3603472>
4. Y. Jain, **K. Cunningham**. Towards Methods for Identifying High-Quality Domain-Specific Programming Plans. In Proceedings of the 2023 ACM Conference on International Computing Education Research V.2 (ICER '23 V2). <https://doi.org/10.1145/3568812.3603478>
5. **K. Cunningham**. "Sketching notional machines with meaning." Poster at Dagstuhl seminar on Notional Machines and Programming Language Semantics in Education, 2019.
6. M. Lara, **K. Cunningham**, B. Su. "Job Placement Experience of Alumni from a 3-year CS Program." In Proceedings of the 50th ACM Technical Symposium on Computer Science Education (SIGCSE 2019). <https://doi.org/10.1145/3287324.3293805>
7. E. Rowe, J. Asbell-Clarke, **K. Cunningham**, S. Gasca. "Assessing Implicit Computational Thinking in Zoombinis Gameplay: Pizza Pass, Fleens & Bubblewonder Abyss." In Extended Abstracts Publication of the Annual Symposium on Computer-Human Interaction in Play (CHI PLAY 2017 Extended Abstracts). <https://doi.org/10.1145/3130859.3131294>
8. E. Rowe, J. Asbell-Clarke, S. Gasca, **K. Cunningham**. "Assessing Implicit Computational Thinking in Zoombinis Gameplay." In Proceedings of the 12th International Conference on the Foundations of Digital Games (FDG 2017). Poster. <https://doi.org/10.1145/3102071.3106352>
9. B. Eicher, **K. Cunningham**, M. Gonzales, S. Peterson, A. Goel. "Modeling Student Misunderstandings: A Tool for Human-Computer Collaborative Learning of Introductory Programming." Poster presented at the Eighth International Conference on Computational Creativity (ICCC 2017).
10. B. Eicher, **K. Cunningham**, M. Gonzales, S. Peterson, A. Goel. "Toward Mutual Theory of Mind as a Foundation for Co-Creation." Presented at Co-Creation Workshop at the Eighth International Conference on Computational Creativity (ICCC 2017).
11. **K. Cunningham**. "Peer-Led Team Learning Supports Computer Science Persistence at Community College." Poster presented at: International Computing Education Research Conference (ICER 2015).
12. **K. Cunningham**, D. Fossati. "Exploring Discovery and Refinement of Knowledge Components with Introductory Programming Assignment Data." Poster summarized research project completed at: LearnLab Summer School, at Carnegie Mellon University, 2015.

**OTHER PROFESSIONAL EXPERIENCE:**

*Consultant, hired by California State Univ. Monterey Bay, Seaside, CA, May 2018-August 2018*

- Analyzed evaluation data from students in the university's accelerated, cohort, and traditional computer science programs.
- Interviewed alumni to understand their experiences in the technology workforce.

*Consultant, hired by TERC, Cambridge, MA, Feb 2017-August 2017*

- Created coding criteria for instances of computational thinking in gameplay of *Zoombinis*, a computer game involving exploration of discrete mathematics and other computing topics.

- Interviewed 3<sup>rd</sup>-8<sup>th</sup> grade teachers in support of their participation in a study of the use of *Zoombinis* play with computational thinking curricular supports in classroom settings.

*Computer Science Education Coordinator, California State Univ. Monterey Bay, July 2013-June 2016*

- Supported students in computer science skill development and technical career preparation, with special focus on students who are part of a cohort-based program. Cohort program was awarded a \$5 million dollar Innovation Award from the state of California in 2015.
- Trained 30 computer science tutors weekly in active learning techniques in computer science, and developed materials for use in tutor-guided small-group learning.
- Critically analyzed computer science curriculum and developed supplemental activities to ensure students were prepared for software engineering and other computing careers.
- Worked closely with both a community college (Hartnell) and a state university (CSUMB).

#### **TEACHING:**

*Instructor, INFO/CS 102, University of Illinois Urbana-Champaign, Spring 2025*

- Taught 115 students a variety of non-programming computing topics.

*Instructor, CS 105, University of Illinois Urbana-Champaign, Spring 2024*

- Taught 250 students introductory Python programming and Excel.

*Instructor, CS 598, University of Illinois Urbana-Champaign, Fall 2023, Fall 2025*

- Developed new graduate seminar about foundational theory in computing education.
- Designed reading list, in-class activities, and final project.

