Formative Evaluation Report: Sun Lab
Memo Report of Findings

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Introduction

WGBH received funding to develop and create NOVA Labs, an online environment that provides teen audiences with an online research lab, educational content, and the opportunity to engage with authentic data, tools, and processes to investigate scientific questions. Through funding from NASA, this work has begun with the development of a first pilot lab, called The Sun Lab. NOVA Education created and launched this lab in early summer 2012. Examining the site in its pilot form, the Lifelong Learning Group (LLG) engaged in a formative evaluation to support refinements and improvements in the design of subsequent NOVA Lab environments.

Based upon consultation with the NOVA Labs team, several evaluation questions were identified and prioritized to guide this formative evaluation phase:

Overall Appeal
1. Do teens understand the point and the experience being offered by NOVA Labs? If not, how do they characterize the site and its content?
2. What factors are most likely to drive teen to use a site like NOVA Labs?
3. What about the NOVA Labs concept is most compelling to a teen audience?
4. What aspects of the NOVA Labs site are most interesting to a teen audience?
5. How do teens feel about the social media community and their interest in participating in it?

Usability and Enjoyment of the Website and Resources
1. What path or sequence to teens use to navigate the site?
2. Are there areas that cause navigation or usability problems?
3. What do teens like and not like about the videos? To what extent do they think they'd use the video resources?
4. What do teens think is being provided / asked of them in the Lab activities?
5. How easy or difficult do the Lab tasks seem?
6. What is the preference for Lab tasks: step-by-step instruction or free-form investigation?

This report provides a summary of the findings from this evaluation.

Methods

A factor that influenced the design of this evaluation was the timing of the Sun Lab's launch (summer 2012), which resulted in a limited pool of teen users actively engaging with the site prior to or during the evaluation period. As a result, evaluation required the recruitment of teens who were unfamiliar with the site. This newcomer population would need to be asked to explore, provide feedback, and address

questions via hypothetical scenarios. In response to these conditions, two methods were used to obtain the needed feedback: focus group interviews and two sets of think-aloud interviews while using the site.

Focus Group Interviews

Two focus group discussions were conducted in August 2012 in Pittsburgh, PA, with teen volunteers from a museum youth program. Each focus group lasted less than 60 minutes, and was comprised of between 5 and 7 teens (all entering or currently in high school) who identify as science-interested or science-savvy. The discussions focused on: overall appeal of the Lab concept and pilot site, motivation and compelling attributes, and potential learning opportunities. Discussions were audio recorded and transcribed, with parental permission obtained in advance of the group.

Think-Aloud Interviews

Eighteen think-aloud interviews were conducted with teens as they interacted with the NOVA Labs website for the first time. These 18 interviews were broken into two sets: One set (n=9) focused on free exploration of the site and overall concept, and the other set (n=9) focused on exploration of specific resources. The think-aloud protocol was administered using the service of Usertesting.com, which guides participants through step-by-step instructions (prompting them to speak thoughts aloud) while recording screen movements and voices. Recruitment was completed through Usertesting's sample panel services, with requests being sent to registered parents; the parents first agreed to let their child participate, the child gave assent, and then the parent facilitated their child's participation and use of the interface to complete the interview activity.

A series of guided prompts directed the teen's use and asked specific questions of the teen during their exploration. The software recorded their screen movements and their commentary/answers as they completed the tasks. In addition, 3-4 written questions were answered at the end of the test. The prompts and questions were different for each set of think-aloud interviews.

Analysis

Qualitative data was coded for themes and patterns that emerged from the responses, triangulating results from individual users in the think-aloud interviews and group discussion in the focus groups. Analysis was guided by the evaluation questions for this study, which is the framework structuring the findings and recommendations below.

Key Findings

Overall Appeal

Factors Driving Teen Use of Site

- When asked to think hypothetically about what would likely drive them to use a site like NOVA Labs, **the consensus was overwhelmingly that the site would be used and valuable for school-related contexts** – whether use by a teacher in class, as homework, to support a science project, as a research tool for a paper, or some other school-based activity.

- In focus group discussions, t**eens felt that the only driver for out-of-school use would be if an individual had very strong prior interest in the specific content area of the lab.** This comment was also repeated in think-aloud interviews, in which teens tended to respond that they would visit on their own if they had questions about the sun (4 out of 9), for a school assignment or project (4 out of 9), or if they had interest in a NASA career (1 out of 9).

