

# Science Identity in Sociohistorical Context: Interpersonal Connections, Social Goals, and Perceptions of Time and Agency in Adolescence During a Pandemic.

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## Abstract

Informed by an integrative theoretical approach connecting ecological systems theory and socioemotional selectivity theory, the present study examined how high school students, during the COVID-19 pandemic, reflected on various aspects of identity after watching videos of mentored science learning activities featuring students of similar ages and backgrounds. We focus particularly on messages around science, as the pandemic—and social discourse around the pandemic—has made the work of science especially visible. (1) the pandemic magnified the effect of peer, family, and community influences on adolescent identity development, (2) the pandemic simultaneously prompted a shift towards social goals while also impeding the pursuit of those goals, and (3) students expressed a lack of personal agency and clarity about their futures, despite the positive messages featured in the videos.

## Introduction

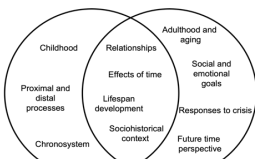


Figure 1. Integrative theoretical approach underpinning the present study.

We argue that the pandemic—as a defining sociohistorical event that may have shaped how people perceive themselves in relation to others as well as their own future goals—presents an important opportunity to examine how adolescent youth reflect on their interest and identification with science.

## Study Aims

The present study seeks to understand how diverse groups of high school students, during a unique and generatively-defining sociohistorical event—the COVID-19 pandemic—reflect on their sense of self after watching videos of mentored science learning activities featuring students of similar ages and backgrounds. We expected that the videos would prompt students to reflect on their identities and possible futures in science in the context of the pandemic. Rather than adopting one particular identity development framework, we sought to explore and thematically organize the content of students' reflections about identity more broadly, informed by ecological systems theory and socioemotional selectivity theory. Reflecting the qualitative, exploratory nature of our study, we did not formulate specific predictions, and we anticipated that additional research questions related to our primary study aim would emerge during inductive coding.

## Participants

In July of 2020, we conducted 11 virtual focus groups with 38 high school students from two university-based summer research programs in the United States. These programs serve students traditionally underrepresented in higher education and STEM pathways. Thirteen participants identified as Hispanic/Latinx, nine as Multiracial, eight as White, and six as Black/African American. Participants were roughly evenly distributed across each of the four grade levels of high school. Table 1 presents the demographic makeup of the students who participated in the focus groups.

## Procedure and Analysis

**Procedure:** Students participated in 90 minute focus groups online, led by a trained member of the research team. The focus groups began with brief introductions. Then students watched two videos: 1) a 4 min video that introduced the undergraduate mentors and high school mentees that are the focus of the curriculum and 2) one of the four main videos which are the focus of each instructional module. After students watched the videos the focus groups continued with a series of questions that prompted participants to connect what they watched to their own experiences and perceptions of science. The session ended with questions about participants' interest in science and thoughts about their future.

**Analysis:** We employed a reflexive thematic analysis (Braun & Clarke, 2020) capturing both deductive and inductive elements (Charmaz, 2014). Deductive elements included the a priori, theory-based codes that we expected to emerge from the focus group responses. Because our study focused on science interest, identity development, and salient features of identity (such as gender and race/ethnicity), our analysis approach sought to examine the focus group responses through these lenses. However, to preserve the authenticity of participant voices, we also coded inductively to identify themes from participants that emerged from the focus groups that we did not originally anticipate.

## Digital Storytelling

We developed a self-directed online curriculum designed to help high school students imagine a future in science aligned to their values and identities. The videos feature authentic depictions of mentored science learning activities between undergraduate mentors and high school mentees of color interacting together in both formal settings. Our videos made contextual cues salient through visual depictions of females and youth of color engaged in science, personal reflections around stereotypes and microaggressions, and resilience in the face of discrimination.

Video	Description
<b>Introductory video: Why Science Matters</b>	<ul style="list-style-type: none"> <li>Rich B-roll scenes from labs</li> <li>Expression about why science matters and what it takes to do science from both mentees and near-peer mentors</li> <li>Expressions of what students care about and how science connects</li> </ul>
<b>Video 1: Skills and Attitudes to Do Science</b>	<ul style="list-style-type: none"> <li>Take-home message: Science matters to the students</li> <li>Brief snapshot of how science requires persistence, curiosity, creativity, and other skills that some may not immediately think are important in science</li> <li>Take-home message: Doing science is much more than "being smart" and everyone can do science</li> </ul>
<b>Video 2: The Look and Feel of Science</b>	<ul style="list-style-type: none"> <li>Rich B-roll of students in action of what doing science look and feels like</li> <li>An immersive look at experiences in the lab with the emotional quality of students' excitement, frustration, patience, etc.</li> <li>Engages viewer in sensory experience of doing scientific work, including people, objects, textures, smells, sounds, etc.</li> <li>Take-home message: We have all experienced science firsthand and we can imagine ourselves as scientists in the future</li> </ul>
<b>Video 3: Positive and Negative Forces</b>	<ul style="list-style-type: none"> <li>Students express positive and negative forces they experience throughout video</li> <li>Description of diverse roadblocks encountered, such as having to work while being a student, various financial pressures, micro-aggressions, lacking access to rigorous science courses at school, expectations of being available for friends, etc.</li> <li>Expressions of proactive and adaptive strategies students used to overcome those roadblocks with a focus on reframing with proactive strategies</li> <li>Take-home message: Positive forces help shape paths for success and effective strategies for handling difficulties and setbacks, which are part of doing science and life, generally.</li> </ul>
<b>Video 4: Forks, Roadblocks, and Timelines</b>	<ul style="list-style-type: none"> <li>Mentees talking about their plans for the future and strategies they are thinking about to get there. Ideas about potential forks they may encounter and choices to make or roadblocks that may demand adaptability.</li> <li>Mentors describing their timeline: Where did their path start and what were the specific forks they encountered? Where does their path lead for them and what do they expect to encounter? What strategies helped them thus far and what will help them in the future? Who are the positive forces in their lives that they lean into and depend on?</li> <li>Take-home Message: Everyone has images of what they want to be like and avoid being like for next year and beyond and everyone can do something now to make attaining these desired selves more likely—difficulties should be expected—they are part of life and life isn't always fair.</li> </ul>



