

# SHIMA SALEHI

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Graduate School of Education  
Stanford University

## **EDUCATION**

Ph.D. in Learning Sciences, Graduate School of Education, Stanford University

Doctoral Advisor: Carl Wieman

Committee: Carl Wieman, Daniel Schwartz, Roy Pea, Thomas Kenny & Sarah Church

September 2013 to August 2018

DISSERTATION: "*Improving Problem-solving Through Reflection*"

Ph.D. Minor in Psychology, Stanford University, USA (2017).

M.A. in Learning, Design and Technology, Stanford University, USA (2011).

B.Sc. in Electrical Engineering, Sharif University of Technology, Iran (2009).

## **RESEARCH INTERESTS**

Science Education, Engineering Education, Assessment, Educational Equity, Scientific Problem-solving, Technology in Learning and Assessment

## **SCHOLARSHIPS, HONORS AND AWARDS**

2019 Editors' Suggestion for Physical Review Physics Education Research Journal (2019): Salehi, S., Burkholder, E., LePage, P., Pollock, S., & Wieman, C.E. Demographic gaps or preparation gaps?: The large impact of incoming preparation on performance of students in introductory physics.

2019 The 2019 Iris Moreno Totten Education Research Award (2019): Ballen, C.J., Salehi, S. Structural equation modeling (SEM) in biology education research: Moving beyond "what works" to understand how it works, and for whom. Geological Society of America Annual Meeting, in the Symposium "Making Sense of Methodologies and Theoretical Frameworks in Geoscience Education Research." Indianapolis, Indiana.

2015 Physics Education Research Conference Notable Paper (2015): Salehi, S., Keil, M., Kuo, E., & Wieman, C.E. How to Structure an Unstructured Activity: Generating Physics Rules from Simulation or Contrasting Cases.

## **RESEARCH EXPERIENCE**

2013-18 Research Assistant, Graduate School of Education, Stanford University

2011-13 Research Associate, Transformative Learning Technologies Lab, Stanford University

## TEACHING EXPERIENCE

- 2012-13 Teaching Assistant for Prof. Blikstein, Stanford University, Beyond Bits & Atoms: Designing Technologies for Learning
- 2011-12 Instructor, **Khan Academy** Farsi, Massive Open Online Course in Calculus
- 2011-12 Instructor, **Khan Academy** Farsi, Massive Open Online Course in Algebra
- 2011-12 Instructor, **Khan Academy** Farsi, Massive Open Online Course in Differential Equation
- 2011-12 Teaching Assistant for Prof. Blikstein, Stanford University, Beyond Bits & Atoms: Designing Technologies for Learning
- 2009-10 Teaching Assistant for Prof. Mashayekhi, Sharif University of Technology, System Dynamics
- 2008-09 Teaching Assistant for Prof. Kaboli, Sharif University of Technology, Electrical Machines

## LEADERSHIP EXPERIENCE

2012 Co-Founder and instructor of KelaseDars, a not-for-profit organization offering educational videos for Farsi speaking high school students (Provided 500+ videos and served 3M+ students in Iran & Afghanistan)

## SELECTED RESEARCH SUMMARY

I study how science and engineering can be taught *effectively* and *inclusively*. For *effective teaching*, I have examined the potential of technological platforms as teaching and assessment tools [3, 8, 10, 11, 18]. I have used interactive simulation to identify and assess main practices used in solving a novel, complex problem. I have further designed instructional interventions to teach students the identified problem-solving practices [24, 25, 28]. For *inclusive teaching*, I have examined different characteristics of learning environments that can foster or hinder inclusivity in science and engineering education. I have studied demographic performance gaps and their underlying mechanisms in multiple introductory STEM courses [1, 22]. I have examined the effects of instructional practices on students' self-efficacy, sense of belonging, and underrepresentation performance gap [5], as well as their effects on students' perception of learning environment, and their peer knowledgeability [2]. I have also examined the effect of assessment methods on gender performance gap [6, 21].

## PUBLICATIONS

### A. Published or Accepted

1. **Salehi, S.**, Burkholder, E., LePage, G. P., Pollock, S., & Wieman, C. (2019). Demographic gaps or preparation gaps?: The large impact of incoming preparation on performance of students in introductory physics. Accepted in Physical Review Physics Education Research.
2. **Salehi, S.**, Holmes, N.G., Wieman, C.E. (2019). Exploring bias in mechanical engineering students' perceptions of classmates. *PloS one*, 14(3), e0212477.
3. Bumbacher, E., **Salehi, S.**, Wieman, C., & Blikstein, P. (2018). Tools for science inquiry learning: Tool affordances, experimentation strategies, and conceptual understanding. *Journal of Science Education and Technology*, 27(3), 215-235.
4. Hawkins, R. X., Smith, E. N., Au, C., Arias, J. M., Catapano, R., Hermann, E., ... & **Salehi, S.** (2018). Improving the Replicability of Psychological Science Through Pedagogy. *Advances in Methods and Practices in Psychological Science*, 1(1), 7-18.
5. Ballen, C. J., Wieman, C., **Salehi, S.**, Searle, J. B., & Zamudio, K. R. (2017). Enhancing Diversity in Undergraduate Science: Self-Efficacy Drives Performance Gains with Active Learning. *CBE-Life Sciences Education*, 16(4), ar56.