  "I mean, my high school has an astronomy class and I can see them like using [the Open Investigation] like a lot, you know, like on a daily basis even. But, I mean, I don't know about the average kid who would just, oh, let's go on this website and like – I don't know. You know, like it's not catered for that type of average [teen]."[1]

- **The benefits for school use, however, were many and attractive to teens in the focus group discussions.** Several teens mentioned specific courses or teachers from their own experience who would use the site and that they felt it would have improved their experience in the class:

  "Dude, my physics teacher is going to be so excited about this."

  "During freshman year we did a small portion on space and sun and stuff, and so we had to do labs like non-stop forever. And it was – it got really boring because if we ever used a website, which our teacher was all for the idea, but there's not really anything good out there. This looks like it could be like really cool, and it already looks like easier to use than the websites we were using."

  "But this is so much cooler [than the sites our teacher tried to make us use], so I'm like really excited, and kind of jealous that we'll never get to use this for school."

- There was generally not a high pre-existing interest in the content area of the sun; however, **there were multiple requests and questions about for new and different content areas in the future**, suggesting that the Labs format may have even greater appeal as it touches those content interests for individual teens.

Perceived Purpose of NOVA Labs

- Teens who explored the site on their own in the think-alouds (without direction about where to go or what to look at) **did not tend to understand that the purpose of the site was to conduct one's own investigations with authentic data** (only 2 of 9 mentioned something related to this after 10 minutes of free exploration).

- **Overall, teens associated the site's purpose more generally with its content, saying the site seemed to be to teach about the sun or about science** (6 out of 9). A few repeated the theme that the site was for teens who were "really interested" in the topic area already, not just those with general science interest.

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[1] Unless otherwise noted, quotes in this report come from one of the two focus group discussions. For ease of reading, some filler words (e.g., "like" or "um") have been removed from transcriptions.

- **Two features that seemed to be more helpful in explaining the purpose of the site were the intro video and the infographic, both in the slideshow on the home page.** One user specifically noted that these two items were what gave her a clear understanding (but only after discovering them after a much longer period of exploration, in which she remained unclear about the purpose). **Most notably, she only had the opportunity to come across the infographic when she came *back* to the homepage after exploring other sites** because the slide show moved past the graphic rather quickly in the intro and does not reappear.
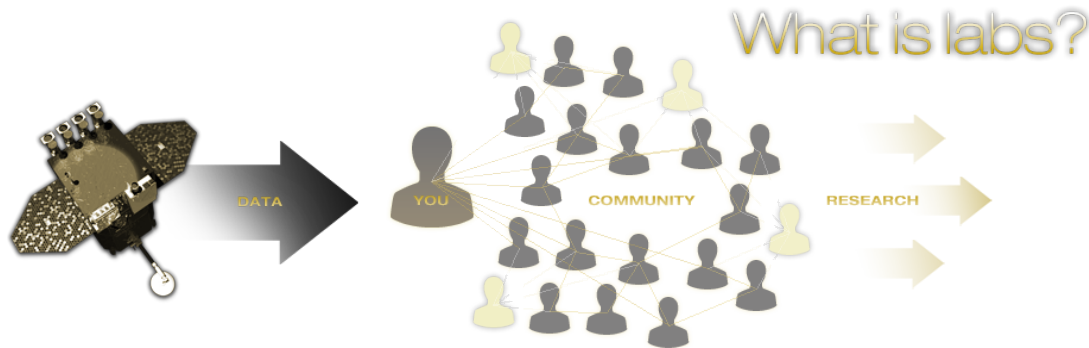
Compelling Features of Concept and Website

- For participants in the focus groups**, the overall concept of NOVA Labs was very positively received**, with teens generally thinking it had cool and interesting aspects that would add to their school experiences. The video features and lab features were generally the most instantly compelling ideas for most of the teens.

- Similarly, **users who explored the site freely in think-alouds most often mentioned the Boot Camp/videos as the feature they'd most like to explore further** (4 out of 9) **or the Lab portion** (2 out of 9). Note: not all teens spent time exploring every section, as exploration was self-guided.

- **The other compelling attribute of the overall NOVA Labs concept was its authenticity. This was partially impacted by the relationship with NASA, which seemed to create a positive impression on teens** – as identified via the logo on the home page and through the scientists' affiliations. **But it was most impacted when teens were told or read that the site was sharing real data from NASA satellites and instruments.** In both focus group discussions, teens sought verification on this point, that what they were seeing was *real* data, and not just content for an educational purpose.

