

Open-Source Science and Storytelling: Investigating The Impact of Narrative Structure on Adolescent Engagement

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INTRODUCTION:

Inclusion, equity, and collaboration - these are the defining characteristics of open-source communications changing the landscape of modern science. An increasing number of scientists, journalists, and academic institutions are committing themselves to these principles in order to make scientific knowledge as accessible as possible. Open-source science “refers to the removal of major obstacles to accessing, sharing and re-using the outputs of scholarly research” (Tennant, 2016). Open-source scientific communications seek to correct historic imbalances in access to scientific -research by being free to access, use and download by anyone unconstrained by time or geographic location (Fisher, 2022). This form of open-source content results in the broader dissemination of information by increasing viewership and diversity of audiences (Davis, 2008). While open-source science has thus been able to overcome the barriers posed by the traditional “gate-keepers” in the field, additional challenges remain even once audiences gain access to scientific information.

There is currently a large gap between the accessibility of scientific knowledge and public engagement. In the advent of the digital age, information has become readily available to viewers across the world. However, this accessibility does not necessarily correlate to audience interest or engagement. This disparity is especially critical for adolescents aged 11-14 who often find themselves disinterested and removed from science during their middle school years (Genareo, 2016).

Studies have found that interest in science declines by 23% from middle school to the end of high school with enduring interest in STEM being largely formed by age 14 (Genareo, 2016). According to numerous researchers this is a pattern “most pronounced for girls, non-white ethnic minorities, and urban low-income youth who report less positive attitudes about science, participate in fewer relevant out- of-school activities, and are less likely to pursue further study and careers in STEM” (Staus et al, 2020, p.1). In other words, these students are less likely to develop STEM identities or “think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science” (Singer, 2020).

Adolescent audiences may have access to scientific information from their schools, but this is not the same as engagement or sustained interest in the subject. This paper

therefore seeks to better understand how the structure of open-source scientific communications are received by such readers so that students of all backgrounds may be enriched by the exciting knowledge being produced in the life sciences.

RESEARCH QUESTION:

How does the narrative structure of open-source science communications impact adolescent engagement?

RESEARCH DESIGN:

Aim 1 - Categorize open source science communications in terms of form, content, and structure

In order to address this aim, I established a list of criteria to determine if selected science communications are within the parameters of the study. This criteria was developed based on the definition of open-source science provided by Fisher in the article “Open access guidance, databases and more!,” and the classifications methods used in a study entitled “ The state of OA: a large-scale analysis of the prevalence and impact of Open Access articles”.

Since this study focuses on open-source science communications, selected works must be free to view and download, accessible without institutional affiliation, and possess scientific credibility. In addition to being open source, it must also be seen if the communications are focused on the life sciences, possess a narrative structure which is a literary term used to describe the framework of a story (Author Learning Center, 2018), and intend for their audience to be adolescents within the 11–14-year-old age range.

Once the preliminary criteria are met, I plan to analyze the selected communications using an adapted quantitative systematic literature review. This type of review will be highly effective because it results in reproducible, reliable, and quantifiable knowledge (Pickering & Byrne, 2013). It also identifies important gaps in understanding due to its comprehensive analysis (Pickering & Byrne, 2013).

This research methodology entails defining a topic, formulating research questions, and identifying related keywords. The keywords will pertain to the desired criteria (concentration on the life sciences, mention of intended audience, etc) and “be used to search electronic databases for relevant papers” (Pickering & Byrne, 2013, p.14) that have academic credibility. I will then read and assess communications containing the

keywords to see if they are truly relevant. From there I will be able to develop a personal database on open-source life science communications for adolescents. This database will be composed of “categories and subcategories of data to be populated with information about each paper found through the electronic searches” and summary tables (Pickering & Byrne, 2013, p.16). Categories may include information about the specifics of the communications but will also allow me to identify the narrative structures and forms of the various communications by quantifying their different components. As a result of such review, the selected communications will be classified as having either linear, non-linear, circular, parallel, or interactive structures. These communications will also be categorized as either audio, visual, or text content.

