# HILLARY SWANSON

Curriculum Vitae
April 2019
Northwestern University
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Evanston, IL 60208
(847) 491-3726

## EDUCATION

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|---|---|
| Ph.D. Science and Mathematics Education | University of California, Berkeley, 2015 |
| B.A. Physics, Asian Studies Minor | Colorado College, 2002 |

## PROFESSIONAL APPOINTMENTS

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|---|---|
| 2019 – present | Research Assistant Professor, School of Education and Social Policy, Northwestern University |
| 2016 – 2019 | Postdoctoral Fellow, School of Education and Social Policy, Northwestern University |

## PUBLICATIONS

### Refereed Journal Articles

**Swanson, H.**, & Collins, A. (2018). How failure is productive in the creative process: Refining student explanations through theory-building discussion. *Thinking Skills and Creativity*, *30*, 54-63.

Trninic, D., **Swanson, H.**, & Kapur, M. (2018). Productive dissent in learning communities. *Instructional Science*, *46*(4), 621-625.

### Book Chapters

**Swanson, H.**, Anton, G., Bain, C., Horn, M., Wilensky, U. (in press). Computational thinking in the high school science classroom. In S. Kong, and H. Abelson (Eds.) *Computational Thinking Education.* Singapore: Springer.

**Swanson, H.** (in press) Refining student thinking through scientific theory building. In E. Manalo (Ed.) *Deeper Learning, Dialogic Learning, and Critical Thinking: Research-Based Strategies for the Classroom.* Abingdon-on-Thames: Routledge.

**Conference Proceedings**

Pearl, H., **Swanson, H.**, & Horn, M. (2019). Coordi: A virtual reality application for reasoning about mathematics in three dimensions. *ACM Conference on Human Factors in Computing Systems (CHI '19 extended abstracts).*

**Swanson, H.**, Arastoopour Irgens, G., Bain, C., Hall, K., Woods, P., Rogge, C., Horn, M., Wilensky, U. (2018). Characterizing computational thinking in high school science. In J. Kay, & R. Luckin (Eds.), *Rethinking Learning in the Digital Age. Making the Learning Sciences Count: Proceedings of the 13th International Conference of the Learning Sciences* Vol. 2, 871-878. London, United Kingdom: International Society of the Learning Sciences.

**Swanson, H.**, Anton, G., Bain, C., Horn, M., Wilensky, U. (2017). Computational thinking in the science classroom. In S.C. Kong, J. Sheldon, & K.Y. Li, (Eds.), *Proceedings of the first International Conference on Computational Thinking Education*. Vol. 1, 17-22. Hong Kong: The Education University of Hong Kong.

**Swanson, H.** (2016). Prior knowledge for the construction of a scientific model of equilibration. In C.K. Looi, J. L. Polman, U. Cress, & P. Reimann (Eds.), *Transforming Learning, Empowering Learners: Proceedings of the 12th International Conference of the Learning Sciences* Vol. 1, 162-169. Singapore: International Society of the Learning Sciences.

**Swanson, H.** (2012). Finding the common thread: learner's intuitive knowledge of the patterns that underlie distinct phenomena. In J. v. Aalst, K. Thompson, M. J. Jacobson, & P. Reimann (Eds.) *Future of Learning: Proceedings of the 10th International Conference of the Learning Sciences*, Vol. 2, 587-588. Sydney, Australia: International Society of the Learning Sciences.

White, B.Y., Chiu, J. L., Barth-Cohen, L., Schwendimann, B., Berson, E., Chen J. K., **Swanson, H.**, Sato, E. (2010). Towards a taxonomy of explanations in science education. In K. Gomez, L. Lyons & J. Radinsky (Eds.), *Learning in the Disciplines: Proceedings of the 9th International Conference of the Learning Sciences*, Vol. 2, 493-495. Chicago, IL: International Society of the Learning Sciences.

