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# Examining the Impact Narrative Interactivity Has on Fostering Identity Formation in an Educational Game

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## **Abstract**

Educational games often include elements of narrative, although little work has been done on establishing how best to leverage narrative interactivity in service of a game's purpose. My ongoing research on narrative-centered games is guided by the situative perspective, which considers the ultimate purpose of a learning task to be the student's increased sense of belonging and identity with the subject matter. In my proposed dissertation research, I am particularly interested in

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how differing degrees of narrative interactivity support an educational game's potential to impact students' identity formation and attitudes towards the subject of study. I pursue this research in the context of an educational game for middle school computer science.

## **Author Keywords**

Narrative Interactivity, Identity Formation, K-12 Education

## **ACM Classification Keywords**

K.8.0 [Personal Computing]: General – Games

## **Program Context**

I have recently completed the third year of PhD studies in computer science at North Carolina State University. This past semester I completed the Written Preliminary Exam, presenting work that I conducted on using a virtual learning companion that uses narrative to bring gender equity to an educational game for computer science. I have already begun building on this work by further developing the system and conducting a series of small user studies. This winter, I plan on conducting a full classroom study that will yield the data for my dissertation. I then hope to complete the Oral Preliminary Exam (the dissertation proposal) the

following semester, and graduate in May 2017. As my proposed research questions are not finalized yet, this CHI Play Doctoral Consortium comes at an excellent time to help shape my dissertation research.

### **Research Context and Motivation**

Interactivity is central to both playing and learning. Designers of educational games must consequently think deeply about the nature of interactivity within their systems. To investigate the quality of interactivity within educational games (and to explore how we could improve it), we must treat it as the multi-dimensional concept that it is. The most obvious dimension is *physical interactivity*, the way that players navigate their avatars and manipulate objects within the physical space of the game, for example. Another key dimension that all serious games must have is *curricular interactivity*, a term we might use to describe the way in which players engage with the learning objectives of the game. My dissertation work explores a third key dimension: *narrative interactivity*.

Narratives – both those we tell and those we consume, both about ourselves and about others – shape our identities in powerful, long-lasting ways. Some have suggested that we can fully equate the identity of an individual with the narratives about that individual [11]. The importance of narrative appears in most, if not all, theories in the learning sciences. In the cultural-historical perspective, for example, we can see adults interpreting their past experiences to project probable futures for their children [4]. The situative perspective on learning, meanwhile, emphasizes the importance of contextualizing knowledge, which can be accomplished through narrative [10].

Guided by such learning theories, my colleagues at NCSU and I have created a narrative-centered game, ENGAGE, that aims to help middle school students learn computer science. In ENGAGE, students play the role of computer scientists solving a socially relevant mystery. The game’s narrative provides a form of scaffolding, with students developing computational thinking skills as they progress through the multi-week intervention. Crucially, ENGAGE also hopes to leverage the narrative element’s potential for facilitating identity formation. Little research has been done, however, on the specifics of how such narrative-centered games can most effectively foster identity formation. My dissertation work addresses this open research question.

### **Background and Related Work**

Research has looked at how educational games can help shape and change human behavior [12] and engage students with curricular content [9]. The process of aligning instructional content with core gameplay has also been investigated [8]. Moreover, recent syntheses of the game-based learning literature have found that games can yield positive learning outcomes across a range of subjects and settings [5]. A recent pair of meta-analyses have independently concluded that, in general, educational games are often found to be more effective than traditional instructional methods in terms of cognitive outcomes, such as learning and retention [7, 13].

*Narrative-centered* educational games aim to take advantage of the transformative power of narrative. These immersive environments afford multiple perspectives, situate learning, and facilitate transfer [6]. Indeed, the theory of *transformational play* takes

us beyond any broad claims about the potential of games to make learning “fun”, and provides more concrete guidance on how to design game-based learning environments that can positively impact students in ways unique to games [1]. In this model, the student takes on the role of a protagonist and, using newly acquired domain knowledge, transforms (a) the fictional context of the game environment, (b) her understanding of the domain knowledge, and (c) herself as someone who uses that domain knowledge to solve socially relevant problems.

### **Statement of Thesis/Problem**

I seek to understand how various degrees of narrative interactivity in an educational game can improve a student’s ability to identify as a computer scientist, particularly those students who are traditionally underrepresented in the field and thus least likely to identify as computer scientists.

