

Inspiring Curiosity in Science Through Film

By: Elizabeth Herzfeldt-Kamprath

“Scientific knowledge serves as the foundation for preserving national parks, so science must be a fully integrated part of the National Park Service organizational culture, as reflected in the Service’s value system, its worldview, and its daily management of the parks.”¹ - National Parks Science Committee Report, 2004

Abstract

This investigation sets out to explore how effectively science communication can bridge the gap of understanding between scientists and the greater public, particularly through the medium of short and shareable videos. The purpose of this investigation is to define successfully engaging science videos and to shape a set of guidelines for creating a series of science-focused videos. The central themes of the research cover three areas: (1) storytelling & curiosity; (2) scientific literacy, inquiry & science education; and (3) effective video production techniques. The study’s primary goal is to determine how successfully engaging and educational science videos cohesively present visual and spoken information that is accurate, trusted and inspiring of further inquiry. I theorize that this is done through quality production, a captivating narrative mode, demonstrating exciting scientific research and clearly presenting accurate scientific knowledge. The research informs a set of parameters that will be implemented during the study to measure the effectiveness of a video, for instance, how engaging is the scientific knowledge? Then, a sample of 50 videos will be reviewed and coded. The five videos that are coded the highest will be further examined for qualitative analysis. The end goal is to create a set of guidelines that can be used by student filmmakers interested in working with scientists doing research in the National Capital Parks, and to create a pilot video that can be a reference for future student filmmakers in addition to promoting science in the parks.

Methods

Collected Video Samples

A total of 50 sample videos were collected by qualitatively examining content in order to determine if it met certain parameters worth evaluating. The three qualities that were focused on included length: was it a short and shareable length?; science: was scientific inquiry featured?; and production: was the film edited rather than streamed? These videos were sources primarily from YouTube, but also from Vimeo, websites and Facebook. Organizations that emphasize scientific education, such as National Park Service, National Geographic, New York Times: Science Take, National Science Foundation, and NASA were referenced for content.

¹ <https://www.nps.gov/rle/researchers.htm> (pp 1-3)

Peer Evaluation

In order to quantitatively evaluate the videos I created a ranking system that examined three key areas: storytelling & curiosity, scientific literacy, inquiry & education, and production techniques. Through research I determined these areas were important for an audience to understand and engage with content, however there are other important factors not considered (one example is how the audience views the video).² Because the range of selected videos were diverse in content, approach and structure, the rating system of 1 - 5 was used in order to capture the viewer's opinion of the video. The ratings were then totalled in order to gain the video's ranking.

I performed an initial rating on all of the videos to establish a baseline. Volunteer participants were then found to perform additional rankings. Participants included nine film students from American University and a 15 representatives from the National Park Service. The 50 videos were grouped randomly into 24 groups. Each participant was given four videos to evaluate. The following *Guidelines* were given to participants:

Guidelines For Review:

First of all, thank you for taking the time to assist in this research project. Your input will serve as additional information, help determine the validity of this rating system, and ultimately provide insight into how short and shareable science-focused videos are successful.

Please read through these guidelines before watching and coding videos.

- 1. Read through each category for ranking below (Storytelling & Curiosity; Scientific Literacy, Inquiry & Education; Production Techniques).*
- 2. Scan and review Video Ranking Form.*
- 3. Using the links in the form, watch all videos once for entertainment and to become familiar with the content.*
- 4. Watch each video again, individually, and rate for each category 1 through 5. Notes are inserted into the table for your reference. Deliberate swiftly, comparing and contrasting with your assigned videos.*
- 5. Answer two "yes/no" questions at the end of the form.*
- 6. Please contact me if you have any questions. Once you've coded all three videos please send an email to me (herzfeej@gmail.com) with the attached completed excel sheet.*

² Reference *Study Parameters Defined* document for more information.

Categories:

Storytelling & Curiosity:

Visual Style & Trustworthiness (Rate 1-5)

Does the visual style support the theme? A visual style contributes to a sense of trustworthiness promoting or enhancing the message would rate as a '5'. In contrast, a visual style that conflicts with the content or makes the viewer doubt the accuracy of the science would rate a '1.'

Curiosity Sparked (Rate 1-5)

Does the narrative structure broadly peak curiosity in the topic? A video that instills curiosity in its viewers by approaching a topic in a new way and leaves room to speculate would rate as a '5', while a video that hinders curiosity in a topic would rate a '1.'

