

# Students' construction of identity as a learner of science during learning conversations: Implications for the professional development of educators in informal science education

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## Summary

Education researchers and practitioners are increasingly recognizing the need for learning in informal settings to complement formal science learning (Bybee, 2001; Falk, 2001). Informal science education may be critical in meeting the goals of reform and in keeping students and the public informed of advances in science. As such, greater attention has been given to learning in informal science education settings.

A growing body of research in informal learning environments examines how groups engage in learning conversations to make meaning from content and exhibits in these settings. The National Research Council (2009) speculated that individual and group identity might be shaped and reinforced during such learning conversations.

The purpose of this study was to gain insight into the ways identity as a learner of science was constructed during learning conversations at a science camp. Findings from this study suggest implications for the professional development of informal science educators.

## Central Research Question

The central research question that guided the study was:

*What is the role of conversation in influencing science learner identity development during an informal science education camp?*

## Informal Science Education: Science Camps

Characteristics of Informal Science Education	Typical Characteristics of Science Camps
Occur outside the school setting	Community-based
Not developed for school use	Short-term, science intensive programs
Not developed as part of a school curriculum	Residential or day-camps
Voluntary	Held in novel locations
Non-assessed	Offered during winter and summer breaks
Non-competitive	Focus on persisting in science or pursuing science careers
Driven by the needs and interests of the learner	Provide access to resources
	Gains in confidence, attitudes, and interest in science

## Learning Conversations

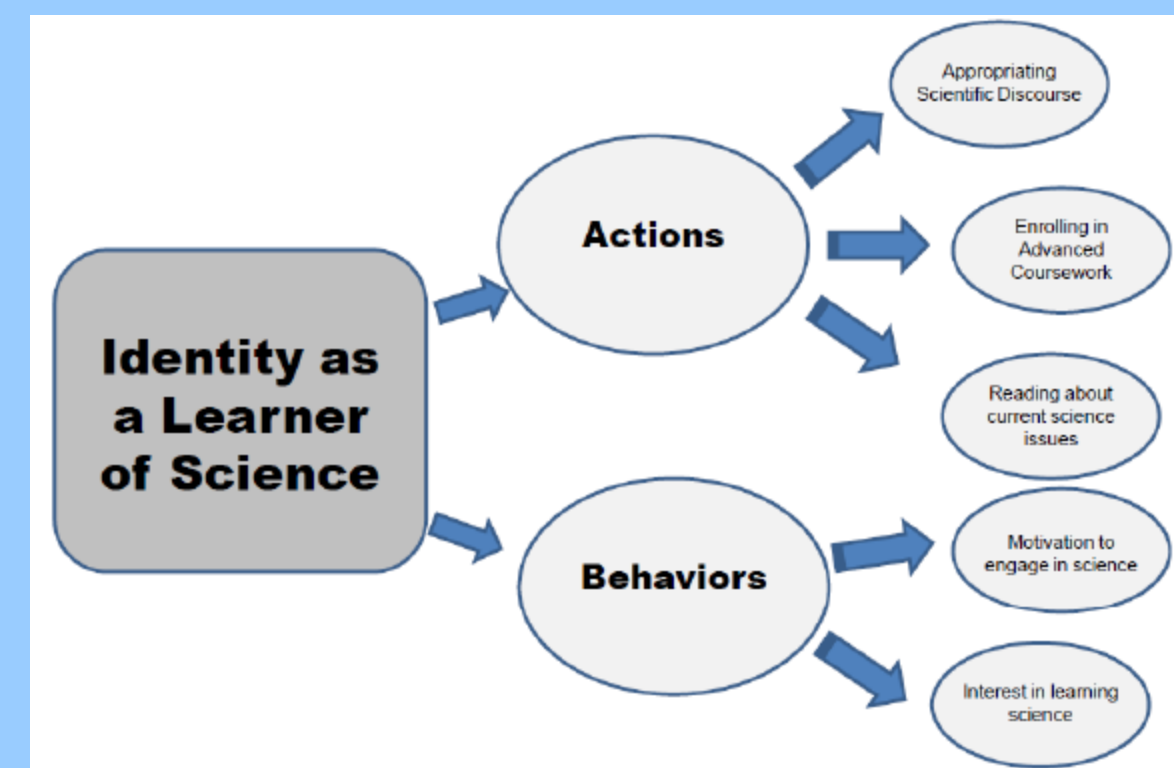
The conversations that participants engage in during social interactions in informal learning environments are referred to as learning conversations (Allen, 2002; Crowley, Callanan, Jipson, Galco, Topping & Shrager, 2001). Through the discourse that surfaces as a result of these meaning making conversations, participants may have opportunities to engage in identity development (National Research Council, 2009).