## Themes

Code	Description	Example quote
Race / ethnicity	Mention of race or ethnicity—explicit or implicit OK	"I mean I think that when it comes to equality, like image and skin colors, I think that science can help prove that regardless of skin color, everyone's the same. Everyone's human."
Racism / discrimination	Language around experiences or observations of racism and discrimination	"I feel like science could play a big role in telling us how, like what is right and what's wrong. I feel like science could tell us how racism is bad, and sexism is bad because of our natural instincts, and what humans think of each other."
Gender	Mention of gender—explicit or implicit OK	"I thought it was really cool that there were these shadowing, the STEM people, and I was glad that there were a lot of women because women are less represented in STEM people."
SES / Class	Mention of SES or class	"I think that certain communities don't get the same access to the healthcare and have all the services to really protect themselves which results in, like, the unequal distribution of the cases and how they're mainly in, like, lower income communities."
Age	Mention of age	"Yeah some of them are not even in college yet and they already know what they want to do with their lives and I just think that's cool for them."
Other identity	Other facets of identity that are not related to race/ethnicity, gender, age, and SES/class. Must address aspects related to a sense of self for the individual.	"And I guess science or just technology made from scientific discovery has definitely helped my family with medical problems, like health issues."
Intersectionality / diversity	Non-specific reference to diversity (i.e., does not specifically identify which identity markers are included when referring to "diversity")	"I think for me definitely seeing that they didn't all look the same for sure. Like diversity within the group because I think it's, there's like a generalization that only certain groups can fit into STEM and really be successful and it's not very common to see that many different types of people actually pursue a career in that field."
Interests (now-focused)	Interests that refer to the present time	"I haven't really changed the way I think of science because I always, like, had a great interest and appreciation for science and through this pandemic it makes you appreciate and think more of all the scientists and people that are trying to work hard to find a cure to help others. It's really made me appreciate them way more."
Career / aspirations (later-focused)	Mention of aspirations or career plans that refer to a future time	"Maybe because I really want to go into medicine and that's why I'm taking so many science courses because medicine evolves from science so you have to know your science in order to go into medicine. You have to know what you're going to give people and all that."
Pandemic-related	Any excerpt—identity or otherwise—that relates to the pandemic or the coronavirus	"Definitely we're going to have more advances but at the same time I don't feel like we're going to be fully prepared for example we were not prepared for the coronavirus and maybe something is going to happen in the future."

## Conclusions

Attending to the sociocultural context in which adolescents develop is a core consideration in understanding the process of identity formation (Crocetti, 2018). This is particularly salient when examining STEM identity formation among adolescent girls, for whom salient media images and stereotypical depictions of individuals in science can profoundly shape these identity processes (see Steinke, 2017, for a review). Media depictions of who does science and who is successful in science—key elements of the learner's macrosystem—can shape how individuals perceive themselves and their own futures in science. Our videos were intended to prompt such reflections. As students' focus group responses indicated, two broad types of participant responses emerged: **self-oriented** and **other-oriented**. That is, while some responses related to students' own experiences, other responses mentioned the interpersonal dynamics and connections that shaped how they reflected on their personal science identities during the pandemic. Perhaps it is not surprising that the videos, which featured authentic interactions between undergraduate mentors and high school mentees engaged in science research, would prompt reflections about relationships with friends, family members, and other individuals. Participants' responses underscore the importance of attending to the broader interpersonal context in the science identity development processes.

The videos that our participants watched during the focus group session clearly depicted how other adolescent youth were navigating their own processes of imagining and pursuing academic and career pathways in science. Yet, despite the salient cues presented in the videos, participants struggled to articulate their future plans (related to science or otherwise) with much specificity. Because the pandemic context (i.e., impeding social goals and priorities, acceleration of milestones due to a perceived shortened time horizon, etc.) appeared to contradict the content featured in the videos (e.g., adolescent youth freely engaging in one-on-one and group activities without masks, as these videos were filmed the summer before the pandemic), our focus group participants might have been unable to relate to or connect with the individuals featured in the videos in a meaningful way. Though some students expressed a lack of agency about their future plans within and outside of science, others expressed some sense of agency through statements of interest and possible intent to pursue science in the future.