6. Ballen, C. J., **Salehi, S.**, & Cotner, S. (2017). Exams disadvantage women in introductory biology. *PLoS one*, 12(10), e0186419 (**Co-leading first author**).
7. Blikstein, P., Fuhrmann, T., & **Salehi, S.** (2016). Using the Bifocal Modeling Framework to Resolve “Discrepant Events” Between Physical Experiments and Virtual Models in Biology. *Journal of Science Education and Technology*, 25(4), 513-526.
8. **Salehi, S.**, Keil, M., Kuo, E., & Wieman, C. E. (2015). How to structure an unstructured activity: generating physics rules from simulation or contrasting cases. In *2015 physics education research conference, College Park* (pp. 291-294) (Reviewed conference proceeding) (**Notable paper award**).
9. Schwartz, D. L., Cheng, K. M., **Salehi, S.**, & Wieman, C. (2016). The half empty question for socio-cognitive interventions. *Journal of Educational Psychology*, 108(3), 397.
10. Bumbacher, E., **Salehi, S.**, Wierzchula, M., & Blikstein, P. (2015). Learning Environments and Inquiry Behaviors in Science Inquiry Learning: How Their Interplay Affects the Development of Conceptual Understanding in Physics. *International Educational Data Mining Society* (Reviewed conference proceeding).
11. **Salehi, S.**, Schneider, B., & Blikstein, P. (2014, April). “The Effects of Physical and Virtual Manipulatives on Learning Basic Concepts in Electronics” Proceedings of the 12<sup>th</sup> ACM International Conference on Interactive Tabletops and Surfaces (Reviewed conference proceeding).
12. T. Fuhrmann, **Salehi, S.**, and Blikstein, P (2014) “A Tale of Two Worlds: Using Bifocal Modeling to Find and Resolve “Discrepant Events” Between Physical and Virtual Models in Biology.” Proceedings of the International Conference of Learning Sciences, 2014 (Reviewed conference proceeding).
13. Fuhrmann, T., **Salehi, S.**, & Blikstein, P. (2013, June). Meta-modeling knowledge: Comparing model construction and model interaction in bifocal modeling. In *Proceedings of the 12th International Conference on Interaction Design and Children* (pp. 483-486). ACM (Reviewed conference proceeding).
14. Fuhrmann, T., Greene, D., **Salehi, S.**, & Blikstein, P. (2012) “*Bifocal Biology: the Link Between Real and Virtual Experiments.*” Proceedings of the Constructionism 2012 Conference, Athens, Greece (Reviewed conference proceeding).
15. T. Fuhrmann, D. Greene, **Salehi, S.**, and Blikstein, P (2012) “*Bifocal Biology: Combining Physical and Virtual Labs to Support Inquiry in Biological Systems,*” Accepted for presentation in International Conference of Learning Sciences, Sydney, Australia, 2012 (Reviewed conference proceeding).
16. Blikstein, P., Greene, D., Fuhrmann, T., and **Salehi, S.** (2012). “*Bifocal Modeling: Combining Real and Virtual Models for Science Learning in a School Setting,*” In Proceedings of the IDC 2012 Conference, Bremen, Germany (Reviewed conference proceeding).
17. Blikstein, P., Fuhrmann, T., Greene, D., **Salehi, S.**, Rosenbaum, C., & Worsley, M. (2012). Bifocal modeling: Combining virtual and physical experiments in real time using low-cost sensors and open-source computer modeling. In *10th International Conference of the Learning Sciences: The Future of Learning, ICLS 2012* (Reviewed conference proceeding).
18. **Salehi, S.**, Schneider, B., & Blikstein, P. (2012) “*Comparing the Effect of Interactive Tabletops and Desktops on Students’ Cognition.*” Proceedings of the 11<sup>th</sup> ACM International Conference on Interactive Tabletops and Surfaces (Reviewed conference proceeding).
19. **Salehi, S.**, Kim, J., Meltzer, C., & Blikstein, P. (2012, February). Process pad: a low-cost multi-touch platform to facilitate multimodal documentation of complex learning. In *Proceedings of the Sixth International Conference on Tangible, Embedded and Embodied Interaction* (pp. 257-262). ACM (Reviewed conference proceeding).
20. Kim, J., Meltzer, C., **Salehi, S.**, and Blikstein, P (2011) “*A Multimedia Multi-touch Learning Platform*” Proceedings of the 10<sup>th</sup> ACM International Conference on Interactive Tabletops and Surfaces, Kobe, Japan (Reviewed conference proceeding).