## Theoretical Framework

### Identity theory

Identity is about becoming and being recognized as a certain type of person (Gee, 2001; 2011). Identity is considered dynamic, socially constructed, context dependent and an ongoing process of negotiation (Olitsky, 2007; Roth & Tobin, 2007; Varelas et al., 2007). Gee (2005; 2011) argued that we use language to enact identity at the right time and in the right context to get recognized as a certain type of person.

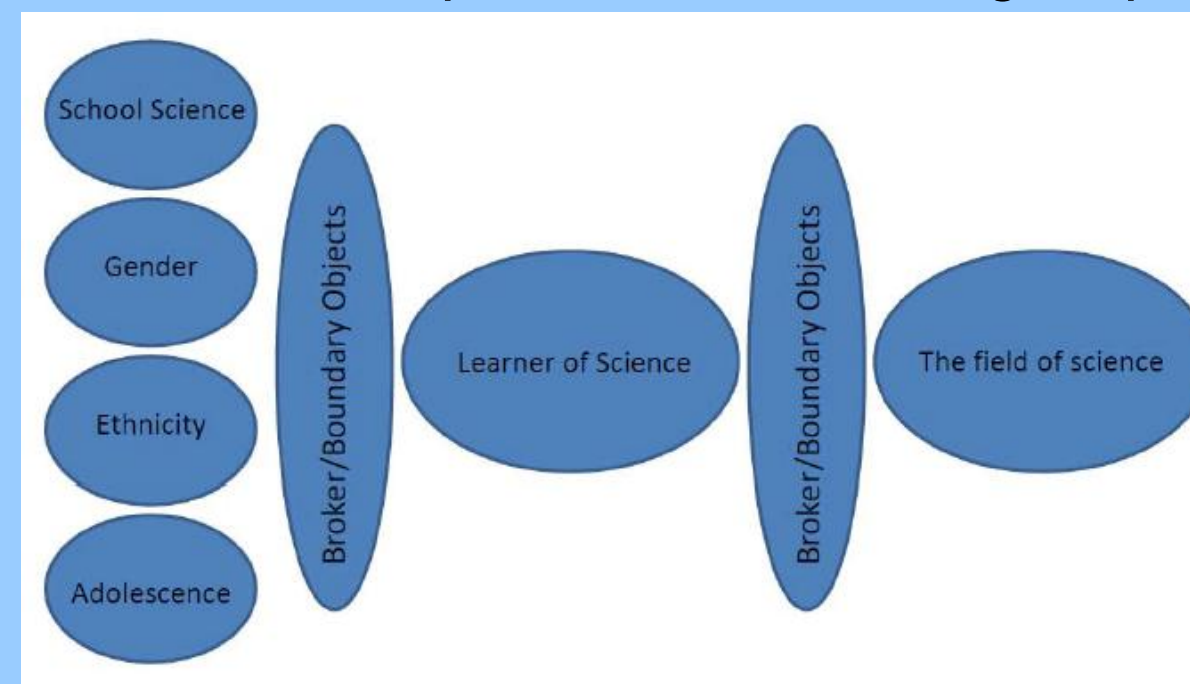


Nasir (2002) argued that learning is about becoming as well as knowing and that how the learning setting affords ways of becoming is central to understanding learning. Varelas et al. (2007) stated that seeing oneself as a capable learner is an

important component of one's identity as a learner of science. An identity as a capable learner can influence the practices an individual engages in as well as the trajectories available to the learners within these practice (Nasir, 2002).

