

Examining Sixth Graders' Science Identity Development in a Multimodal Composing Environment

Shiyan Jiang, University of Miami, s.jiang@umiami.edu,
Ji Shen, University of Miami, j.shen@miami.edu
Blaine E. Smith, University of Arizona, blainesmith@email.arizona.edu
Kristin W. Kibler, University of Miami, kbw24@miami.edu

Abstract: This study explored sixth graders' science identity development in an integrated STEAM course. Data sources include online surveys, semi-structured group interviews, and students' multimodal artifacts. The results showed that (1) Multimodal composing practices extended students' understanding of scientific knowledge and practices; (2) Taking the role of scientist made students actively think about what scientists would do in their professions; (3) Some students developed hybrid roles to resolve science identity conflicts and transitions.

Keywords: science identity, role-taking, multimodality, scientific knowledge and practice

Introduction

As students may identify themselves as constructors, consumers, or critics of science knowledge, one challenge in science education is to help students develop appropriate science identities (National Research Council, 2017). Although much work has been devoted to investigating and supporting students' science identity development over time (Barron et al., 2010; Carlone, 2017; Van Horne & Bell, 2017), little is known about their perceptions of their own science identity development. Moreover, a growing body of research on digital multimodal composing has shown promise for facilitating the development of disciplinary identities (Smith, 2017). However, most of the studies focused on the cultivation of literate identities and there is a lack of research in exploring the effect of multimodal composing on disciplinary identity development beyond literacy.

Taking on these challenges, we developed an integrated STEAM course that aimed to facilitate students' disciplinary identity development. Two design features were utilized in the course to realize this goal. First, role-taking was used as an explicit means to facilitate students' disciplinary identity development. Second, the course was driven by multimodal composing, through which students' disciplinary identity development could be expressed in multiple ways. The study investigated the following research question: *How did playing the role of scientist while multimodal composing contribute to science identity development?*

Theoretical framework

We employ a sociocultural perspective that people embody a collection of roles in different organizations and communities (McCall & Simmons, 1966; Stryker & Burke, 2000). From this perspective, a science identity is enacted when a person demonstrates normative science knowledge and practices (Carlone & Johnson, 2007), shows positive attitude towards science and science related careers (Archer et al. 2010), and gains recognition as a legitimate participant by self and others in various communities related to science (Lave & Wenger, 1991).

We also draw a social semiotic approach to multimodality (Jewitt, 2010; Kress, 2010). A multimodality framework posits that individuals make meaning with multiple modes and identities are developed through multimodal composing processes and products (Halverson, 2010).

Methods

The STEAM course was offered as an elective for 6th graders in a public, magnet school in a large southeastern city in the United States. A total of 32 students enrolled in the course. The course was driven by a final project to create a multimodal science fiction and students worked in small groups of three to five on their projects. Besides working on their projects, major course activities included technological training, science lessons, guest lectures and lab visits led by faculty members from the university, and multimodal reflections (Smith & Dalton, 2016). The students used iKOS (ikos.miami.edu) to create knowledge entries and chapters for their multimodal science fictions.

When working on their final project, each student selected one of the following roles with the requirement that each group had to have at least one writer and one scientist: writer (developing the narrative), scientist (integrating science), and designer (creating multimodal representations). Despite the differentiated roles, team members were asked to collaborate with each other on their tasks.

Data analysis involved recursively coding online surveys, semi-structured group interviews, student artifacts, and multimodal reflections to compare cases and generate crosscutting themes related to science identity development.

Findings

Nine students (Female: 4; Male: 5) selected the role of scientist and they are the focus of this study. Through our analysis, three themes related to science identity development emerged.

First, the students extended views on how to represent science knowledge through multimodal composing. All of the nine students created multimodal artifacts that integrated a variety of text, images, comics, animations, videos, and charts to represent science knowledge. Through creating multimodal artifacts in the course, eight out of the nine students developed new and broader perceptions of representations of science knowledge and six out of the nine students identified being a scientist as a future career. Thus, leveraging interests in using multiple modes as resources to access, learn, investigate, engage, communicate and represent science had the power to forge science identities.

Second, the students developed extended views of scientific practices (e.g., online researching and collaboration) and enjoyed their role as a scientist. Through taking the role of scientist, seven out of the nine students reconceptualized what science is and what scientists can do. Taking the role of scientists did not guarantee that students would pursue a future career in science, but it made students actively thought about what scientists would do, instead of purely focus on scientific knowledge.

Lastly, the students were consistent in reporting that they eventually ended up with hybrid roles. Regardless of role preferences or level of interests in science, all students changed from scientists to hybrid roles, which consisted of a combination of the role of scientists with other roles. The hybrid roles enabled students to learn science concepts and represent science ideas from the perspectives of different roles. The discrepancy between their preferred professional identity and roles in the team rendered visible issues of identity conflict and transition.

Discussion and implication

In this study, we examined students' science identity development through role-taking and multimodal composing. Our findings indicate that multimodal composing creates an alternative space for students to express and author science identities. This finding highlights the importance of allowing multiple points of entry for students to practice science and express their understanding. We also found that students actively investigated and reflected on what scientists would do as a profession while taking the role of scientists. The finding points to the potential of embedding students in the role of scientists that can foster students' interest in science and motivation to pursue science as a career. In addition, students ended up with hybrid roles in this program. This phenomenon calls attention on helping students make connections between a science identity and other more preferred identities.

This work contributes to the research on science identity development by exploring the ways that playing the role of scientist and multimodal composing provided unique opportunities for sixth graders to engage in science, to develop identities in science, and to see and understand science differently. Also, it contributes to designing learning environments in facilitating the youth to develop disciplinary identities.

Selected references

- Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of research in science teaching*, 44(8), 1187-1218.
- Kress, G. (2010). *Multimodality: A social semiotic approach to contemporary communication*. New York: Routledge.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge university press.
- McCall, G. J., & Simmons, J. L. (1966). *Identities and interactions*. New York: The Free Press.
- Smith, B. E. (2017). Composing across modes: A comparative analysis of adolescents' multimodal composing processes. *Learning, Media and Technology*, 42(3), 259-278.
- Stryker, S., & Burke, P. J. (2000). The past, present, and future of an identity theory. *Social psychology quarterly*, 284-297.
- Van Horne, K., & Bell, P. (2017). Youth disciplinary identification during participation in contemporary project-based science investigations in school. *Journal of the Learning Sciences*, 26(3), 437-476.