    "Probably using the live data from NASA [is most interesting]. … this was just more like, okay, this is actual data from – that's like currently being collected. I thought that was cool."

    "I like how you said there was like streaming, like real video, and like everything's like legit, coming from like real satellites."

> *"Like those are like the sunspots on the sun [in the image] like at the moment, or are they just like, hey, we're just going to throw these on for the Sun Lab?"*

- Suggested improvements for the site's features or its concept were varied, with individuals suggesting different ways – from big to small – that the site could be improved. **The most frequently mentioned suggestions for improvement from the think-alouds were: Increasing the amount of interactivity (often mentioning a desire for games); decreasing the amount of reading required to be successful; and adding new or other content (besides the sun).**

Social Media Components

- Although a familiar tool for many, Facebook may be a somewhat limiting method for participation by some teen audiences. **Among the 12 high schoolers who participated in focus groups, 8 had a Facebook account and 5 did not.** The students also noted potential barriers of parental permission (some banned their children from using Facebook, even for school purposes) and school firewalls that prevent access of Facebook while on the premises.

- **In general, teens felt that individual posting/sharing of their results from Labs work (particularly posting via Facebook) would not be something they would do.** A main reason was that their personal social network would have a lack of interest about this kind of information; a related reason was a desire to keep school work and personal networks somewhat separate.

> *"It's not like I'm going to – I would never really personally like upload this to Facebook and be like, look at my sun graph."*

> *"Well, I think the biggest thing is not many people are going to care [about it if I post something from the Sun Lab to Facebook]."*

- **However, both focus group discussions independently mentioned that the idea of seeing all teens' results in aggregate, and their own results compared against those, could be interesting**. The idea had a competitive spirit to it that was attractive.

> *"I think people might be interested to like compare their results with, for example, like everybody who's visited the site or whatever. I mean, maybe that would appeal to a little competitive side, see if you were closer to the scientists' predictions than everybody else who visited."*

- In response to the **Facebook Meet-the-Scientist Event** example (Phillip Chamberlain), results were somewhat positive in both the focus group and think-aloud samples. **The idea of a Q&A opportunity with a real scientist was seen as a positive and unique opportunity and outlet for participants**. Feelings about their own participation, by asking questions or making comments, were more mixed. **About half of the respondents exploring in the think-alouds and many of the teens in the focus group felt they might post a question if they had an interest in the subject or a specific question of concern (perhaps for homework).** But, like all components, the interest in content seemed to be a driving factor.

- Several other factors or concerns came up, related to the concept of the Facebook Event:

- Among the self-guided explorations, several (3 out of 9) expressed some misunderstanding about the purpose of the page when first viewing it. These users **thought that an "Event" meant the site was promoting an in-person event , rather than an online Q&A.**

- **Three users noted specifically that they would feel comfortable leaving a question on the page, but not a comment**. They both noted that they felt unqualified or might sound stupid making a comment of any sort to an expert scientist.

- **One user noted that the comments on the current example seemed very "insider,"** using language and terminology he/she did not know. This was a barrier to use and feeling qualified to participate.

- **Several teens had an expectation that the Q&A portion would be "on demand,"** thinking of scenarios when they would want to be able to ask a question and have it answered rather quickly (say, for a homework assignment).

- **One user ended up at Dr. Chamberlain's personal Facebook page and felt that it humanized him.**

Usability and Enjoyment of the Website and Resources

Path and Sequence of Navigation

- **During free-form exploration for 10 minutes, the most common pattern of use was to explore the sections as they were listed in the top navigation bar from left to right**: About, Get Involved, Using Labs, Social Feed, Boot Camp, Sun Lab. In nearly all cases, the top navigation bar was the primary (sometimes the only) method used for moving around the site. Links in other parts of the pages were less used.

  - One user noted, as he explored, that **although "Boot Camp" was repeatedly mentioned as a critical piece, he wondered why it was so late in the navigation menu**. He thought it should be moved to a place of greater prominence.

