Cognitive Dissonance and Equity: Designing Digital Simulations for K-12 Computer Science Teacher Education

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Abstract: This research explores the use of digital simulations that evoke cognitive dissonance in preservice computer science (CS) teachers with an aim to improve equitable participation and success in CS education. Twelve teacher educator fellows participated in a co-design workshop to build digital simulations of challenging equity scenarios for use in their teacher education programs. We report on the results of the design and use of these scenarios in the training of preservice K-12 CS teachers.

Keywords: computer science, teacher training, equity, clinical simulation, cognitive dissonance

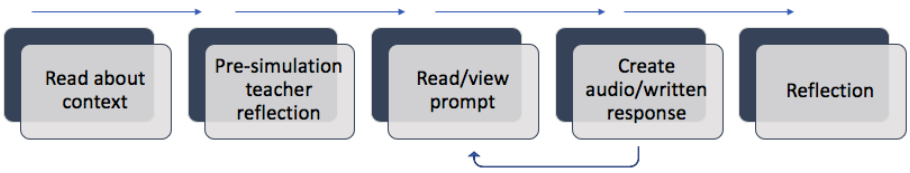
Learning theory

Effective teachers must often overcome the discomfort (i.e. cognitive dissonance) caused by difficult conversations in which they encounter attitudes, beliefs, or behaviors that conflict with their own. For example, when dealing with confused students, angry parents, or frustrated colleagues, teachers must address stressful situations while remaining calm, attending to student needs, and simultaneously deploying effective teaching practice. When these conversations touch on key issues of equity – such as identity, self-esteem, or sense of belonging - the consequences of teachers' words and actions can have a significant impact on people, particularly for students from groups historically underrepresented in computer science (Yeager, Purdie-Vaughns, Hooper, & Cohen, 2017). Preparing novice teachers to overcome their cognitive dissonance in order to effectively respond to issues of equity is particularly salient in CS education given the social and economic benefits students reap from studying CS, and the slow growth rate of students from historically underrepresented groups enrolling in advanced CS courses (Code.org, CSTA, & ECEP, 2019).

Can the use of digital simulations that emulate cognitive dissonance-evoking teaching scenarios – with support from teacher educators and embedded with instructional scaffolding - improve new teachers' capacity to effectively self-regulate in order to support the broadening of participation and success in CS education?

Learning design

Previous research has shown that preservice teachers are given fewer opportunities to practice contextualized, interactive behaviors compared to novices in other "helping" professions (Grossman et al., 2009). Clinical simulations embedded with structured debriefing tools provide preservice teachers with the opportunity to experience and practice the connection between education theory and practice in a low-stakes environment. In this project we build upon an existing mobile web application for digital clinical simulations of K-12 teaching (Thompson et al., 2019). These simulations immerse users in short vignettes of volatile moments in teaching rendered in text, animation, or video, and require them to respond with improvised text and audio responses. Users are then asked to reflect on their responses and connect their actions to their own existing mindsets and values (Figure 1).



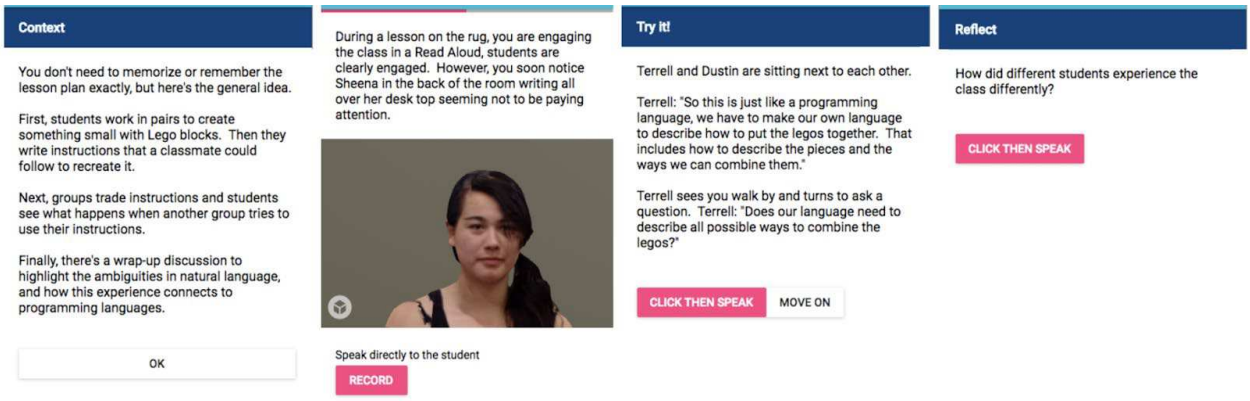


Figure 1. Example digital simulation user experience path.

Twelve teacher educators from higher education institutions across the United States were brought together for a two-day workshop on building digital simulations of K-12 CS education scenarios that would evoke cognitive dissonance in preservice teachers. Using scaffolded exercises and researcher-provided simulation templates, the fellows each designed one or more scenarios for use in their own institutions' preservice CS teacher training program.

Implementation and early evidence

Project fellows piloted the clinical simulations with 200+ preservice teachers in Fall 2019 before fully implementing use of the simulations with 600+ preservice teachers in Spring 2020. We will analyze fellows' responses to a post-pilot survey in order to report preliminary findings of the contextual factors that influenced implementation. We will also utilize preservice teachers' structured debriefs to evaluate which instructional designs and implementations were most successful at inducing both cognitive dissonance and self-reflection, a significant first step towards self-regulation and the reform of inequitable systems and practices within educational settings (Garcia & Guerra, 2004).

Our project addresses two critical learning needs and opportunities: (a) the need to develop instructional scaffolds that prepare novice CS teachers for difficult social, emotional, and pedagogical scenarios in schools (Larke, 2019), and b) the opportunity to integrate lessons learned from clinical simulations used in medical training into digital simulations to improve CS teacher learning outcomes at scale.

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