Preparing CS Education CS PhD Students

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

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UIUC Computers+Education research area:

23 PhD students

7 CS Ed courses

6 Advising faculty
- 5 in Computer Science
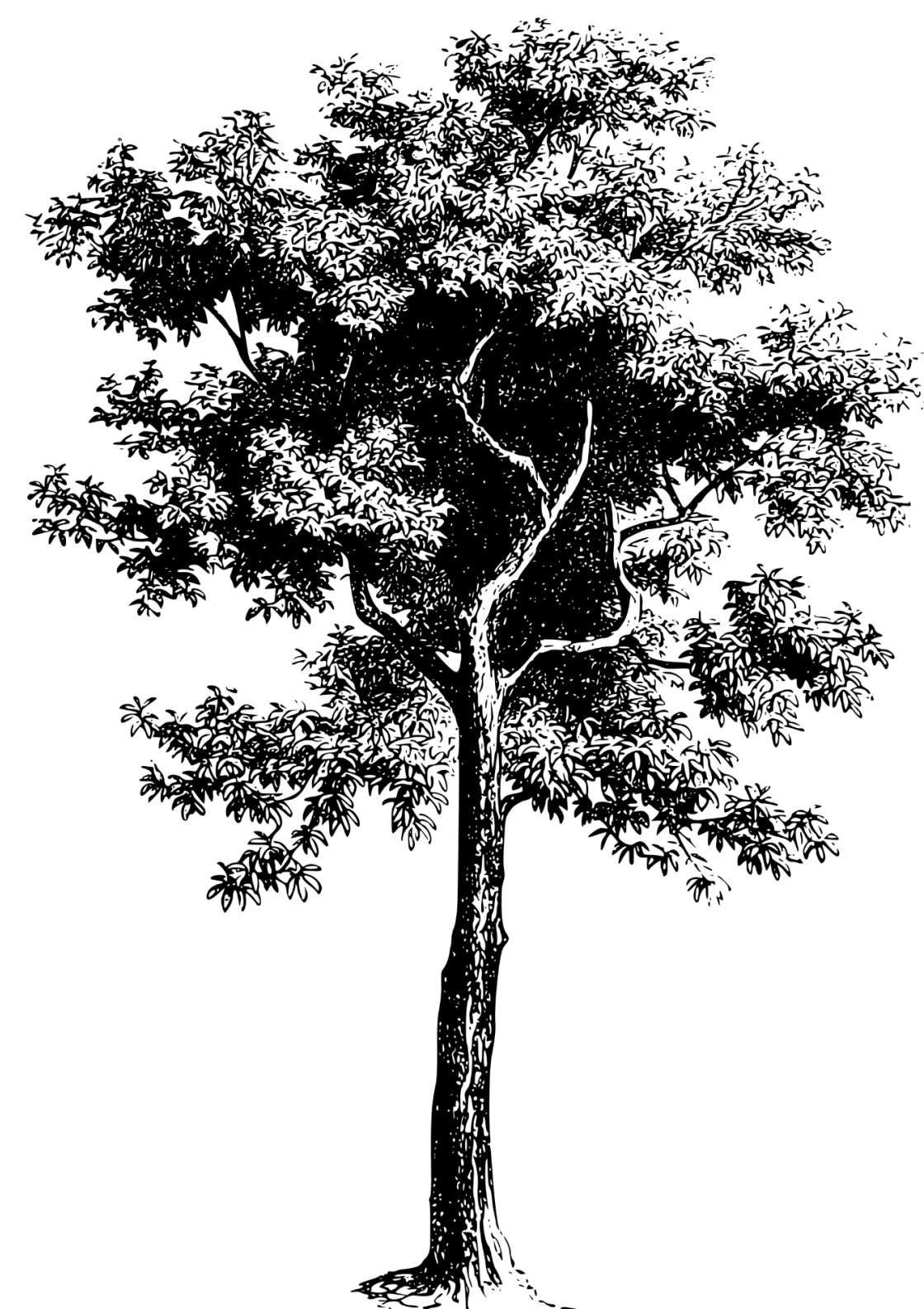- 1 in Education
- 4 tenure-track
- 2 teaching-track

Most incoming PhD students have no background in CSEd or foundational areas. A theoretical background is crucial because it provides tools for researchers to identify and address gaps in the extant research.