- **Five of the nine users chose to watch the intro video on the home page at some point during their exploration, without prompting** – four viewed it as one of their first actions. **This video was clearly an attractive feature**. In one focus group, several teens interrupted the conversation at the start to ask to watch the video right then, noting that the "doodle" cover screen was intriguing. One teen explained it this way:
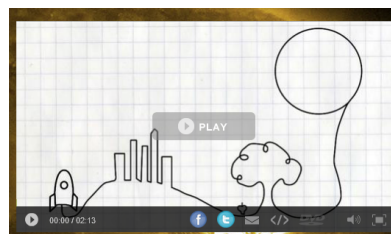

  "…you see a doodle in a video, you just think, oh, this is going to be interesting, and it's probably going to be like a little bit silly at the same time. And I don't know. That just kind of appeals to me. It's like better than seeing someone who's like sitting in front of a PowerPoint."

Navigation or Usability Challenges

- **Pop-up warning before viewing Boot Camp video.** Across the think-alouds, six users (out of 18) had apparent problems or visibly got confused when faced with this pop-up message upon clicking "launch" in Boot Camp. For some, it was a deterrent to watching the video at all, and they went elsewhere on the site.
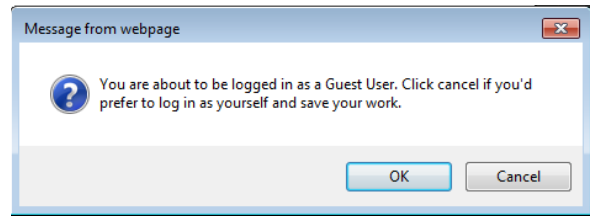
- **Video problems: slow, jumpy, crashing, or commercial.** Across think-alouds, five users (of 18) had minor or serious problems viewing the videos. These included: 1) slow load-times, 2) "jumpy" videos where it was hard to hear the sound, 3) a video that cut out becoming "unavailable" before the end, and 4) one user who saw a SanDisk commercial prior to the Boot Camp video. In the focus groups, the facilitator had a weak WiFi connection, and was only able to show a portion of the intro video before the video froze and could not re-load.

- **PBS header and search bar.** In two cases, users noticed and/or used the Search bar at the top of their screen during exploration, although that search bar is not for Labs, but for all of PBS. Using it took them out of the Labs environment

- **Sunspot images on home page.** Two users exploring the home page indicated that the out-of-context images of sun spots (above Do Research) made them think it was a biology lesson, because they looked like specimens under a microscope.
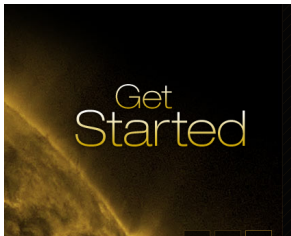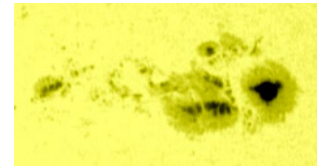

- **"Get Started" on home page isn't clickable.** Only one user tried to do this.

Boot Camp and Video Resources

- Overall, the video resources across the site were very positively received by teens in think-alouds and focus groups. **As a concept, teens strongly preferred the opportunity to get information via video (rather than reading), and for most, the short length of the Labs videos was appealing.** In both samples, teens reported feeling that the videos were very professional-looking and well done, which added to their appeal.

- In free exploration, being asked to choose one of the Boot Camp videos to watch, most teens (5) watched the Sun 101 video, which was at the top of the Boot Camp page. However, the other four selected Space Weather or Technology videos, generally based upon the appeal of the topic names. One teen noted that the images at the face on the Boot Camp page did not seem to depict what would be seen in the videos.

- **One of the most positively received attributes of the videos teens sampled was the use of animations and diagrams** – both to attract attention, but more importantly, to explain concepts. Five of the nine testers who viewed a video mentioned the diagrams or animations as something they liked. As noted previously, the "doodle" design of the home page video attracted interest and curiosity about the video. **But these "doodle" diagrams also seemed to help a feeling of understanding the content.** In some cases, teens suggested there be more diagrams in the videos to illustrate concepts (as opposed to images of the sun).
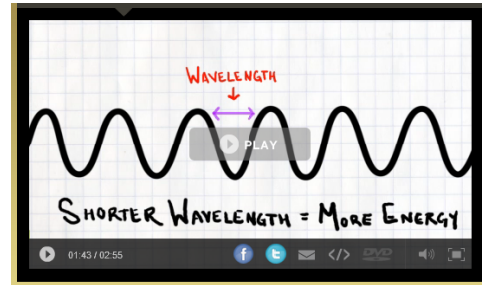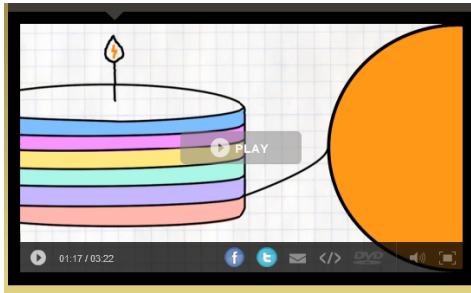
- **The other strong, positive attribute of the videos was the narration; teens felt that the narrators were engaging, clear, and not boring.** This was mentioned by two teens in the think-alouds, as well as in one of the focus group interviews.

