

Context

- **Stem jobs are growing** (U.S. Bureau of Labor, 2019)
- **Schools are falling short** (NRC, 2010; Sengupta, Kinnebrew, Basu, Biwas, & Clark, 2013)
- **Minoritized students largely left out** (K-12 Computer Science Framework, 2016; U.S. Department of Education, 2016)
- **Increased efforts to prepare teachers for CS integration** (ISTE, 2016; SREB, 2016)



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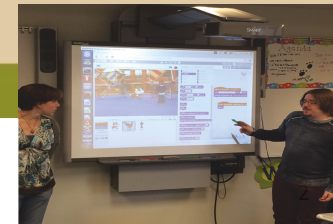
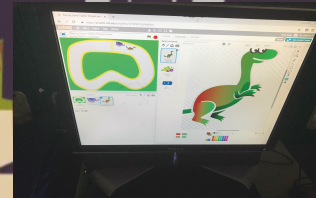
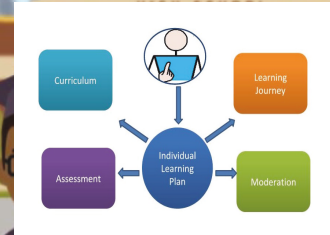
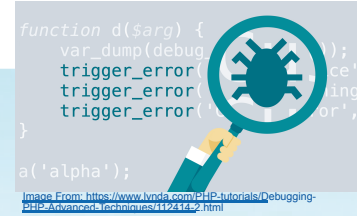
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Theoretical Framework

Equitable Teaching Framework (Shah et al., 2013)

Access to:

- Rich Course Content
- Quality Instruction
- Identities as Computer Scientists
- Peer Relationships



