Kathryn Cunningham

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EDUCATION:

Ph.D. University of Michigan, School of Information *Graduation*: 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 *GPA*: 3.926
Majors: Computer Science, Molecular and Cellular Biology *Minor*: Mathematics

RESEARCH INTERESTS:

Using *human-centered computing methods* in the context of *computer science education*, my research improves learners' motivation and cognition while learning programming, with a long-term goal of broadening pathways to computing education. My current focus is on understanding and supporting novice learners with diverse goals, and developing new software-supported scaffolding that allows learners to focus on code's purpose.

HONORS:

Computing Innovation Fellow, 2021-2022
National Science Foundation Graduate Research Fellow, 2017-2020
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:

1. **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). https://doi.org/10.1145/3411764.34455711
2. 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). https://doi.org/10.1145/3446871.3469750
3. **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). https://doi.dx.org/10.22318/icls2020.705
4. B. Ericson, 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). https://doi.org/10.1145/3364510.3364524
5. 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). https://doi.org/10.1145/3344429.3372504
6. **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). https://doi.org/10.1145/3304221.3319788
7. 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).
8. 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). 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

9. **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). https://doi.org/10.1145/3105726.3106190
   2nd runner up, John Henry Award

UNDER SUBMISSION FOR PEER REVIEW:

1. **K. Cunningham**, A. Feng, Y. Qiao, E. O'Rourke. 2022. Bringing "High-level" Down to Earth: Gaining Clarity in Conversational Programmer Learning Goals. Submitted to the Proceedings of the 53rd ACM Technical Symposium on Computer Science Education (SIGCSE '22)

POSTERS, EXTENDED ABSTRACTS, AND WORKSHOPS:

1. **K. Cunningham**. "Sketching notional machines with meaning." Poster at Dagstuhl seminar on Notional Machines and Programming Language Semantics in Education, 2019.
2. 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). DOI: https://doi.org/10.1145/3287324.3293805
3. 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). DOI: https://doi.org/10.1145/3130859.3131294
4. 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. DOI: https://doi.org/10.1145/3102071.3106352
5. 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).
6. 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).
7. **K. Cunningham**. "Peer-Led Team Learning Supports Computer Science Persistence at Community College." Poster presented at: International Computing Education Research Conference (ICER 2015).
8. **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.

DOCTORAL CONSORTIA:

1. **K. Cunningham**. "Purpose-First Programming: Scaffolding program writing and understanding to align with purpose-oriented identities." Psychology of Programming Interest Group, Summer Workshop (PPIG 2020). Doctoral Consortium.
2. **K. Cunningham**. "Purpose-first Programming: A Programming Learning Approach for Learners who Care Most About What Code Achieves." In Proceedings of the 2020 ACM Conference on International Computing Education Research (ICER 2020). Doctoral Consortium. DOI: https://doi.org/10.1145/3372782.3407102
3. **K. Cunningham**. "The Novice Programmer Needs a Plan." In Proceedings of the IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC 2018). Doctoral Consortium. DOI: https://doi.org/10.1109/VLHCC.2018.8506481
4. **K. Cunningham**. "The Effect of Sketching and Tracing on Instructors' Understanding of Student Misconceptions." In Proceedings of the 2017 ACM Conference on International Computing Education Research (ICER 2017). Doctoral Consortium. DOI: https://doi.org/10.1145/3105726.3105746

PROFESSIONAL EXPERIENCE:

Postdoctoral Scholar, Northwestern University, Evanston, IL, January 2021 – Present

- Developing a programming learning environment that enables novice programmers to create and understand authentic code quickly, using real-time feedback that scaffolds learners' ability to connect code with the goals it achieves.

Consultant, employed 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, employed 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 3rd-8th 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:

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:

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.

SERVICE:

Conference reviewing: ICER 2021, CHI 2021, SIGCSE 2017-2021, ITiCSE 2020, UIST 2018
Journal reviewing: Transactions on Computing Education (TOCE), Computer Science Education (CSE)
Ad-hoc NSF proposal reviewer

RESEARCH MENTORSHIP:

I have mentored seven undergraduates on research projects, resulting in co-authorship on four publications.

Ika Qiao – Summer 2021
Alex Feng – Summer 2021
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