  "I think that's very important when in a video the person who's speaking isn't someone who's speaking like monotone."

  [About the homepage video:]
  Participant A: "[The narration] followed the doodle, like the light-hearted… "
  Participant B: "Yeah. It was like a happy little upbeat kind of voice."

- **In using the site independently, only one user engaged with the questions (multiple choice or open-ended) to the right of the videos**, but he/she did not wait until the end of the video and doing so interrupted their video-watching (and he/she did not go back to finish the video). None appeared to realized that the questions needed to be answered to access further videos or content.
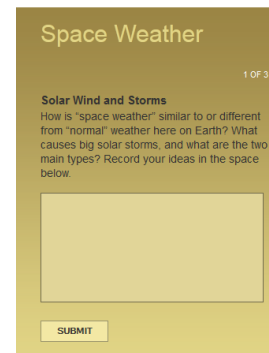
- **With the appeal of the videos, teens felt they'd be likely to watch multiple videos on the site, depending on the context of why they were there (i.e., school, interest in science, desire to learn more about the topic).** In the hypothetical question about whether they'd view some, all, or none of the videos, six of the think-aloud interviewees said "ALL" – although it should be noted they were not told how many videos were on the site (only 3 were evident) and social desirability may have influenced some positive responses. That said, only one respondent said he/she was not likely to watch any of the videos if he/she came to the site, having found the one sampled to be boring.

Sun Lab

- User understanding of the purpose of the Sun Lab was mixed. **As users first came to the Sun Lab page, it was not instantly clear to most that the purpose was to allow them to conduct their own investigations or to analyze real data from scientific instruments.** Only four of the think-alouds indicated their first impression was that it was for "doing your own investigation" (or a similar concept). When asked again, however, after completing a Lab activity, more of the teens (7 out of 9) used words such as *investigate, experiment, analyze, examine, or predict* in their descriptions of its purpose. Others still felt it was content-based: to learn more about the sun.

- Independent use of the Sun Lab included tests of a variety of the different activities: 6 users tried Solar Cycle (first on the list), 2 tried Mixed-Up Magnetic Fields, 1 tried Huge Spots, 1 tried Complicated Spots, 1 tried Rapid Growth, and 3 tried Open Investigation.

- **Guided Labs: Teens exploring the activities on their own (even those with an adult working alongside them) found the guided Sun Lab activities to be moderately to very difficult.** A few felt that aspects got a little easier as they went along, but all identified it to be hard. For Solar Cycle, much of this had to do with the difficulty of counting sun spots and groups. For Storm Predictions, there were more struggles in knowing what to do and in feeling it was hard after they got the wrong answer, without a chance to try again. In Storm Prediction areas, it was observed that users had difficulty getting oriented to what they were looking at, and understanding the purpose of the activity and/or the steps they were supposed to follow.

  o In nearly each case of a 10-minute trial, **at some point the teen "gave up" on actually doing what was asked by the activity (e.g., counting spots and groups; carefully comparing pictures in each time period; etc.),** and simply clicked or entered numbers to move past the necessary screens. This was true even of teens who otherwise seemed engaged and interested in the activity. Other teens described the activity as "not fun" or like "a test."

  o In contrast, in the focus group discussions, teens were quickly walked through each step of the Solar Cycle Lab – without reading the instructions on screen, but with the facilitator describing what she was doing at each page (just to give them a sense of the activity). **In simply viewing the Lab experience, heavily guided by someone familiar with the Lab and not being asked to try the task themselves, participants thought it seemed much easier and straightforward as an activity.** This might suggest slightly easier use in a guided, classroom environment.