Svihla, V., Gerard, L., Ryoo, K., Sato, E., Visintainer, T., **Swanson, H.**, Linn, M.C., Lee, H-S., Liu, O.L., and Dorsey, C. (2010). Energy across the curriculum: Cumulative learning using embedded assessment results. In K. Gomez, L. Lyons & J. Radinsky (Eds.), *Learning in the Disciplines: Proceedings of the 9th International Conference of the Learning Sciences* Vol. 2, 257-259. Chicago, IL: International Society of the Learning Sciences.

**Manuscripts in Submission**

Arastoopour Irgens, G., Dabholkar, S., Bain, C., Woods, P., Hall, K., **Swanson, H.**, Horn, M., & Wilensky, U. (2018). *Modeling and measuring students' computational thinking practices in science.* Manuscript submitted for publication.

**Swanson, H.** (2018). *Cultivating a theoretical turn-of-mind.* Manuscript submitted for publication.

**Swanson, H.**, & Collins, A. (2018). *Teacher strategies for engaging students in theory-building discussion.* Manuscript submitted for publication.

**Swanson, H.**, & Collins, A. (2019). *Learning to theorize in a complex and changing world.* Manuscript submitted for publication.

**Manuscripts in Preparation**

**Swanson, H.** (2019). *Student competencies for scientific theory building.* Manuscript in preparation.

**Swanson, H.**, Horn, M., & Wilensky, U. (2019). *Characterizing computational thinking practices in science.* Manuscript in preparation.

**Swanson, H.** & Wilensky, U. (2019). *Engaging students in building theories of dynamical systems phenomena: a comparison of aggregate-pattern and individual-mechanism approaches*. Manuscript in preparation.

## FELLOWSHIPS AND AWARDS

**Northwestern University**

2018 Postdoctoral Professional Development Travel Award ($500)

**International Academic Forum**

2018 International Academic Forum Scholarship ($350)

**University of California, Berkeley**

2014 Dean's Normative Time Fellowship ($18,000)

2010 Graduate Division Block Grant Fellowship ($12,000)

2009 Power Top-Off Award ($2,000)

**Colorado College**

2002 Crown-Goodman Presidential Scholarship ($12,000)

2001 Evelyn Bridges Poetry Prize ($350)

2001 Gaylord Prize ($1,000)

**Institute for International Education**

2001 Freeman-Asia Fellowship ($6,500)

## GRANTS

**Northwestern University**

2018 Undergraduate Research Grant ($3500)
Project: Virtual Reality Graphing Application
Principal Investigator: Hillary Swanson

2018 Undergraduate Research Assistant Program Grant ($2,250)
Project: Broadening Participation in a Computational Future
Principal Investigator: Hillary Swanson

**Colorado College**

2001 Venture Grant ($500)
Project: Education in Japan
Principal Investigator: Hillary Swanson

## CONFERENCE PRESENTATIONS

**Swanson, H.** (2019, August). *Developing competencies for scientific theory building.* Paper to be presented at the biennial conference of the European Association for Research on Learning and Instruction, Aachen, Germany.

**Swanson, H.**, & Wilensky, U. (2019, August) *Engaging students in theory building in the science classroom.* Poster to be presented at the biennial conference of the European Association for Research on Learning and Instruction, Aachen, Germany.

**Swanson, H.** (2019, June). *Cultivating a theoretical turn-of-mind in the science classroom: Developing competencies for articulating deeper structure and abstraction.* Paper to be presented at the annual conference of the Jean Piaget Society, Portland, Oregon.

Pearl, H., **Swanson, H.**, & Horn, M. (2019, May). *Coordi: A virtual reality application for reasoning about mathematics in three dimensions.* Poster to be presented at the ACM Conference on Human Factors in Computing Systems, Glasgow, United Kingdom.

Dabholkar, S., **Swanson, H.**, & Wilensky, U. (2019, March). Epistemic considerations of modeling: Understanding the usefulness and limitations of models with Emergent Systems Microworlds. In T. Bielik (Chair), *Using Technology to Promote Students' Modeling Practice and Complex Systems Thinking.* Symposium to be presented at the annual meeting of the National Association for Research in Science Teaching, Baltimore, MA.