*Instructor, CS 500, University of Illinois Urbana-Champaign, Spring 2023*

- Developed new graduate seminar about design of environments for programming learning.
- Designed reading list, in-class activities, and final project.

*Instructor, CS 500, University of Illinois Urbana-Champaign, Fall 2022*

- Co-developed new graduate seminar about computer science education research.
- Designed reading list, in-class activities, and final project.

*Graduate Instructional Assistant, Data-Oriented Programming, University of Michigan, Winter 2019*

- Led an hour-long weekly discussion session about intermediate Python programming, regex, SQL, and other data science topics.
- Designed programming projects, homeworks, exams, and lecture activities.

*Instructor, Cohort Enrichment - Year 1, CSin3 program, Hartnell College, Fall 2013-Spring 2016*

- Led a three-hour weekly session for freshmen that covered programming fundamentals, study skills, teambuilding, culture building, career exploration, and resume creation.
- Guided Peer Instruction and pair programming activities about introductory programming.

*Instructor, Data Structures Boot Camp, CSin3 program, Hartnell College, Summer 2015 and 2016*

- Taught intensive 2-week boot camp on data structures basics, including binary search, Big-O, linked lists, stacks, queues, and recursion.
- Utilized active lecture style featuring Peer Instruction. Assignments incorporated unit testing.

*Guest Lectures*

- *University of Michigan ENG 101: Introduction to Computers and Programming, Fall 2019*
- *University of Michigan EECS 498/598: Computer Science Education Research, Winter 2019*
- *Georgia Institute of Technology CS 1315: Introduction to Media Computation, Spring 2017*

#### **INVITED TALKS:**

Panel at SIGCSE Virtual 2024. Jinyoung Hur, Parmit Chilana, **Kathryn Cunningham**, Dan Garcia, and Mark Guzdial. 2024. Assessments for Non-CS Major Computing Classes. In Proceedings of the

2024 on ACM Virtual Global Computing Education Conference V. 2 (SIGCSE Virtual 2024).  
<https://doi.org/10.1145/3649409.3703620>

Panel at SIGCSE Virtual 2024. Eliane S. Wiese, James Finnie-Ansley, Rodrigo Duran, **Kathryn Cunningham**, and Mehmet Arif Demirtas. 2024. Challenges and Solutions for Teaching Decomposition and Planning Skills in CS1. In Proceedings of the 2024 on ACM Virtual Global Computing Education Conference V. 2 (SIGCSE Virtual 2024).  
<https://doi.org/10.1145/3649409.3691076>

Tutorial at Dagstuhl seminar on Notional Machines and Programming Language Semantics in Education.  
“Using the Structure Behavior Function framework to understand learning of computer programming.” July 9, 2019.

Education Arcade group, Massachusetts Institute of Technology. “Computational Thinking (from my perspective)”. August 9, 2017.

#### **EXTERNAL SERVICE:**

Conference reviewing: ICER 2021-2025 (SPC 2025), SIGCSE 2017-2025 (SPC 2024-2025), CHI 2021, 2024, 2025, ITiCSE 2020, UIST 2018

Journal reviewing: Transactions on Computing Education (TOCE), Computer Science Education (CSE)

Grant proposal reviewing: Ad-hoc and panel NSF reviewer

#### **RESEARCH MENTORSHIP:**

##### *PhD students:*

Salma El Otmani – Fall 2025-present

Mehmet Arif Demirtas – Fall 2023-present

Jinyoung Hur – Fall 2023-present

Hongxuan Chen – Summer 2023

##### *Masters students:*

Zepei Li – Spring 2023

Ang Li – Spring 2023

##### *Undergraduates:*

Aditi Shukla – Spring 2025-present

Claire Zheng – Fall 2024-present

Yoshee Jain – Spring 2023-present

Jumee “Emily” Park – Fall 2024-Spring 2025

Nicole Hu – Spring 2024

Jonathan Zhang – Fall 2022-Summer 2023

Anushree Berlia – Fall 2022

Alex Chen – Winter 2022

Sid Runwal – Winter 2022

Ika Qiao – Summer 2021

Alex Feng – Summer 2021

Helen Zhu – Fall 2020

Rahul Agrawal Bejarano – Spring 2019-Spring 2020

Alec Minchington – Summer 2019

Austin Lam – Summer 2019

Shannon Ke – Spring 2018

Sarah Blanchard – Spring 2017

#### **PROGRAMMING LANGUAGES:** Python with SciPy/NumPy/Matplotlib, Java, C, C++, R