Wenger's (1998) identity theory postulated that members belong to multiple communities. He contended that the process of brokering helps to connect the boundaries of these various communities.

In terms of learning science, the various communities to which the learner belongs must be connected for the individual to imagine a trajectory of full membership in the community of science learners. Brokers and boundary objects help to negotiate the brokering process. In the context of the informal science education camp, I theorized that the informal educators and tools of science could serve as brokers and boundary objects that would guide learners in viewing themselves in the community of practice of a learner of science.



## Study Design and Methodology

### Qualitative Case Study

Creswell (2003) identified case studies as a method in which, "the researcher explores in depth a program, an event, an activity, a process or one or more individuals" (p. 15).

## Case Description

*Marine Science Consortium* (Wallops Island, VA)

*Coastal Ecology* Field Trip Program

*Coastal Ecology* Program activities: science lectures, hands-on activities, research cruises, field-based experiences, & laboratory exercises

## Sample Science Camp Activities

Science Camp Activity	Description
Research Cruise	Physical Oceanography Observations <ul style="list-style-type: none"> <li>Current cross</li> <li>Secchi disk</li> <li>Forel Ule Color Chart</li> </ul>
	Water Quality Testing <ul style="list-style-type: none"> <li>pH</li> <li>Dissolved Oxygen</li> <li>Salinity</li> </ul>
Organism Lab	Macro-organism lab <ul style="list-style-type: none"> <li>Taxonomy</li> <li>Organism identification</li> <li>Dichotomous keys</li> </ul>
Intertidal Field Experience	Biological Sampling <ul style="list-style-type: none"> <li>Organism collection</li> <li>Sieving</li> <li>Seining</li> </ul>
Marsh Field Experience	Data Collection <ul style="list-style-type: none"> <li>Water quality testing</li> <li>Organism collection</li> <li>Zones of the marsh</li> </ul>