- **Open Investigation:** Several teen users selected the Open Investigation. **Teens seemed to have difficulty figuring out exactly what they should do in this area.** They engaged in some exploration of what was there, but in this context, none attempted to pursue a specific question or line of inquiry.

  o The part of the Lab they that most figured out was the selection of different dates and ability to look at the sun at different times in the past – **the most common comments were "How far back does it go?" "Does it go back to before I was born?" and "I want to look at my birthday." The authenticity of the images and the source (NASA telescopes) were all positive attributes.**

- o Only one user even noticed the area for selection of instruments/views in the Open lab. **The one teen who found this instrument area, clicked on the drop-down list, and said, "Whoa. I don't know what this is" before quickly moving away**.

  - o In the focus group, in which students were told the purpose of this Lab and its various features highlighted, **the teens also noted that the addition and use of the instruments was difficult to understand. Given their lack of familiarity with technical names and terminology, they asked for explanations or clearer names of instruments** (i.e., in terms of "what this shows you").

- **Solar Cycle Lab:** This lab was tried most frequently, and several patterns emerged in how teens (and their parents) explored and interpreted the activity:

  - o **In all cases, the users immediately focused on the large equation presented on the first screen. Teens spent significant amounts of time on this introductory page (2-3 minutes), trying to "solve" the equation using the information presented.** The equation also created an instant association of the activity with math. The time spent on this intro page, trying to "solve" the equation, was all before they even got to the first practice sun-spot-counting activity.

  - o **Teens did generally understand what they were supposed to do in the activity (count sun spots and groups) after they went through a few screens.** However, most found the task of distinguishing individual spots and groups to be fairly or very challenging.

  - o **Some difficulty seemed to be had with navigation in the process of counting spots –** moving the sun image around and zooming in and out. The controls were generally intuitive for users, but the difficulty in quickly switching between a "big picture" view (for counting groups) and the "up close" view (for counting spots) was sometimes difficult and users would lose their place of what they'd counted and have to go back.

  - o **Teens generally liked that this Lab was structured to give them the chance to practice, compare their results to scientists' results, and to improve their ability with multiple trials.** In the focus group, teens noted that they liked that it placed their estimates onto a graph – noting the importance of graphing for schoolwork.

- **Storm Prediction Labs:** Four of the individual lab activities were tried by at least one teen user. Each of the labs was structured as a comparison over time between two sets of images (A & B). The user is supposed to use an arrow to click through 4 or 5 image-pairs (showing change over time) and assess which (A or B) is more likely to cause a solar storm.

  - o **In all cases, users did not readily understand that they were supposed to look for change over time in the images.** Users quickly understood that they were comparing A and B, and saw the area asking them to "vote" for their pick. But, in all cases, they immediately tried to vote and were confused or frustrated when they were not able to vote.

  - o After being unable to vote, users did figure out that they needed to scroll through the images. But, by that point, they had made their decision, and **most did not use the subsequent images to inform or change their vote. Similarly, there were not many comments expressing that they understood they were looking at the same image over time**.

- o **The explanations for their votes mostly indicated that they did not understand what it was they were looking for in the activity.** For instance, in Huge Spots, the user based their vote on "having more spots than the other one"; in Mixed-up Magnetic Fields, the user based their vote on "spots being closer together, which will make a bigger flare."

- o Most users made the incorrect selection at the end of the challenge. Different than the Solar Cycle challenge, they did not get the chance to try again and improve.

- o **Three of the users watched the video at the end of the lab, but none indicated that they understood what they were looking at** (i.e., they hadn't read the text to the left). One suggestion made was that those videos needed narration the Boot Camp videos had.

Step-by-Step vs. Open-Ended Exploration

- **Across teens, all indicated that the need to have step-by-step activities was very important. Although some saw value in the opportunities for more open exploration, this was seen as an addition to step-by-step activities**. Other users – particularly those who were frustrated by their activity – felt step-by-step was the most important factor.

- Even more notable: **Many teens who used the structured lab activities indicated that they felt those were open-ended (and were not step-by-step).** They often felt the activity could have been easier with more step-by-step support. This was less true of the focus group participants (who were walked-through the activity), but even in this facilitated context, teens did discuss a feeling that the Solar Cycle Lab could have provided better step-by-step instruction:

  "Participant 1: The second image you got to [in the Solar Cycle] where it's just a picture of the sun and it has all the boxes and information, maybe not have that all pop up at once. Do like a bit at the time, because it seemed kind of intimidating just to have lots of information –

  Participant 2: Like, step one, step two? Yeah. That's a good idea."

