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Enhancing Experiential Digital Learning

Exploring the Impact of Interactive & Narrative-Driven Media on Informal STEM Learning in Kids & Young Adults

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Overview: With a wide array of digital platforms and formats available to informal STEM media producers, it can be challenging to decide which approach to use to reach different audiences. This is particularly important in the context of distant, remote, or challenging concepts, such as polar science, which the average viewer might not have much experience with or exposure to.

This study explores how two groups of younger audiences (ages 11-14 and 18-25) engage with polar science delivered through two media formats. It also explores the validity of a "strand" framework, and the potential role of STEM socialization in engaging with science topics.

- **Goal 1: Design to Achieve Learning Outcomes:** Understand the learning outcomes associated with two popular styles of science engagement: narrative-driven approaches (Polar Extremes film) and immersive, exploratory approaches (NOVA Polar Lab)
- **Goal 2: Measure Polar Science Learning:** Develop a learning outcome metric appropriate for polar science and aligned with the "strand" framework
- **Goal 3: Understand Science Identity Development:** Explore whether and how young people experience science as a process or skill set, as opposed to a culture or group they identify with, or a potential career path.

Knowing how each audience engages with the format and what they learn can help media producers create more targeted and effective materials.

Methods: Data collection included nationally representative surveys of 18-25 year olds on MTurk and TurkPrime, and surveys and focus group discussions with a smaller sample of 11-14 year olds in Santa Barbara CA and online.



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Topline Findings

Both the film and lab successfully supported learning outcomes across the six Strands of Informal STEM Learning.

Learning outcomes varied between age groups, with younger audiences displaying more Strand 1 (interest & engagement) and older audiences exhibiting more instances of Strand 4 (metacognition, reflecting on science).

The film was slightly better at promoting Strand 1 and Strand 4, while the lab more strongly supported Strand 3 (active inquiry), Strand 5 (collaboration and communication), and Strand 6 (identification with science).

Two primary learning outcomes were observed within the viewers (18-25), despite designing a survey questionnaire to cover all six strands. This means that learning tended to fall within the broad categories of "polar science impressions" and "recognizing scientific inquiry."

Respondents recalled knowledge only moderately well after the film and lab (Strand 2, understanding). While both audiences could reiterate what they saw, they didn't tend to explore 'why' or engage in deeper reflections, unless prompted by a focus group moderator.

Results indicate that discussing science with others is more of an influence on learning outcomes than whether someone has a friend or family member in a science-related career.

Young women (18-25) were far more likely than men to have abandoned science as a potential career because they felt "it wasn't for them." They recalled times when they were 'bad' at science or math, or when they did not feel welcome in male-dominated STEM fields. Men, however, did not report feeling they lacked inherent abilities in STEM or that they felt unwelcome in the field, if they decided not to pursue a STEM career.

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NARRATIVE / FILM SUPPORTS

Compared to the lab, the film was more effective at supporting...

- **STRAND 1 - Interest & Engagement / Importance of Polar Science.**

Participants who watched the film were significantly more likely to report that the information they learned is so important that others should be aware of it as well

- **STRAND 4 - Metacognition / Reflecting on Science.**

Participants who watched the film were significantly more likely to report that polar science helps us to appreciate how humans are a 'force of nature'

INTERACTIVE / LAB SUPPORTS

Compared to the film, the lab was more effective at supporting...

- **STRAND 3 - Scientific Method.**

Testing/experimentation - Participants who played the lab were significantly more likely to recognize "testing/experimentation"

Making observations - Participants who played the lab were significantly more likely to recognize "making observations"

- **STRAND 5 - Engaging in Scientific Practice / Science Norms**

Feeling like a part of the team - Participants who played the lab were significantly more likely to report feeling like part of a team

- **STRAND 6 - Identification with & Confidence in Science**

Confidence to understand other science content - Participants who played the lab were significantly more likely to report feeling confident that they could understand other science content that they come across

Confidence to pursue a science-related career - Participants who played the lab were more likely to report feeling confident that they could go into a science-related career (whether or not they decide to)

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Recommendations

The following recommendations apply to science media producers and educators alike!

Facilitation is instrumental to learning

While older audiences can often make connections between what they see and what it means more broadly, younger audiences benefit greatly from facilitators or discussion leaders that connect learning outcomes to deeper understanding.

- *Continue to support teacher guides*
- *Include more opportunities for choice and autonomy: while the lab acts as a de-facto facilitator, the opportunity for learners to make their own choices about other media should be embedded into the program as well*
- *Embed opportunities throughout STEM media products for audiences of all ages to reflect*

Intentionality works

The lab was explicitly designed to highlight collaboration in science, and it shows! Media creators can use the Strands and other frameworks to help them both with developing content and ultimately reinforcing the most important learning outcomes.

- *Make it a truly collaborative game: by including other players in Lab activities, such as a networked multiplayer game, learners can see how they too are solving polar puzzles with a team of fellow explorers*

Discussing science with others enhances the experience

Those who regularly discussed science topics with others more frequently tended to display greater learning outcomes in science on all of the strands.

- *Ask audiences to share what they learned with others: whether face-to-face or via social media, media producers can encourage viewers to go out and actively discuss science with others in order to reinforce their new knowledge and integrate science into their daily lives*

Highlighting 'everyday' solutions may counteract feelings of dread

Younger audiences need a little help to not feel so downtrodden after viewing upsetting content (such as climate change); older audiences tend to be more inspired and hopeful.

- *Focus on solutions: highlight what both science professionals and everyday people are doing to try to fix the problems highlighted by the science*
- *Ask viewers to participate directly: completing a home utility audit (like water or energy) gives kids a chance to see that reducing consumption doesn't have to be abstract; they can do it right where they live!*