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ABSTRACT

Study context

Previous work has shown that reflecting on personal stories and research narratives of diverse scientists can have a positive effect on undergraduate students' science identities, relatability to scientists, and their understanding of the nature of science (NOS). These studies involved primarily text-based stories.*

Research design

Nonfiction film is an immersive storytelling medium and an effective teaching tool, yet no previous studies have explored the impact of nonfiction films on these outcomes in undergraduate students. To address this gap, we performed a convergent, mixed methods study to measure the effect of watching two nonfiction films featuring scientists telling their personal stories and research narratives on students' science identity, relatability to the scientists in the films, understanding of the NOS, and factual recall. Two short films were assigned in a large online undergraduate microbiology course. After watching each video, students completed a survey.

Analysis

We analyzed quantitative responses using descriptive statistics and open-ended responses using a computational textual analysis method of structured topic modeling. Preliminary results indicate that watching the films had considerable impact on student learning as well as their perceptions of scientists, self-identification as scientists, their relatability to the scientists in the films, and an understanding of how science works.

Contribution

This study will further our understanding of using interventions like nonfiction films to support science identity development and NOS comprehension for students, which could improve student engagement and potentially broaden participation in science.

* For original abstract with reference citations, email shannon@scicommlab.org

INTERVENTION & STUDY DESIGN

Course: General Microbiology (300-level) at NCSU, Fall 2023

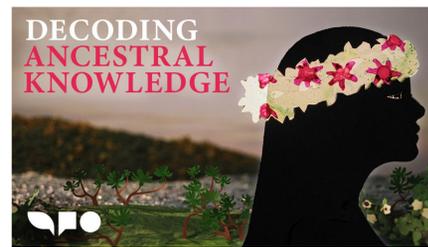
Format: 15 week online, asynchronous

Intervention: Film + survey at weeks 8 and 10

Grading: Credit for survey completion

	Decoding	CRISPR
Class size	286	286
Survey Respondents	265, 92%	277, 97%
Consent to participate	229, 80%	243, 85%

Week 8: DECODING ANCESTRAL KNOWLEDGE



10:25 min
Scan to watch film or go to bit.ly/decodingancestralknowledge



Week 10: CRISPR APOSTLE



11:39 min
Scan to watch film or go to bit.ly/crisprapostle



Personal story

Research narrative

Survey Questions, Mixed Methods (~20 min):

Learning gains (film-dependent)

Decoding: How can the study of microbial diversity contribute to everyday life?

CRISPR: What is the role of microbiology in CRISPR technology?

Science Identity

This video changed my ideas of what it means to be a scientist/researcher.

Agree/Disagree

Explain

This video changed my ideas of how I see myself as a scientist/researcher.

Agree/Disagree

Explain

Scientist Relatability

How did you relate to the identity of the scientist/researcher shown in this film?

Nature of Science (NOS)

What did you learn about how the process of how science works?

RESULTS

BOTH FILMS

Figure 1. This video changed my idea of what it means to be a scientist/researcher (N=231)

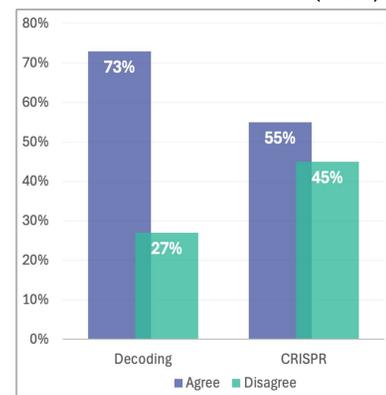
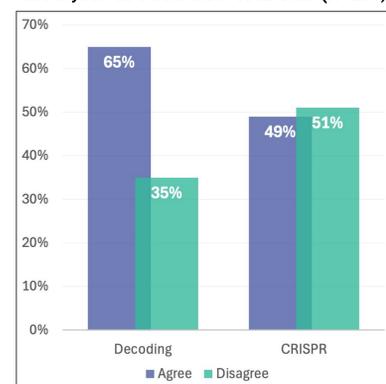


Figure 2. This video changed my idea of how I see myself as a scientist/researcher (N=231)



DECODING ANCESTRAL KNOWLEDGE

Table 1. Top 5 prevalent topics in open responses to "This video changed my ideas of how I see myself as scientist/researcher (explain)."

Decoding	Topics	Quotes
Most prevalent topic	Change in Perception, Validation and Integration of Culture and Knowledge	"I believe the video did change my ideas of how I see myself as a scientist. I enjoy science and I also enjoy art and culture so to see these things interact with one another was interesting to me. Before watching the video, I do not think I would have been inclined to connect culture with biological science but after viewing the video I can see this may help in bringing about new ideas and understanding."
	Being a Counter Stereotypical identity	"I see that I can be a researcher without being the stereotypical researcher. I can observe my daily life and environment, identify some occurrences, and seek to find the solutions to them. It doesn't all have to be overly complicated."
	Science for Passion and a Positive Global Impact	"I want to be able to use science towards my passions as someone who is interested in the field of science and healthcare. If I believe that there is a problem within my community that can be helped with science, this video has motivated me to do the same."
	Diversity and Flexibility in Scientific Identity	"Being a scientist involves just as much of the individual's background as their knowledge. I have my unique experiences and ways of thinking that make me valuable as a scientist and able to contribute in unique ways."
Least prevalent topic	Personal Exploration and Motivation in Science	"For a while, I've been struggling with my motivation to pursue my career as a scientist, and this video provided relief for me in a way. It was refreshing watching this woman become a scientist because she was driven by her love of her community."