Relatable Characters (Rate 1-5)

Is the character making a positive connection with the audience? Characters who have a welcoming demeanor and are authentically presented as a researcher or knowledgeable in the field would rate as a '5'. If a character is off-putting or not believed to be an expert the rate would be a '1'. Please note that some videos do not have a 'character' and therefore the narrator, subject, or filmmaker is the 'character.'

Audience Targeted & Reached (Rate 1-5)

Is the content clearly designed for a specific audience? When the content is conveyed in an appropriate manner it enhances the meaning and value to the audience and would rate a '5', while content that is complex or boring for the targeted audience would be rated a '1.'

Scientific Literacy, Inquiry & Education:

Diversity Represented (Rate 1-5)

Is the video diverse in content and character? A broader audience will be reached when content and characters are accessible to more people and would rate a '5'. Conversely, content presented from a singular perspective would rate a '1.'

Clarity in Presenting Knowledge (Rate 1-5)

Does the presentation of information contribute to an understanding of a scientific concept. A clear presentation of scientific knowledge allows the audience to comprehend and retain a meaningful connection to the concept and would rate a '5', while confusing and inauthentic presentation of science would rate a '1.'

Depth in Exploration of Scientific Issues (Rate 1-5)

How deeply are scientific issues explored and analyzed? The scientific method is utilized to fully explore or analyze a topic would rate a '5', while topics that are not explored in any meaningful way would rate a '1.'

Further Inquiry (Rate 1-5)

Are you motivated to independently look for more information on the topic or similar topics? A process of inquiry is effectively demonstrated and the viewer is likely to seek answers to questions inspired by the video would rate a '5'. Inversely, the process of inquiry is presented inauthentically or somehow deters further investigation into a topic would rate a '1.'

True & Authentic Information (Rate 1-5)

To what degree do we know the information presented to be true and authentic? Information comes directly from the source or is referencing credible scientific research would rate as a '5'. In contrast, information that is clearly inaccurate, falsified or misleading would rate as a '1.'

Connection to Society (Rate 1-5)

Does the topic have significant meaning beyond the video? A topic that is made relatable and positively connects in a meaningful way to the larger society would rate a '5', while a topic that is isolated or has no relevance beyond the video would rate a '1.'

Model Scientific Inquiry (Rate 1-5)

Is scientific research demonstrated in an ethical way? Scientific inquiry and/or research that is modelled goes beyond simply illustrating a scientific claim but enables the visualization of knowledge and would rate a '5'. In contrast, a video that does not model the process of scientific research or unethically does so would rate a '1.'

Engaging Scientific Knowledge (Rate 1-5)

Is the scientific knowledge presented in an engaging way? The content, characters, visual aesthetics, and story are vividly engaging and knowledge is fostered through the experience would rate a '5'. Inversely, if the science content presented is not engaging or is even off-putting it would rate a '1.'

Production Techniques:**Production Quality (Rate 1-5)**

How effectively does the production quality contribute to the meaning? A video that is highly produced (technical shots, complicated editing and a well crafted soundscape) and supports the meaning of the film would rate a '5', while a film that is poorly produced and distracting from the content (bad audio, shaky camera, no editing) would rate a '1.'

Visual Style (Rate 1-5)

Does the aesthetic approach enhance the watching experience? A visual style that is appealing, easily illustrates content and is appropriate to the message would rate a '5'. Inversely, a visual style that is uncomfortable to watch or not believable would rate a '1.'

Analysis

Top Five Videos

Once all ratings were collected and collated, the top five videos were determined based on their average total score and studied further for qualitative analysis. These five videos were reviewed again in order to identify answers the following questions that inform the video guidelines.

Points to Examine:

- How was the scientific research presented to the audience?
 - What was the quality of the production, how complex or simple, was it well produced or not?
 - How did the video model inquiry and organically inspire curiosity?
 - Determine qualitative components in the video that could contribute to a sharable quality.
 - Examine and highlight the elements that rated high and how they contributed to the success?
1. [1] *The Stink of The Corpse Flower, Explained* by NPR: Skunk Bear Channel
 - Storytelling Approach: Today I Learned but more in-depth; Inquisitive; Explanatory & Informative
 - High level of production
 - Complex concepts are discussed immediately and represented in three ways: text on screen, spoken, and visually illustrated
 - Context happens immediately after the introduction
 - The question is posed immediately, re-stated, re-phrased, and illustrated
 - The interview clarifies a concept then raises more questions (pointed out by the host) that are then explored.
 - The pacing was fast and engaging

Comments:

“Best: components of stink; heating up visuals. Worst: no mention of why flowers want to be pollinated--make seeds”

2. [2] *Secrets of the Snowy Owl* by NPR: Skunk Bear Channel
 - Storytelling Approach: Journey of Discovery; Explanatory
 - High level of production, maybe on the lengthy side
 - Incredible graphics that help to illustrate the story where footage is unobtainable
 - Visuals help to explicate the story and are not distracting
 - The process of discovery is vividly demonstrated
 - Youtube comment by Charles Chen (1 year ago (edited))

“I love this video for the sheer enjoyment of discovery that it captures.