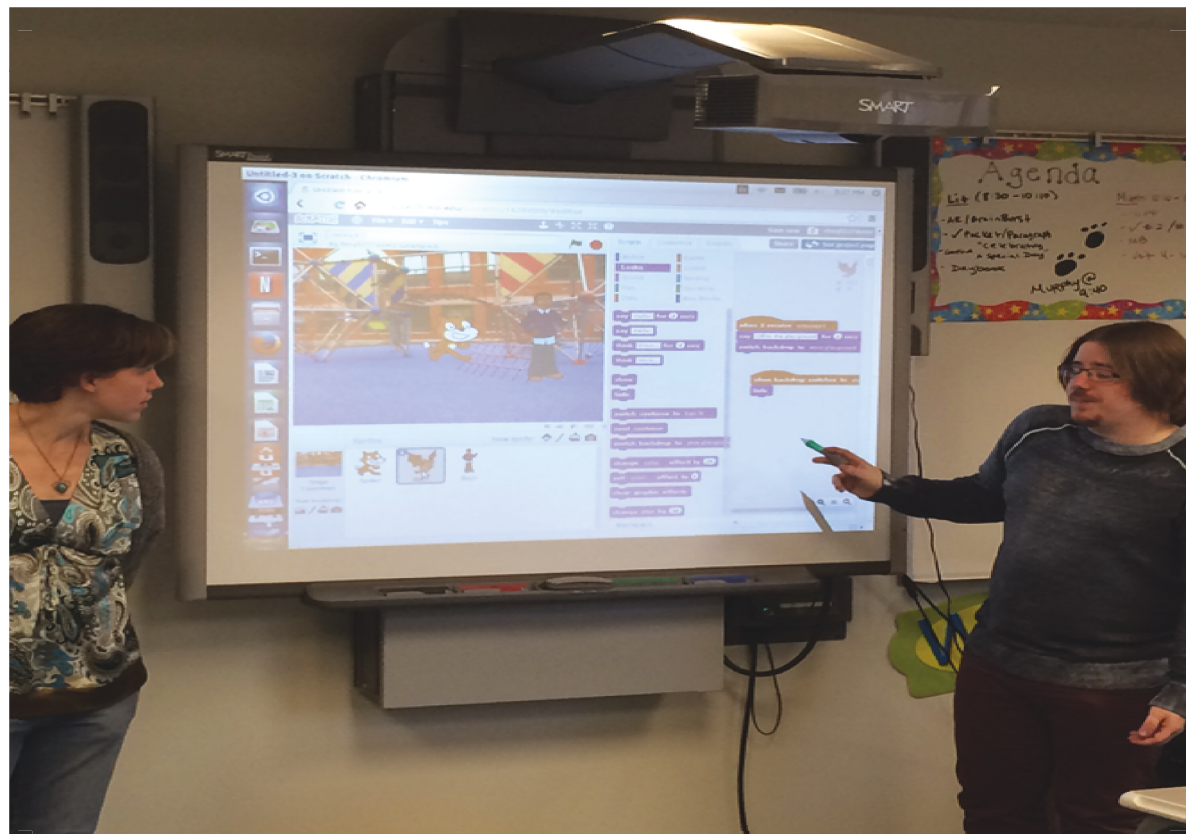
Methods- Background & Context

- College Field Experience
 - Public & Private Schools
 - 15 Minute classes
 - CS Tools for Learning
- Week long PD session during the Summer
 - CS Curricula and Standards
 - Pedagogy
 - Weekly Field Placements
- College Field Experience on Engineering Course



Methods-Data Participants

- 64 Undergraduate reflections
- 51 class observations
Spring 2015-2017
- CS & STEM Majors



Methods-Data Analysis

- Data analyzed in Dedoose
- Developed coding Scheme based on the Shah et al. (2013) equitable practices framework
- Expanded on the framework

Access to Peer Relationships	Strategically partnering students	Students are put together in pairs/groups whose strengths complement one another.	"At the beginning of the class, the students took the pre-study survey and also took a group picture. We then had the beginners switch partners. The more advanced students could keep the same if they wanted to continue to work on the same projects from last time. For the beginners, we had them use the tutorial to animate a word in scratch."
	Encouraging and structuring peer interaction	Class work is structured to require students to work collaboratively.	"In the lesson I asked students, to use their prior experiences to come up with an algorithm that will draw a triangle using less blocks. It was easy for a few students to figure out, but others took much longer time. I allowed the students to have a discussion and share ideas. The discussion helped the students understand how loop statements can be used to avoid using the same statement many times in the algorithm."
	Modeling ideal peer collaboration	Undergraduates model the collaborative behaviors they wish the students to exhibit, e.g. peer programming.	"Morgan and I have this good system going where I stand in front of the students and engage them in the activity, whereas Morgan is sitting on the computer doing what the students are saying they think should be done next."

Significance

- Undergraduates developing **Equitable Practices**.
- **Quality of Instruction** was demonstrated with the pedagogical background were employing practices.
- Undergraduate lessons contained **Rich Course Content** for CS education.
- Undergraduates structured **Peer Interactions** in lessons.
- **Access to Identities as Computer Scientists** were present but limited.



Example: Encouraging Interaction to Out of School Identities

References

- ISTE (2016). National Educational Technology Standards for Students. Retrieved from <http://www.iste.org>
- National Research Council (NRC). (2010). Committee for the Workshops on Computational Thinking: Report of a workshop on the scope and nature of computational thinking. Washington, DC: National Academies Press. http://www.nap.edu/catalog.php?record_id=12840.
- Rodriguez, S. L., & Lehman, K. (2017). Developing the next generation of diverse computer scientists: the need for enhanced, intersectional computing identity theory. *Computer Science Education*, 7 (3-4), 229-247.
- Sengupta, P., Kinnebrew, J. S., Basu, S., Biswas, G., & Clark, D. (2013). Integrating computational thinking with K-12 science education using agent-based computation: A theoretical framework. *Education and Information Technologies*, 18(2), 351-380.
- Shah, N., Lewis, C. M., Caires, R., Khan, N., Qureshi, A., Ehsanipour, D., & Gupta, N. (2013, March). Building equitable computer science classrooms: Elements of a teaching approach. *Proceeding of the 44th ACM technical symposium on Computer science education* (pp. 263-268).
- Southern Regional Education Board. (2016). *Bridging the Computer Science Education Gap: Five Actions States Can Take*. Commission on Computer Science and Information Technology. Retrieved from https://www.sreb.org/sites/main/files/file-attachments/cs_commission_2016_0.pdf
- U.S. Bureau of Labor Statistics. (2019) BLS periodic table of science, technology, engineering and Mathematics (STEM) occupations. Retrieved from: <https://www.bls.gov/k12/content/teachers/posters/pdf/periodic-table.pdf>
- U.S. Department of Education, Office of Innovation and Improvement. (2016). *STEM 20126: A Vision for Innovation in Stem Education*. Washington, DC: Author. Retrieved from <https://innovation.ed.gov/what-we-do/stem/>



Scott Sheridan – stsherid@udel.edu

Nancy Lavigne – nlavigne@udel.edu

Chrystalla Mouza – cmouza@udel.edu

Lori Pollock – pollock@udel.edu



Award # 1639649

