Fostering Science Identity Through Transmedia Storytelling: A Mixed- Methods Approach

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Abstract: Transmedia storytelling has been shown to provide a wide range of positive learning outcomes, like increased academic achievement and interest. However, while several studies have investigated the potential learning benefits of transmedia storytelling, it is still not fully understood how it can support learners' identity development. Here, we present findings from a study that investigated the impact of a transmedia storytelling experience, Frankenstein200, on learners' science identity. While we could not identify a statistically significant impact of Frankenstein200 on learners' science identity from the survey data, the qualitative findings showed that many participants could imagine themselves as scientists and identify with scientists after taking part in Frankenstein200.

Introduction

In this work, we introduce our transmedia storytelling experience, Frankenstein200, which builds on Mary Shelley's renowned 1818 novel *Frankenstein; or, the Modern Prometheus*. Using Shelley's *Frankenstein* story as a point of reference, we designed Frankenstein200, a transmedia storytelling experience that combines hands-on activities and an online narrative experience, and is intended to bolster participants' science identity construction practices. In the narrative experience, players assume the role of a lab assistant at a fictional organization called L.I.F.E. (the Laboratory for Innovation and Fantastical Exploration), run by Dr. Tori Frankenstein, a distant descendent of Victor Frankenstein. Players interact with two other lab assistants, Mya and Xavier, and help solve a range of problems and puzzles. In addition, our team created a set of hands-on activities and related resources, which complement the online experience.

Methods

To test the impact of the Frankenstein200 experience on science identity construction practices, we conducted studies at three schools: a public elementary school (5th graders), a charter K-8 school (a combined class of 5-8th graders), and a public middle school (7th graders) (n= 88; 49 males, 39 females). Average age was 11.5 years (SD= 1.11). At each school, students were divided into three groups: hands-on only (n=34), online narrative experience only (n=25), and transmedia, with students completing both the hands-on activities and online narrative experience (n=29). We collected quantitative and qualitative data on science identity, such as pre- and posttest survey data, and essays about students' perceptions of scientists' qualities and whether they identify with those qualities. Students completed the activities as part of normal classroom and/or homework activities, and the activities were designed to align with Arizona state standards.

Science identity was measured through the Science Identity Measure (Deemer, Smith, Thoman & Chase, 2014). The 4-item scale is centered around a single factor (sample item: "I see myself as a science student"). Cronbach-alpha for pretests (α=.744), and posttests (α=.735) were good. In addition to the science identity scale, we used a qualitative measure: a short essay designed to explore how completing the project affected students' perceptions of scientists and their own science identity. For the current analysis, we had the online narrative experience and transmedia groups answer the same essay questions. Although online experience and transmedia groups' day-to-day experiences were different, both groups were asked to draw on the L.I.F.E. narrative, which provided vivid and concrete examples by enabling learners to take part in an interactive digital experience. For the quantitative analysis, a mixed analysis of variance (MANOVA) was used to determine whether there are any statistically significant differences between the science identity score pre- and posttest means of the three groups (hands-on, online narrative experience, and transmedia). For the qualitative analysis, the coding process followed the framework and procedures proposed by Miles, Huberman and Saldaña (2014). To integrate the quantitative and qualitative findings from our study, we used the triangulation metaphor approach (Erzberger and Kelle, 2003) as a framework to describe the relationship between quantitative (survey) and qualitative (essay) results and integrate the data sets.

Results

No significant difference was found between pre- and posttest scores among the three groups (hands-on, online narrative experience, transmedia) (See Table 1). The statistical analysis revealed no significant main effect of time ($F(1, 95) = 0.10$, $p=.03$). In terms of gain, no significant changes were identified between groups ($F(2, 95) = .40$, p=??). While the quantitative findings showed no significant differences among the hands-on, online narrative, and transmedia groups, the qualitative results showed that after completing the activities, many learners (n=55 out of 88) could list cognitive and social attributes of good scientists as well as imagine themselves as someone who could be a scientist. While there were some overlaps between how the hands-on and online narrative experience/transmedia groups described a good scientist, there were several differences. First, students across all conditions emphasized the importance of cognitive attributes (e.g., being smart, being good at science, being able to plan and execute scientific projects). Not surprisingly, these findings suggest that for many learners, science is primarily an intellectual activity that requires various cognitive skills and competencies. A second common theme across groups is that science is a deeply social endeavor which may have a wide range of consequences for societies and individuals. However, while the hands-on group tended to view good scientists as professionals who are smart and capable of planning and running experiments, learners who completed the online narrative experience were more likely to perceive good scientists as professionals who are perceptive and follow ethical regulations. Similarly, in terms of social attributes, while the hands-on group mostly saw good scientists as passionate and kind individuals, learners who completed the online narrative experience tended to favor attributes such as being respectful and honest.

Table 1: Mean score and standard deviations for science identity.

Condition	Pretest	Posttest
Hands-on	3.66 (0.49)	3.67 (0.56)
Online narrative experience	3.41 (0.83)	3.35 (0.99)
Transmedia	3.55 (0.67)	3.56 (0.64)

Discussion and Implications

This study contributes to the growing body of research on the potential benefits of transmedia learning environments (e.g., McCarthy, Tiu & Li, 2018; Fleming, 2013). Although we did not find evidence from the survey data that our intervention helped learners more strongly position themselves as scientists, our essay approach suggested that many students could identify with scientists after taking part in the Frakenstein200 experience. This discrepancy may derive from the fact that while the quantitative scale focused on learners' traditional academic identity, the essay utilized a narrative perspective and encouraged students to reflect on a range of imaginative and concrete examples from the Frankenstein story. Since identity construction is a complex social-cognitive process, learning scientists may need to use mixed methods approaches to study how students develop their roles as scientists. Future research could investigate the effects of narratives by using longer studies and other types of quantitative and qualitative tools to document science identity development trajectories. Researchers could also use additional science narratives or science fiction stories to see how different sources help or hinder learners' science identity construction practices.

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