**Swanson, H.** (2019, April). *Cultivating a theoretical turn-of-mind.* Paper to be presented at the annual meeting of the American Educational Research Association, Toronto, Canada.

**Swanson, H.**, Arastoopour Irgens, G., Bain, C., Hall, K., Woods, P., Rogge, C., Horn, M., Wilensky, U. (2018, June). *Characterizing Computational Thinking in high school science*. Paper presented at the 13th International Conference of the Learning Sciences, London, England.

Moses, A., Rogge, C., **Swanson, H.**, Arastoopour Irgens, G., Horn, M. Wilensky, U. (2018, May). *Student perceptions of computational thinking in STEM*. Poster presented at the Northwestern University Undergraduate Research Expo, Evanston, IL.

Rogge, C., Moses, A., **Swanson, H.**, Horn, M., Wilensky, U. (2018, May). *Student competencies for computational thinking in STEM*. Poster presented at the Northwestern University Undergraduate Research Expo, Evanston, IL.

**Swanson, H.** & Trninic, D. (2018, April). *Noticing Change in Rate.* Paper presented at the annual meeting of the American Educational Research Association, New York, NY.

**Swanson, H.** (2018, March). Embodied physics knowledge. In R. Lam (Chair), *Embodiment and Learning*. Symposium conducted at the Asian Conference on Education and International Development, Kobe, Japan.

**Swanson, H.**, & Collins, A. (2017, August). *Strategies for engaging students in rich epistemic discourse.* Paper presented at the biennial conference of the European Association for Research on Learning and Instruction, Tampere, Finland.

**Swanson, H.**, Anton, G., Bain, C., Horn, M., Wilensky, U. (2017, July). *Computational thinking in the science classroom.* Paper presented at the first International Conference on Computational Thinking Education, Hong Kong.

**Swanson, H.** (2017, June). Noticing change in rate. In D. Trninic (Chair), *Embodied patterns of knowing: investigating the role of rhythm in cognition and development.* Symposium conducted at the annual meeting of the Jean Piaget Society, San Francisco, CA.

Beheshti, E., Weintrop, D., **Swanson, H.**, Horn, M., Orton, K., Jona, K., Trouille, L., Wilensky, U., (2017, April). *Computational thinking in practice: How STEM professionals use CT in their work.* Poster presented at the annual meeting of the American Educational Research Association, San Antonio, TX.

**Swanson, H.** (2016, June). *Prior knowledge for the construction of a scientific model of equilibration.* Paper presented at the International Conference on the Learning Sciences, Singapore.

**Swanson, H.** (2016, April). *Supporting students' construction of a model of equilibration*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Baltimore, MD.

**Swanson, H.** (2016, April). *The development of pattern knowledge in response to instruction.* Poster presented at the annual meeting of the American Educational Research Association, Washington, D.C.

Fitzmaurice, H., Sayavedra, A., **Swanson, H.** (2013, April). In search of common resources: an investigation of learners' intuitive pattern knowledge. Roundtable presentation at the annual meeting of the American Educational Research Association, San Francisco, CA.

**Swanson, H.** (2012, April). *Locating energy in an explosion: the effects of generation and critique of visual representations on student understanding of energy in chemical reactions.* Paper presented at the American Educational Research Association Annual Meeting, Vancouver, British Columbia.

**Swanson, H.** (2012, April). *Locating energy in an explosion: The effects of generation and critique of visual representations on student understanding of energy in chemical reactions.* Paper presented at the annual meeting of the American Educational Research Association, Vancouver, British Columbia.