There was no logical reason to take this trip for this short video, but I thought that the moment that Baltimore was sighted and the journey itself is representative of

much of what science is all about: observation, patience, trial and error, data tracking, persistence, and the joy one feels at the end of such an endeavor.

I will show this to my 5 year old and I'm sure she will take delight in this journey!

KEEP UP THE GOOD WORK!"

Comments:

"Got a little lengthy"

"I enjoyed the production quality of this video the most"

3. [13] *Tagging Bumble Bees to Study Their Movements* by Day's Edge Productions & HHMI

- Storytelling Approach: Explanatory; Exploratory; Follows a Host
- High level of production, maybe on the lengthy side
- Beautifully shot and a compelling visual story immediately in the video
- Quirky music subtly plays under the dense/explanatory portion when the scientist presents the complex form of research he is undergoing
- The scientist is presented as an engaging human/character rather than as the "expert" (there is banter with the host), however this does not detract from his credibility because the host explains who he is and his credibility.
- Leaves with a question and contextualizes why ongoing research is important to a broader audience

Comments:

"While this video was longer than the others, it didn't feel long. The close up shots of the bees were beautiful and the experiment plan was broken down very well, so it could be easily understood. It was cool to see the bees get the trackers put on them and I liked the simple animation to show how the bees' coming and goings were logged. "

4. [7] *Fish out of water* by Nature Video

- Storytelling Approach: Explanatory; VO/Narration throughout the entire piece
- Mid-high level of production, used a lot of found footage and didn't seem to use newly captured footage
- Clearly and concisely explains concepts that are illustrated by the footage
- The pacing of the narration is continually engaging and consistent

5. [15] *From the Field: Rebuilding oyster reefs in Harris Creek, MD* by Chesapeake Bay Program

- Storytelling Approach: Explanatory; A more traditional documentary form
- A lot of "B-Roll" that supports the interviews helps to visually convey the story
- The traditional interviews present scientists as experts
- Fast-paced with the b-roll engages the audience throughout the video. The amount of footage also probably helps!

Comments:

"great shots and multiple perspectives and professionals reference; good audio and visual mixing and editing"

"good connection to society- however it isn't explained well enough, credible sources, good film editing"

“Took a while to learn what 'spat' was after it was first mentioned. Also the guy from Oyster recover mentions that they are placing oysters in the Choptank when the introduction to the video is about Harris Creek”

Broad Themes to Understand

Content Analysis Questions:

- Does the production quality influence the audience's experience engaging in the content? Do higher ratings in production value correlate (strong-weak, positive-negative) with higher ratings in other areas?
- Was there consistency between raters? Was the inter-rater reliability high and how does that support this examination method for successful science videos?
- Is the audience viewing the video from their own perspective? Are film students judging the production value and story more harshly than the NPS staff? And vice versa?

Other Observations

- In all cases (but one) where a NPS Staff and a Film Student observed the same video, the NPS Staff ranked the video higher than the Film Student.
- There does not seem to be any correlation between Film Students rating the Production Quality/Storytelling sections more severely than the NPS Staff, and the NPS Staff being more critical of the Science Literacy versus the Production Quality/Storytelling sections. But I do think it is interesting that Film Students seem to generally be more critical of the videos than the NPS Staff, which I think could point towards the theory that a general audience will be less critical of videos regardless of whether the science is accurate or not. This observation would merit further research!

Guidelines

These guidelines serve as a launching point for how to craft effective science-focused videos. These guidelines were crafted from Research performed by AU Graduate student, Elizabeth Herzfeldt-Kamprath in an effort to understand how effective videos that featured science were successful.

Storytelling

1. Tell a compelling and engaging story by:
 - a. Utilizing storytelling techniques like “and, but, therefore” and presenting tension and conflict that resolves.
 - b. Presenting a compelling character who has something important to convey to the audience. Make sure your character is relatable, engaging, and in some way humanized, and not presented as a stereotyped character.