- Further, **when discussing the Open Investigation, teens in focus groups suggested the value of adding step-by-step instructions about what to do, even if the actual question being answered was left open-ended.** The interface alone seemed a little intimidating on first glance:

  "I was thinking when I first saw it, it was a little bit overwhelming, because I saw, off to the side "instrument", and then above it "pick your date," and it just looked kind of overwhelming. Maybe you could like do some kind of like fade in and say "pick your date," and then the date would come up, and you'd be like, "oh, okay." And then next would be like "pick your instruments,"…"

Other Teen Comments

- Upon noticing the portion of the videos that indicated "transcripts and credits," one teen requested clear citation information for referencing the content in schoolwork or research papers.

  "The pull-down thing where it says transcripts and credits, is that like to – is that like a cite your source type of deal going on? Because that always helps, like it makes it so much easier, because now we have to like cite everything and source things…"

- Similarly, teens in the focus group who noticed the printer icon on some content screens were interested to know if it provided a printable version, which they thought might be useful for research papers, reports, etc.

- A suggestion was also made in a focus group to make direct connections between the Lab challenges and results or discoveries by NASA researchers. This may be similar to the inclusion of the solar flare videos at the end of the Storm Prediction Labs (which were not viewed by the focus group).

  "…I don't know if the real NASA people has ever really used this [Lab instruments] to find something or like solve a mystery or some kind of like cool thing. [If they did] you can have like a link and like how they like really used it. Not like all the time, but like maybe like one cool story, if there's something cool like that."

Conclusions & Recommendations

Overall, the concept and core features of the NOVA Labs framework were well received by teen test audiences. The authenticity of interacting with real data from real NASA research and instruments was very appealing to those who realized those opportunities. Similarly, the use of high quality video segments that were brief, explanatory, and used strong graphics and animations to explain concepts were very appealing to the teen test audiences.

The biggest challenge for the site overall seems to be how to reach the target audience. The pathway of formal education seems to be very promising, as nearly all of the students felt their use of it would be for a school-related purpose. Teens felt it would be a very positive addition to their schoolwork, seeing great benefit in high quality, interesting, and interactive content like this Lab.

Although these tests were artificial in some regards – the users were selected to test the website in a brief period of time out of context from real use – themes emerged in usability and content that may help inform the team in the development of future NOVA Labs.

Reaching Teen Audiences

- The plan to use **dissemination via schools, teachers, and formal education contexts seems a fruitful approach with great potential impact**. From the descriptions of teens, the site aligns with content they are currently learning and the types of resources their teachers like to employ – although NOVA Labs was felt to be of a higher quality than much of what they've encountered previously.

- **Non-formal uses of the site may require identifying smaller segments of the teen audience with particular interest in the content area of a given Lab.**

- Consider **possible enhancements to the homepage depiction of what NOVA Labs is**, as many users did not understand the lab/working-with-real-data purpose unless guided to complete a "Lab" itself.
  - The intro video was strong in this capacity, but will not be viewed by everyone.
  - The infographic was noticed by one user who also found it to be a good interpretive tool. However, its short duration may mean few site visitors notice it.

Navigation and Usability

Improvements to navigation and site architecture are already underway and established by the NOVA Labs team, so basic navigation was not a main focus of this evaluation. The focus was on specific user challenges in interacting with the features, which may impact understanding. Thus, these comments and suggestions are made knowing that some may already be addressed in current plans.

- **Although challenging for any website, opportunities to decrease reliance on reading large quantities of text in order to be successful are advised**. The use of videos was a huge strength of NOVA Labs in this regard. However, in Lab activities, the reliance on reading written instructions often hindered understanding the purpose of an activity (for teens exploring on

their own). Even with the strong video content, the quantity of reading on the site was a frequent critique.

- **Consider changing the sequence in the top navigation bar.** This was the primary route for exploration and navigation, and for newcomers exploring the site, the most common path was to move from left-to-right across the bar (which left the video and lab content last).

- **Consider other ways to introduce the role and purpose of logging in to store results.** Although a very important feature, the pop-up window prior to viewing video became a barrier for some visitors. This was particularly true because the instinct to click "cancel" actually led to a registration page that was further likely to push them away from trying to watch video.
    - Perhaps language in the pop-up or on the buttons could be changed to help a "newbie" understand what's happening, while easily letting a registered user get to his/her log-in.