Aim 2 - Analyze adolescent engagement with selected and categorized open source scientific communications

I plan to accomplish this aim using a two-fold approach to data. I will first assess adolescent engagement with selected open-source communications by performing statistical analysis on passive data. Existing data on viewership and reach of the selected communications will be drawn from online tracking sources. These sources include Reponic, a website which gauges podcast listenership, Social Blade, a site that analyzes the performance of YouTube videos, and Sitechecker Pro, a free platform that provides extensive traffic reports for online pages. Once a sufficient amount of information is collected, a quantitative research approach should be used to assess the reach, engagement, and viewership of the selected communications. I will analyze the collected information in a manner similar to the researchers of the “A systematic analysis of online public engagement with 10 videos on major global health topics involving 229,459 global online viewers” (Campbell, 2020). I will assess reach, engagement, and viewership by comparing the number of total and unique views/visitors/ listeners, number of likes, number of comments, number of shares, view rate, average view duration, retention rate, and impressions divided by frequency (reach) for the selected communications. For the purposes of this aim, the data will be analyzed for each communication and by category.

I will then use a series of focus groups to determine if and why there are differing levels of engagements with the various types of communications. The goal of the focus groups is to enhance our understanding of the appeal various scientific communications have or do not have for this audience. The sampling frame will consist of 11-14 year-olds currently enrolled in middle school. Students will be sampled randomly in order to ensure the focus groups reflect the demographic diversity of multiple schools in a selected area. Once the focus groups are assembled, participants will be asked to read, watch, and listen to selected open-source science communications with different

narrative structures. In order to guide the discussion, the focus group moderator will pose questions regarding the participants' reactions to such content, their previous exposure to similar works, and their opinions on each piece's relative appeal. Afterwards, the data collected from the focus groups will be analyzed qualitatively using a thematic analysis. The form of audience analysis provided by these focus groups will allow for a more in depth inquiry into adolescent engagement with scientific communications to supplement the passive data collected (Focus Groups: Theory and Practice, 1990).

Aim 3 - Develop an open-source science platform for real-time analysis

I propose developing an online platform which will act as a launchpad for adolescents to explore their interest or questions about science. This platform will host a range of open-source communications with different forms and structures focused on the life sciences. The initiative will be built using insights gained from the research methodology outlined above and will allow for the analysis of student preferences with existing open-source science communication using Google Analytics. This initiative is important because it will allow us to bridge the gap between accessibility and engagement in real-time. This real-time analysis adds a new dimension to my research which can be used by other science educators to improve their reach and connection with adolescent audiences.

INTELLECTUAL MERIT:

This work will advance our understanding of adolescent engagement with open-source science due to the multifaceted research methods it employs. The combination of passive and active data will allow us to characterize existing content in important ways as well as providing the field with key information about the target audience. The systematic quantitative literature review method will help address a critical gap in scientific literature and the focus groups will provide invaluable insight on the perspective of children due to their verbal structures. Currently, a systematic quantitative review of open-source science communications does not exist. Yet, it is clear that such a study is needed because little is known about how the framing and form of these works impact a viewer's interest in the communications and the fields they stem from. This study also has potential to advance our understanding of the subject through the use of focus groups. Focus groups can challenge assumptions about adolescents by providing children themselves the opportunity to share their thought processes. Scientists can learn how adolescents' ideas about open-source science may be shaped by group dynamics and gain further insight that may support or contradict verbal responses by observing nonverbal communication during the discussions.

BROADER IMPACTS:

This study will have ramifications for academia, science education, and the formation of STEM identity for adolescents. The knowledge garnered from this proposal can be integrated into middle school curriculums and/or made available to science education providers. This may increase adolescent interest in the life sciences, leading to more students who pursue careers or academic endeavors in the field. Since this study will allow the scientific community to better understand how young children engage with academic content, this information can also be used to help strengthen the STEM identities of the specific age group. If scientific content is structured in a way that is intriguing and accessible to their young minds, they may feel more confident in their ability to understand and practice science. In addition, progress can be made in addressing gender, race, and socio-economic disparities in the sciences if students of diverse backgrounds find their curiosities piqued by thoughtfully curated open-source content.

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