Table 2. Top 5 prevalent topics in open responses to "How did you relate to the identity of the scientist/researcher in the film?"

Decoding	Topics	Quotes
Most prevalent topic	Combining Identity, Cultural Heritage and Science	"...she values the history of her ancestors and the value they gave to the environment and microorganisms. Similarly, I value my ancestral history especially in terms of science. For example, Ayurveda plays a major role in my ancestral history and it is a topic I hope to further study and advance."
	Passion and Dedication to Science	"...she was so intrigued by the world around her and so dedicated to working towards solutions to problems she might find. I found it very inspiring and motivating, encouraging me to keep asking questions and working towards my career goals."
	Personal Connection to a Place/Environment	"...she had a purpose in becoming a researcher. She knew that she wanted to understand her environment and studied to come back to her hometown and aid in conservation. I also have a connection with my hometown... I was born in NC, raised here, and educated here. I know I want to go into medicine and practice in rural North Carolinian Town after my education."
	Cultural Integration (or Lack Thereof) in Science	"...she maintains her cultural beliefs and goes as far as studying the scientific components of these beliefs, as they have been retold for various generations. I think I could take the same approach to some of the folklore I have heard in my life, especially being from a Hispanic culture."
Least prevalent topic	Community Engagement and Well-being in Research	"She was extremely passionate about helping her community. I am as well. I want to pursue research that will help a community...I want to help my community through my science"

CRISPR APOSTLE

Figure 3. Evidence of student learning after watching CRISPR Apostle

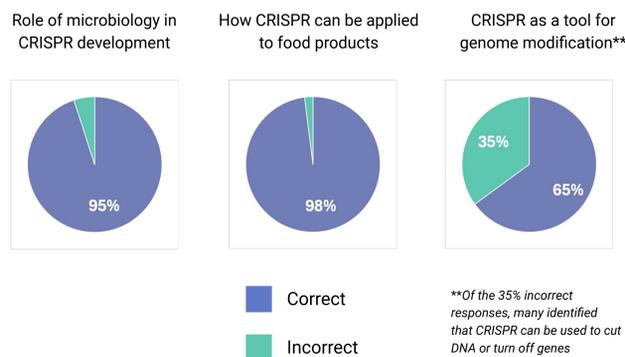


Table 3. Top 5 prevalent topics in open responses to "What did you learn about how the process of science works?"

CRISPR	Topics	Quotes
Most prevalent topic	Process of Science: Plan and Repeat	"This video highlighted the progression of the scientific method, asking questions and then building on those answers to ask even better questions in order to find the answer to the larger picture at work"
	CRISPR Mechanism	"I knew that segments of DNA were "stored" to later be matched up as a defense mechanism. But it helped greatly to see a visualization of the CRISPR repeats, and segments that separated it. With that segment being a target in foreign DNA."
	Food Science Application	"...how important it is to constantly keep up with new research and how it can be integral to different areas of study. I think it was interesting to see it from the perspective of a food scientist though because I usually focus more on the medical field, but I could see why it would be important to have people from different fields so that you can integrate information together."
	Process of Science and Meaning Making	"The process of science isn't founded or grown off of a single principle. As stated in the video he says that a lot of times it takes decades and many scientists to consistently add new theories or ideas for a revealing of a new discovery."
Least prevalent topic	Dynamic, Self-Correcting Approach	"The scientific process is a dynamic and self-correcting system. It's driven by curiosity, critical thinking, and a commitment to uncovering truths about the natural world. The process of science is never truly complete, as it continually evolves and expands our knowledge and understanding."

CONCLUSIONS

Both films had a positive impact on all 4 variables tested (not all data shown), which suggests that nonfiction films with personal stories and research narratives could be useful tools in supporting these student outcomes. Interestingly, both films demonstrated strong evidence of student learning (Fig 3; d.n.s.), but they also had some differences.

DECODING: Science identity & scientist relatability

Considering that *Decoding* incorporates more personal story than research narrative, it's not surprising its powerful effect on how students define scientists, how they see themselves as scientists, and how they related to the scientist in the film. Unifying themes that emerged across all open-response questions included:

- Integrating culture into your science and your identity.
- The importance of finding your passion.
- Serving the environment and community through science.
- Making science personally relevant.

CRISPR: Nature of Science (NOS)

Considering that *CRISPR* incorporates more research narrative than personal story, it's also not surprising its powerful effect on NOS comprehension, with emergent themes including:

- How science is about asking questions and building on them
- Understanding the mechanism of CRISPR.
- How CRISPR can be applied across disciplines, including food science.
- The scientific process of meaning making.

Next steps: Although this study is preliminary, it opens the door for more research into nonfiction films as a possible intervention for these important outcomes that could motivate student learning and persistence.

Interested in using these resources?

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