- c. Pacing information in a visually stimulating way that is faster-paced. Use visual cues, natural sound cues, b-roll and the spoken word to drive the narrative along.
2. For short content, immediately introduce the primary question and a means for discovering an answer.
3. Illustrate the main point in three ways (with text, voice over, narration, interview, b-roll, graphics, sound effects, etc.).
4. Allow your characters to accurately and clearly explain the science and what they are doing. Make it relatable to your audience and double check facts.
5. Quirk and humor go a long way!

Production

1. In order to have a quicker paced narrative make sure to capture a lot of b-roll footage to show a compelling visual story. Capture close up shots, medium shots and wide shots to contextualize your character(s) and the story.
2. Have a “pre-interview” with your main character in order to understand their research and in what direction the story will go. Communicate clearly with them what that direction is and adapt if they have suggestions.
3. Capture high quality audio on everything. Make sure the characters can clearly be heard and understood, and that there is enough of a natural soundscape to build into the setting (since music will be difficult to use, capturing high-quality natural sound is essential).
4. Be aware of NPS guidelines for filming, for instance Park Rangers must be properly uniformed at all times. There are many guidelines and you cannot be aware of all of them, make sure to have backup plans for shots that might not be in compliance unexpectedly.

Impact Goals for Science Series:

- Introduce new topics or methods of research³
- Present factual scientific information and model appropriate research practices and interaction with the environment.
- Heighten the interest for the broad spectrum of scientific inquiry and demonstrate the importance of scientific research in society.
- Briefly introduce the wonders of the natural world and how inspiring encounters with nature and wild creatures can be.⁴
- Grow a new generation of people inspired to care for protected spaces.

What these videos will not try to accomplish:

- In-depth analysis of an area of research.

³ Jaman & McClune, 97: “News reports are valuable for introducing a new topic or lesson. Their potential lies in the teacher’s ability to exploit one of a number of their characteristic features.”

⁴ <https://www.nps.gov/rlc/upload/ScienceCommitteeReport2ndEditionWeb.pdf>

- Provide controversial perspectives that make viewers question the validity of the series as a whole.
- Cover more than one or two main points.
- Introduce multiple (maybe more than one or two, again) characters.
- Present a political agenda.
- Present negative attitudes towards scientific inquiry or the research methods.
- Oversimplify any field of science or topic of research exploration.

References:

Allchin, D. (2003), Scientific myth-conceptions. *Sci. Ed.*, 87: 329–351. doi:10.1002/sce.10055

Armon, Rony. "Expert positions and scientific contexts: Storying research in the news media." *Discourse & Communication*. 2016. Vol. 10(1) 3-21. Web. 16 Feb. 2017.

Bianchi, Marina. "The Magic of Storytelling: How Curiosity and Aesthetic Preferences Work." *Economics*, vol. 8, no. 44, 2014, pp. 1-30A ProQuest Central,
<http://proxyau.wrlc.org/login?url=http://search.proquest.com.proxyau.wrlc.org/docview/1641639603?accountid=8285>.

Casey, Leo. "Questions, Curiosity and the Inquiry Cycle." *E-Learning and Digital Media*. 2014. Vol. 1(5). Web 16 Feb. 2017.

Dagher, Z.R. & Ford (2005). "How are Scientists Portrayed in Children's Science Biographies." *D.J. Sci Educ*. 14: 377. doi:10.1007/s11191-004-7933-2

Dijck, Jose van. "Picturizing Science." *International Journal of Cultural Studies*, vol. 9, no. 1, pp. 5-24.
<http://journals.sagepub.com.proxyau.wrlc.org/doi/abs/10.1177/1367877906061162>

Eijck, Michiel van, and Roth, Wolff-Michael. "Theorizing scientific literacy in the wild." *Educational Research Review*. 2010. Vol. 5(2). Pp 184-194. Web:
<http://www.sciencedirect.com.proxyau.wrlc.org/science/article/pii/S1747938X10000230>. 24 Feb. 2017.

Elam, Mark. "When Scientists Meet Film-Makers: Inventing a Swedish Approach to Public Engagement with Biotechnology." *Acta Sociologica*, vol. 48, no. 3, 2005, pp. 237–251., www.jstor.org/stable/20059946.

Engel, Susan. "Children's Need to Know: Curiosity in Schools." *Harvard Educational Review*. Winter 2011. Vol. 81(4). Pg 625. ProQuest Central. 16 Feb. 2017.