## B. Under Review

21. **Salehi, S.**, Cotner, S., Ballen, C.J. Gender performance gaps across different assessment methods and the underlying mechanisms (Under review for *Frontiers in Education*)

22. **Salehi, S.**, Cotner, S., Ballen, C.J. Introductory STEM courses fail to address variation in incoming academic preparation: consequences for minority and first-generation students (Under review for CBS-Life Sciences Education)
23. Ballen, C.J., **Salehi, S.** Mediation analysis with structural equation modeling in discipline-based education research: moving beyond “what works” to understand how it works, and for whom (Under revision for CBS-Life Sciences Education)

### C. In Preparation

24. A Problem-solving Framework: Characterizing Actions and Decision Involved in Solving a Complex Problem (*with Carl Wieman*)
25. Improving Problem-solving through Reflective Prompts (*with Karen Wang, & Carl Wieman*)
26. How Computer Science Trains Better Problem-solvers (*with Karen Wang, Ruqayya Toorama & Carl Wieman*)
27. The Gender Bias in Perceived Scientific Competency (*with Mohammad Akbarpour & Carl Wieman*)
28. Bringing Reflective Problem-solving Training into BioEngineering Courses (*With Ross Venook, Siavash Abrar, Kara Rogers, and Carl Wieman*)

### SEMINARS AND TALKS

- “Science in Practice: What We Talk about When We Talk about Scientific Problem-solving?” (2018, April). Invited talk at college of biological sciences, University of Minnesota.
- “To Equivocate or Not to Equivocate, That Is Not the Question: The Effects of Gender on Perceived Credibility” (2017, June). Invited talk at gender workshop at Stanford Institute for Economic Policy Research, Stanford University.
- “Science in Practice: What We Talk about When We Talk about Scientific Problem-solving?” (2017, April). Invited talk at physics education research group, University of Colorado, Boulder.

### CONFERENCE PRESENTATIONS

- **Salehi, S.**, Keil, M., Kuo, E., & Wieman, C.E. (2017, July). How to Structure an Unstructured Activity: Generating Physics Rules from Simulation or Contrasting Cases. Contributed talk at symposium of Contrasting cases and invention activities in Physics Education Research Conference, Cincinnati, OH.
- **Salehi, S.**, Kuo, E., McDowell, E., Bumbacher, E., & Wieman, C.E. (2016). “What’s in the Black Box?”: Using Simulations to Learn About and Assess Scientific Inquiry. Contributed poster at the American Educational Research Association (AERA) Annual Meeting 2016, Washington, D.C.
- **Salehi, S.**, Bumbacher, E., Kuo, E., & Wieman, C.E. (2016). Interactive Simulations: Rich Environments for Studying Cognitive Processes During Science Inquiry. Contributed symposium talk at the American Educational Research Association (AERA) Annual Meeting 2016, Washington, D.C.
- **Salehi, S.**, Keil, M., Kuo, E., & Wieman, C.E. (2015). How to Structure an Unstructured Activity: Generating Physics Rules from Simulation or Contrasting Cases. Contributed poster at the Physics Education Research Conference (PERC) 2015, College Park, MD.
- **Salehi, S.**, Fuhrmann, T., & Blikstein, P. (2014) “Of Modeling and Meta-Modeling: What do Students Learn when they Design Bifocal Models in Biology” Accepted in American Educational Research Association annual meeting, 2014.
- **Salehi, S.**, Lizcano, L, R. (2014) “Culture Matters: Implications for female and Latino Students’ Identities and Self-efficacy in a Makerspace Environment” Paper presented at the American Educational Research Association annual meeting, 2014.

- **Salehi, S.**, Fuhrmann, T., Greene, D., & Blikstein, P. (2013) “Effects of Bifocal Modeling on Students’ Assessment of Credibility” Accepted in American Educational Research Association Annual Meeting, 2013.
- Lizcano, L, R. **Salehi, S.** (2013) “Simulating the Effects of Stereotype Threat and Self-Affirmation Intervention Using Agent Based Modeling” Paper presented at the American Educational Research Association Annual Meeting 2013.
- **Salehi, S.**, Schneider, B., & Blikstein, P. (2013) "*Comparing the Effect of Interactive Tabletops and Tangible Toolkits on Students’ Cognition*" Paper presented at the American Educational Research Association Annual Meeting, 2013.