### **Research Approach and Methods**

My dissertation research includes the following goals:

- i. Establish how player actions within the existing educational game map to prior (and evolving) computer science attitudes.
- ii. Determine how varying degrees of narrative interactivity affect a student’s computer science attitudes.
- iii. Discover if this has a measurable impact on a student’s ability to identify as a computer scientist or, if it does not, how we could improve its impact.

Toward the first goal, we conducted a full classroom study of ENGAGE during the 2014-15 academic year, with over 200 middle school students. We administered

a computer science attitudes survey (pre- and post-intervention), engagement survey (post-intervention) and a knowledge assessment (pre- and post-intervention). We also collected game trace data. I plan on using computational methods to analyze the game trace data, with the goal of identifying how player actions differ between students who scored highly on the computer science attitudes survey versus those who scored less highly. I will also look for differences based on engagement and knowledge gains.

We also plan to conduct a new study with modifications to the narrative-centered learning environment. I have already developed a prototype of a virtual learning companion that can add varying degrees of narrative interactivity to ENGAGE. I will fully integrate this pedagogical agent with the existing game, and then conduct a study with at least 100 middle school students. For this new study, I will follow a similar method as previous ones to ensure as representative a participant pool as possible. This will help me to achieve my second goal. To achieve the third goal, meanwhile, we will need to supplement the study with focus groups and qualitative analysis. I believe a mixed methods approach is the only way to fully study the complex topic of identity formation.

### **Dissertation Status**

The research goals articulated above build upon my completed work investigating how the narrative interactivity of a prototype virtual learning companion can improve the gender equity of a game for middle school computer science education [3]. I have also recently investigated the impact of collaboration in a narrative-centered educational game [2].

With regard to my upcoming research goals, I have already conducted some analyses of the survey data. Specifically, I have looked at gender differences in the engagement post-survey and in the knowledge assessment. Analyzing the game trace data is the next step for understanding how learning unfolds in this narrative-centered game. As for preparing for the next study, our team has completed development of the game environment and I am currently building the next iteration of the virtual learning companion. We will conduct the next study during the 2015-16 academic year. My participation in the Doctoral Consortium at CHI Play would be perfectly timed to help clarify the design of that study and to help shape my upcoming dissertation proposal.

### Expected Contributions

My dissertation research will lead to better understanding how we can leverage narrative interactivity to foster identity formation. Enabling young students to identify as a practitioner of a given field, such as computer science, is key to seeing them persist in that field. This research will establish how we can pursue this goal through the use of narrative.

### References

- [1] Barab, S.A. et al. 2010. Transformational Play: Using Games to Position Person, Content, and Context. *Educational Researcher*. 39, 7 (2010), 525–536.
- [2] Buffum, P.S. et al. 2015. Leveraging Collaboration to Improve Gender Equity in a Game-based Learning Environment for Middle School Computer Science. *RESPECT - IEEE Special Technical Community on Broadening Participation*, To appear.
- [3] Buffum, P.S. et al. 2015. Mind the Gap: Improving Gender Equity in Game-based Learning

- Environments with Learning Companions. *Proceedings of the 17th International conference on Artificial Intelligence in Education*, 64–73.
- [4] Cole, M. and Engeström, Y. 1993. A Cultural-Historical Approach to Distributed Cognition. *Distributed Cognitions: Psychological and Educational Considerations*. 1–46.
- [5] Connolly, T.M. et al. 2012. A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education*. 59, 2 (Sep. 2012), 661–686.
- [6] Dede, C. 2009. Immersive interfaces for engagement and learning. *Science (New York, N.Y.)*. 323, 5910 (Jan. 2009), 66–9.
- [7] Douglas B. Clark, Emily E. Tanner-smith, S.K.M. 2013. *Digital Games for Learning: A Systematic Review and Meta-Analysis*.
- [8] Hall, J. V. et al. 2014. Instructional objectives to core-gameplay. *Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play - CHI PLAY '14*, 121–130.
- [9] Isbister, K. et al. 2010. Designing games for learning: insights from conversations with designers. *Proceedings of the 28th international conference on Human factors in computing systems - CHI '10*, 2041–2044.
- [10] Lave, J. and Wenger, E. 1991. *Situated Learning: Legitimate Peripheral Participation*.
- [11] Sfard, A. and Prusak, A. 2005. Telling identities: In Search of an Analytic Tool for Investigating Learning as a Culturally Shaped Activity. *Educational Researcher*. 34, (2005), 14–22.
- [12] Tanenbaum, J.G. et al. 2013. Three perspectives on behavior change for serious games. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '13*, 3389.
- [13] Wouters, P. et al. 2013. A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*. 105, 2 (2013), 249–265.