## Study Participants

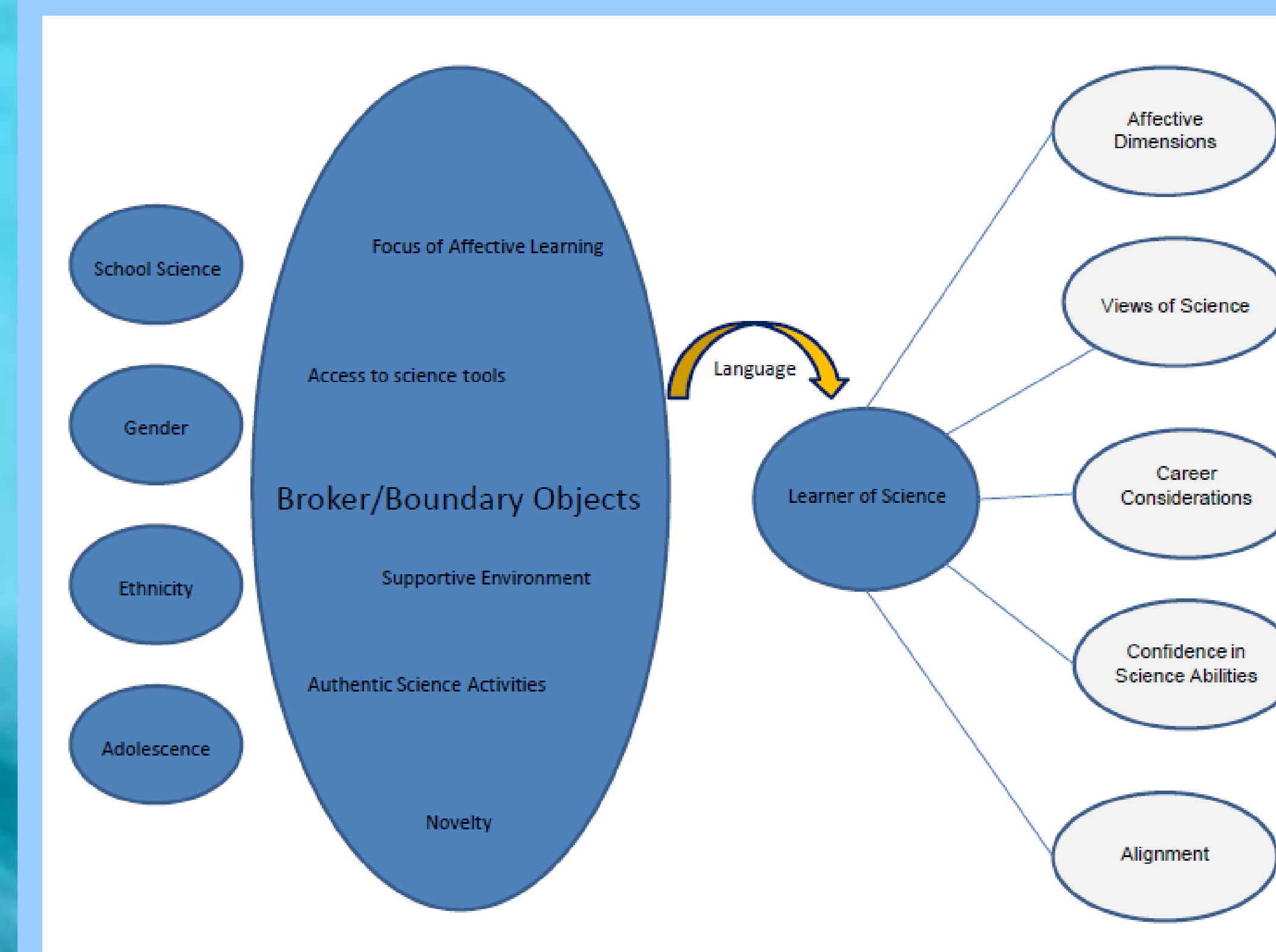
Case Participant	School	Gender	Ethnicity/Race	Grade
Hannah	Patriot MS	F	White	8
Brynn	Patriot MS	F	White	8
Dale	Patriot MS	M	White	8
Celeste	Thomas Jefferson MS	F	African Am.	7
Jordan	Thomas Jefferson MS	M	White	7
Emma	Thomas Jefferson MS	F	White	7

\*Pseudonyms used for student participants and schools for anonymity purposes.

## Corpus of Data and Analysis Methods

Event/Participants	Data Collection Method	Analysis
Observations of Science Activities	Videotape	Discourse Analysis
	Researcher Field Notes	
Student Focus Group Interview	Audiotape	Transcription for verbal and nonverbal interactions
	Videotape	Discourse Analysis
Classroom Teacher Interviews	Audiotape	Transcription for verbal interactions
		Discourse Analysis
Student Reflective Journals	Student responses to journal prompts	Used to construct narratives, or thick-descriptions of case participants

## Theoretical Model



## Identity Development

Identity Development	Description
<b>Affective Dimensions of Identity</b>	<ul style="list-style-type: none"> <li>Greater interest, enthusiasm, and motivation</li> <li>Hands-on, experience-based activities</li> <li>The opportunity to work with their peers in groups</li> </ul>
<b>Alignment</b>	<ul style="list-style-type: none"> <li>Participants began to align their practices and discourses.</li> </ul>
<b>Views of Science</b>	<ul style="list-style-type: none"> <li>Definitions of science</li> <li>Need for science</li> <li>Science in everyday lives</li> </ul>
<b>Confidence in Science</b>	<ul style="list-style-type: none"> <li>Positively influenced confidence</li> <li>More comfortable setting</li> <li>Redefined success in science</li> </ul>
<b>Career Considerations</b>	<ul style="list-style-type: none"> <li>Maintained or developed an interest in pursuing a science career</li> <li>Science career in action</li> <li>Expanded participants' understanding of science careers</li> </ul>