Engel, Susan. "Is Curiosity Vanishing?" *J. Am. Acad. Child Adolesc. Psychiatry*. August 2009. Vol. 48(8). Web. 16 Feb. 2017.

Falk, J. H. and Needham, M. D. (2013), Factors Contributing to Adult Knowledge of Science and Technology. *J Res Sci Teach*, 50: 431–452. doi:10.1002/tea.21080

Heisey, Natalie, and Linda Kucan. "Introducing Science Concepts to Primary Students Through Read-Alouds: Interactions and Multiple Texts Make the Difference." *The Reading Teacher*, vol. 63, no. 8, 2010, pp. 666–676., www.jstor.org/stable/25656177.

Hoffman, Jascha. "Science at the Movies." *Nature*, vol. 455, no. 7214, 2008, pp. 734-735 ProQuest Central; ProQuest Natural Science Collection, <http://proxyau.wrlc.org/login?url=http://search.proquest.com.proxyau.wrlc.org/docview/204469543?accountid=8285>

Jarman, Ruth, and McClune, Billy. *Developing Scientific Literacy : Using News Media In The Classroom*. Buckingham, US: Open University Press, 2007. ProQuest ebrary. Web. 24 February 2017.

Jean-Baptiste, Gouyon. "Science and Film-making." *Public Understanding of Science*, vol 25, no. 1, 2016. <http://journals.sagepub.com.proxyau.wrlc.org/doi/full/10.1177/0963662515593841>

Jenkins, Edgar W. "Environmental Education and the Public Understanding of Science." *Frontiers in Ecology and the Environment*, vol. 1, no. 8, 2003, pp. 437–443., www.jstor.org/stable/3868141.

Kirby, David A. "Science Consultants, Fictional Films, and Scientific Practice." *Social Studies of Science*, vol. 33, no. 2, 2003, pp. 231–268., www.jstor.org/stable/3183078.

Ng, Wan. "Education in a Competitive and Globalizing World : Empowering Scientific Literacy through Digital Literacy and Multiliteracies". Hauppauge, US: Nova, 2012. ProQuest ebrary. Web. 16 February 2017.

Phillips, Richard. "Space for Curiosity." *Progress in Human Geography*. 2014. Vol. 38(4). Pp 493-512. Web: SAGE. 16 Feb. 2017.

Reid, Grace, and Stephen P. Norris. "Scientific media education in the classroom and beyond: a research agenda for the next decade." SpringerLink. Springer Netherlands, 13 Nov. 2015. Web. 24 Feb. 2017.

Richard Bowman (2011) *Rethinking What Motivates and Inspires Students, The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 84:6, 264-269, DOI: 10.1080/00098655.2011.592164

Saville, Emma. "How Curiosity Changes our Brains." WP Company LLC d/b/a The Washington Post, Washington, 2014. ProQuest Central, <http://proxyau.wrlc.org/login?url=http://search.proquest.com.proxyau.wrlc.org/docview/1602518288?accountid=8285>.

Schwarz, C. V., Reiser, B. J., Davis, E. A., Kenyon, L., Achér, A., Fortus, D., Shwartz, Y., Hug, B. and Krajcik, J. (2009), Developing a learning progression for scientific modeling: Making scientific modeling accessible and meaningful for learners. *J. Res. Sci. Teach.*, 46: 632–654. doi:10.1002/tea.20311

Shin, S. Y., Parker, L. C., Adedokun, O., Mennonno, A., Wackerly, A. and San Miguel, S. (2015), Changes in Elementary Student Perceptions of Science, Scientists, and Science Careers After Participating in a Curricular Module on Health and Veterinary Science. *Sch Sci Math*, 115: 271–280. doi:10.1111/ssm.12129

Trauth-Nare, Amy. "Re-envisioning scientific literacy as relational, participatory thinking and doing." SpringerLink. Springer Netherlands, 02 Sept. 2015. Web. 24 Feb. 2017.

Vieira, Rui Marques, and Celina Tenreiro-Vieira. "Fostering Scientific Literacy and Critical Thinking in Elementary Science Education." SpringerLink. Springer Netherlands, 30 Dec. 2014. Web. 24 Feb. 2017.

This research was funded by a grant provided by the National Park Service: National Capital Region of the United States of America, through George Mason University. Thank you to Ann M. Gallagher, M.S., Science Education Coordinator of the Urban Ecology Research Learning Alliance, Natural Resources & Science.