We have developed a graduate-level course focused on the theory that informs CSEd research. The course is centered around a **reading list** developed by the advising faculty.

To build the reading list, advising faculty contributed papers capturing:
- their current work (*leaves*)
- the foundations of their work (*branches*)
- the foundations of the field (*trunk*)

What are the foundations of your work?

Let's discuss best practices in CSEd research training!

Example Readings

- ### Cognitive science, learning sciences, educational psychology
  - diSessa, A. A. (2014). **A History of Conceptual Change Research: Threads and Fault Lines.** In R. K. Sawyer (Ed.), *The Cambridge Handbook of the Learning Sciences* (2nd ed., pp. 88–108). Cambridge University Press.
  - Johnson-Glauch, N., Choi, D. S., & Herman, G. (2020). **How engineering students use domain knowledge when problem-solving using different visual representations.** *Journal of Engineering Education, 109*(3), 443–469.
  - Margulieux, L. E., Dorn, B., & Searle, K. A. (2019). **Learning Sciences for Computing Education.** In S. A. Fincher & A. V. E. Robins (Eds.), *The Cambridge Handbook of Computing Education Research* (pp. 208–230). Cambridge University Press.

- ### CS Ed-specific concepts and theories
  - Weintrop, D., Beheshti, E., Horn, M., Orton, K., Jona, K., Trouille, L., & Wilensky, U. (2016). **Defining Computational Thinking for Mathematics and Science Classrooms.** *Journal of Science Education and Technology, 25*(1), 127–147.
  - Robins, A. V. (2019). **Novice Programmers and Introductory Programming.** In S. A. Fincher & A. V. E. Robins (Eds.), *The Cambridge Handbook of Computing Education Research* (pp. 327–376). Cambridge University Press.

- ### Educational paradigms
  - Greeno, J. G., Collins, A. M., & Resnick, L. (1996). **Cognition and learning.** In D. C. Berliner & R. C. Calfee (Eds.), Handbook of Educational Psychology (pp. 15–46).
  - Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). **Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching.** *Educational Psychologist, 41*(2), 75–86.
  - Tissenbaum, M., Weintrop, D., Holbert, N., & Clegg, T. (2021). **The Case for Alternative Endpoints in Computing Education.** *British Journal of Educational Technology, 52*(3), 1164–1177.

- ### Educational equity
  - Ong, M., Wright, C. A., Espinosa, L. L., & Orfield, G. (2011). **Inside the Double Bind: A Synthesis of Empirical Research on Undergraduate and Graduate Women of Color in Science, Technology, Engineering, and Mathematics.** *Harvard Educational Review, 81*, 172–209.
  - Lewis, C. M., Shah, N., & Falkner, K. (2019). **Equity and Diversity.** In S. A. Fincher & A. V. E. Robins (Eds.), *The Cambridge Handbook of Computing Education Research* (pp. 481–510). Cambridge University Press.
  - Harper, S. R., & Hurtado, S. (2007). **Nine themes in campus racial climates and implications for institutional transformation.** *New Directions for Student Services, 2007*(120), 7–24.

- ### Pedagogical practices
  - Nokes-Malach, T. J., Richey, J. E., & Gadgil, S. (2015). **When Is It Better to Learn Together? Insights from Research on Collaborative Learning.** *Educational Psychology Review, 27*(4), 645–656.
  - Smith, D. H., Emeka, C., Fowler, M., West, M., & Zilles, C. (2023). **Investigating the Effects of Testing Frequency on Programming Performance and Students' Behavior.** *Proceedings of the 54th ACM Technical Symposium on Computer Science Education V. 1*, 757–763.
  - Deslauriers, L., McCarty, L. S., Miller, K., Callaghan, K., & Kestin, G. (2019). **Measuring Actual Learning Versus Feeling of Learning in Response to Being Actively Engaged in the Classroom.** *Proceedings of the National Academy of Sciences, 116*(39), 19251–19257.

- ### Research methodologies
  - Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation* (Fourth edition). John Wiley & Sons.
  - Haden, P. (2019). **Descriptive Statistics** and **Inferential Statistics.** In S. A. Fincher & A. V. E. Robins (Eds.), *The Cambridge Handbook of Computing Education Research* (pp. 102–172). Cambridge University Press.

See the full list at:
go.cs.illinois.edu/computers-and-education-reading-list