## Influential Features of ISE

Feature	Definition	Example
<b>Supportive Environment</b>	<ul style="list-style-type: none"> <li>Lack of grading pressures, competition, rules and procedures</li> <li>Learners able to try on new identities</li> </ul>	<ul style="list-style-type: none"> <li>Hannah was able to work equitably with a teacher to identify a seaweed species during the organism lab.</li> <li>Dale felt more relaxed in the science camp setting because he felt less pressure.</li> </ul>
<b>Focus on Affective Dimensions of Learning</b>	<ul style="list-style-type: none"> <li>Focus on feelings, emotion, interest, enthusiasm and motivation</li> </ul>	<ul style="list-style-type: none"> <li>The science camp activities were fun and developed participants' interest in science</li> </ul>
<b>Access to Science Tools</b>	<ul style="list-style-type: none"> <li>The tools and equipment used by professional scientists for investigations</li> </ul>	<ul style="list-style-type: none"> <li>Participants had access to tools on the research cruise</li> </ul>
<b>Novelty</b>	<ul style="list-style-type: none"> <li>Learning experiences that are new and unique to learners.</li> </ul>	<ul style="list-style-type: none"> <li>Hannah suggested that the dunes field experience to Wallops Island was a novel and unique experience, one in which she may never have another opportunity for in her life</li> </ul>
<b>Authentic Science</b>	<ul style="list-style-type: none"> <li>Learning activities that mirror the practices and contexts of practicing scientists</li> </ul>	<ul style="list-style-type: none"> <li>Participants collected authentic science data on the research cruise.</li> <li>Participants learning science in the field</li> </ul>

## The Role of Learning Conversations

Language Use	Definition	Example
<b>Sense-making practices</b>	<ul style="list-style-type: none"> <li>Making meaning of science content through social interactions with others.</li> </ul>	<ul style="list-style-type: none"> <li>Emma used everyday language to make sense of terms during the organism lab.</li> </ul>
<b>Positioning</b>	<ul style="list-style-type: none"> <li>Individuals put themselves in categories relative to other in relation to cultural and social norms and practices.</li> </ul>	<ul style="list-style-type: none"> <li>Dale used language to position himself in the category of a person that was good at science.</li> </ul>
<b>Alignment</b>	<ul style="list-style-type: none"> <li>Coordinating one's energy and activities to fit within a community of practice.</li> </ul>	<ul style="list-style-type: none"> <li>Gretchen, Addison and Everett began to appropriate scientific discourse.</li> </ul>
<b>Engagement</b>	<ul style="list-style-type: none"> <li>Active involvement in the process of negotiation of meaning. Direct experience of the world.</li> </ul>	<ul style="list-style-type: none"> <li>Jordan believed he was more engaged during the hands-on, field-based activities at the science camp.</li> </ul>
<b>Power Dynamics</b>	<ul style="list-style-type: none"> <li>The ways that individuals exert power and control over one another.</li> </ul>	<ul style="list-style-type: none"> <li>Hannah felt less pressure and less under the watch of the teacher.</li> </ul>
<b>Seeing Others in New Ways</b>	<ul style="list-style-type: none"> <li>Learning more about members of a community and developing new relationships and views of others.</li> </ul>	<ul style="list-style-type: none"> <li>Emma and Jordan believed that others would learn more about them.</li> </ul>

## Implications for Teacher Education

The data collected from this study can provide insight for teacher education in informal science environments and guidance for professional development opportunities for informal science educators. A finding from the study was the role informal science educators at the MSC played in facilitating learning conversations and the construction of identity for learners. This study suggests that fostering learning conversations and identity development for visitors and participants of informal science education programs is a fruitful area for professional development of informal science educators.

## Recommendations for PD of Informal Science Educators