**Swanson, H.** (2011, April). *Scaffolding understanding of energy transfer using the Knowledge Integration Framework*. Poster presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Schwendimann, B., Chiu, J., Barth-Cohen, L., Bursen, E., King-Chen, J., **Swanson, H.**, Sato, E., White, B.Y. (2010, June). *Towards a taxonomy of explanations in science education*. Poster presented at the 9th International Conference of the Learning Sciences, Chicago, IL.

Svihla, V., Gerard, L., Ryoo, K., Sato, E., Visintainer, T., **Swanson, H.**, Linn, M.C., Lee, H-S., Liu, O.L., and Dorsey, C. (2010, June). Prior knowledge for understanding thermal equilibration. In V. Svihla (Chair), *Energy across the curriculum: cumulative learning using embedded assessment results.* Symposium conducted at the 9th International Conference of the Learning Sciences, Chicago, IL.

## INVITED TALKS

**Swanson, H.**, & Arastoopour Irgens, G**.** (2019, March). *Integrating computational thinking in STEM classrooms.* Webinar for the National Initiative for Cybersecurity Education.

**Swanson, H.** (2014, November). *Teaching cross-cutting concepts while engaging in scientific practices: Addressing the next generation science standards through patterns curriculum.* Presentation to the pre-service teaching students of K-8 Teaching and Inquiry-Based Lesson Design in the Science and Mathematics Classroom, University of California, Berkeley, Berkeley, CA.

**Swanson, H.** (2014, October). *The Patterns Class: Leveraging students' prior knowledge toward their development of cross-domain knowledge*. Presentation to the Web-based Inquiry Science Environment research group, University of California, Berkeley, Berkeley, CA.

**Swanson, H.** (2014, May). *Helping students develop cross-domain models.* Presentation to pre-service teaching students of Revolutionary Teaching in the Science and Mathematics Classroom, University of California, Berkeley, Berkeley, CA.

**Swanson, H**. (2010, August). *Eliciting energy ideas.* Presentation to the Cumulative Learning Using Embedded Assessment Results (CLEAR) Teacher Retreat, Berkeley, CA.

## RESEARCH EXPERIENCE

### Northwestern University

2019 – present: Engaging Students in Building Theories of Scientific Phenomena
Lab-based exploratory study comparing aggregate-pattern and agent-based computational modeling approaches to theory building.
Principal Investigators: Uri Wilensky & Bruce Sherin
Funding: National Science Foundation (1842375)

2017 – present: Integrating Computational Thinking in High School Science
Design-based research on how a whole-school approach to computational science develops students' computational thinking practices and positive attitudes toward computation.
Principal Investigators: Uri Wilensky & Michael Horn
Funding: National Science Foundation (1640201)

2016 – 2018 Broadening Participation in a Computational Future: Casting a Wide Net
Design-based research on how computationally-enriched science curriculum develops students' computational thinking practices and positive attitudes toward computation.
Principal Investigators: Uri Wilensky, Mike Horn, Kai Orton, Kemi Jona
Funding: Spencer Foundation (10004580)

**University of California, Berkeley**

2011 – 2015 Pathways to Equitable Science Instruction
Design-based research on the role of everyday knowledge in students' construction of theories of patterns of change and control.
Principal Investigator: Andrea diSessa
Funding: Spencer Foundation (201100101)

2010 – 2012 Visualizing to Integrate Science Understanding for All Learners
Design-based research on how dynamic visualizations could be integrated into science curriculum to help students learn challenging concepts.
Principal Investigator: Marcia Linn
Funding: National Science Foundation (0918743)

2009 – 2011 Cumulative Learning using Embedded Assessment Results
Design-based research on assessments meant to capture and contribute to learning of concepts in middle school science courses.
Principal Investigator: Marcia Linn
Funding: National Science Foundation (0822388)

2009 – 2013 The Nature of Scientific Explanations
Theoretical work developing a taxonomy and coding scheme for characterizing scientific explanations of both experts and novices.
Principal Investigator: Barbara White

## TEACHING EXPERIENCE

**University Teaching**

Northwestern University
- Making Programming Accessible Independent Study (Spring 2019)
- Mathematics Learning through AR Independent Study (Winter 2019)
- Mathematics Learning through VR Independent Study (Fall 2018)
- Computational Thinking in Science Independent Study (Spring 2017)
- Journal Club (Fall 2016, Winter 2017, Spring 2017)
- Nature of Science Independent Study (Spring 2016)

University of California, Berkeley
- Introduction to Secondary Science Teaching (Spring 2014)
- Supervised Teaching in Science for Secondary Schools (2009 - 2014)

**K-12 Teaching**

ASCEND K-8 School, Oakland CA
- Science Enrichment, Eighth Grade (Spring 2013, Fall 2013, Spring 2014)

United for Success Academy, Oakland CA
Science Enrichment, Sixth Grade (Fall 2012)

Berkeley High School, Berkeley CA
Science Enrichment, Ninth Grade (Spring 2011)

High Tech High International, San Diego CA
Integrated Physics and Math, Ninth Grade (2007 – 2009)

High Tech High Bayshore, Redwood City CA
Integrated Physics and Math, Ninth Grade (2006 – 2007)

West High School, Iowa City IA
General and AP Physics, Eleventh – Twelfth Grade (Spring 2006)

Maharishi School, Fairfield IA
Calculus, Twelfth Grade (2002 – 2005)
Chemistry, Tenth Grade (2002 – 2005)
Physics, Eleventh Grade (2003 – 2005)

**Professional Development**

Northwestern University
CT-STEM Summer Workshop, School of Education (Summer 2016, Summer 2017)

University of California, Berkeley
Project-Based Learning Workshop, Graduate School of Education (Summer 2015)

**Supervision & Advising**

Northwestern University
Curriculum Developers, School of Education **(**2016 – present)
Kevin Hall, Philip Woods
Teaching Fellows, School of Education (Summer 2016)
Natasha Blitz, Jeremy Jones
Undergraduate Research Apprentices, School of Education (2016 – present)
Ryan McHenry, Harrison Pearl, Aimee Moses, Carson Rogge, Mitchell Estberg, Anne Xie

University of California, Berkeley
Undergraduate Research Apprentices, Graduate School of Education (2011 – 2015)
Timmy Ma, Youjin Chung, Risa Santoso, Mahmuda Akther, Tinh Le, Joan Hwang, Arthi Benjaram, Paul Petit, Julio Soldevilla

Pre-Service Science Teachers, Graduate School of Education (2009 – 2014)
Mandy Bliss, Jill White, Jason Rose, Lindsay Wells, Anna Boone, Emily Chan, Chris Bing, Shelley DeFord, Amber Zertuche, Pooja Maharaj, Thomas Ryan, Jacqueline Felipe, Monica Sircar, Michael Mishali, Hilary Maynard, Jordan Malin, Dori Bowman-Schmidt, Edward Lin, Desmond Ng, Sarah Perez, Justin Teicheira, Michael Yee, Danielle Barnett, Natasha Pignatelli, Jonathan Wright, Mac Esters

## SERVICE TO PROFESSION

### Committee Member

International Conference on Computers in Education

### Journal Reviewer

Journal of Research in Science Teaching
Information and Learning Science

### Conference Reviewer

International Conference on Computers in Education
International Conference of the Learning Sciences
Annual Conference of the National Association for Research in Science Teaching
Biennial Conference for the European Association for Research on Learning and Instruction
ACM CHI Conference on Human Factors in Computing Systems

### Grant Reviewer

Israeli Ministry of Science and Technology

## PROFESSIONAL CERTIFICATION

### California Commission on Teacher Credentialing

2007 Physics, Preliminary Credential

### Iowa Board of Educational Examiners

2006 Physics Grades 5 – 12, Initial License

## PROFESSIONAL AFFILIATIONS

American Educational Research Association
European Association for Research on Learning and Instruction
International Society of the Learning Sciences
Jean Piaget Society
National Association for Research in Science Teaching