- Slow connections make viewing video and sometimes loading Labs slow and difficult. This may be unavoidable, but should be considered in light of some technological limitations at schools.

- The PBS header and search bar may inadvertently direct some people out of the Lab environment. Again, this may not be a feature that can be changed. **Depending on difficulty, adding a search feature for Labs (to keep them in the environment)** might help mitigate this.

Video Resources

- **The use and style of the current videos is a strong and successful strategy to maintain.** The style, tone, narration, and length of the videos were all tremendous attributes for the audience. They were relatable, understandable, and the look even pulled in a number of viewers.

- **Continue and consider opportunities to further use animations and diagrams to help explain important concepts.** These were very well-received by teens and the combination of those diagrams with narration helped them feel like they were understanding the content.

- **Maintain the engaging style of narration in the videos, as well as the inclusion of scientists who are strong presenters / communicators.** This added to the engaging qualities of the videos, as well as their feeling of reliability of information.

- **Without instruction, teens may not realize there are multiple videos in a Boot Camp series or use the "quiz" questions at the end of videos to move on to the next video in a series**. Consider other design options that might highlight this option/requirement.

- **The name Boot Camp is evocative** – it was perceived as both intriguing, making teens want to click on it, but also as denoting that hard work would follow.

The Sun Lab

- **The Lab activities are generally difficult for teens; they were not insurmountable, but they were challenging.** There did not appear to be a concern that any of the challenges were too easy or simplistic.

- For the **Solar Cycle Lab**, the difficulty was in the task they were being asked to do – distinguish sun spots and groups – which is positive, as the activity should be challenging to help students learn the concepts. **Strengths of this lab to consider for future labs was the use of 1) a practice round with guided instruction, 2) the comparison of your answer with a scientist's answer, 3) repeated trials to improve your skills, and 4) graphing results at the end.**

- The prominence of the equation on the front page of the **Solar Cycle Lab**, however, may have been a diversion. It attracted a lot of attention, time, and study at the outset, and an expectation that they would need to make this calculation on subsequent pages. In reality, it was the task of counting sunspots and groups that users were less prepared for when they got to the activity. **Consider what understanding of the equation is necessary and whether it makes sense to be the first thing highlighted in the Lab.**

- For the **Storm Prediction Labs**, the dual need to focus on comparing two images *and* analyzing those two images over time was unclear to users. The comparison part was understood, but the need to scroll through images to look at change-over-time was not. **Consider ways to sequence or highlight the change-over-time feature to minimize missed opportunities.** When scrolling through images, often users did not notice the time-stamps at the bottom that indicated when the image was from. **One option would be to better highlight the date/time on the images and/or to remove the need to scroll through to view multiple images (i.e., show all time-series images on a single page).**

- With the **Storm Prediction Labs** users also struggled to understand what aspect of the images they were supposed to be looking at (despite instructions on the first screen). Users often focused on their naïve idea of what would be a factor to cause a flare (i.e., more spots or closer together spots), rather than on the scientific quality they were instructed to examine. **Consider repeatedly highlighting "what you are looking for" somewhere more prominent on each page of a challenge.**

- **Maintain the strong use of guided exploration activities in the Lab environment.** Even teens intrigued by the option to do free exploration felt that guidance was needed to feel successful and know what you are doing. **In fact, there were requests across teens to make the current guided explorations MORE step-by-step to reduce confusion.**

- **Consider enhancements to an Open Investigation area that might give users more guidance in** *how* **to get started on their own – orienting them to the features on the page that they might use and how.** Label features with both technical names and more common explanations of what they do. If there is a specific video that provides the tutorial, perhaps link to it directly on this page (for users who have not completed the full Boot Camp sequence).

Social Media

- While a familiar mechanism, **the likelihood of teens using their personal Facebook pages in relation to the Labs is somewhat limited. A feature of being able to post your Labs work to Facebook is not likely to be used**.

- A substantial segment of teens may not have a Facebook account and some schools don't allow access to those pages on their networks, placing some limitations on that interface alone. On the positive side, however, it is familiar and convenient (in terms of repeated or frequent access) for those who do use the interface.

- **A more interesting social idea for teens was the competitive angle of comparing their individual results against the aggregate of other teens' results** (to see who did the best), as opposed to comparing individually to people they know.

- **The idea of an opportunity for Q&A with a real scientist (as shown in the Facebook Event example) was compelling and interesting to teens.** This type of direct interaction with a scientist is relatively uncommon for them and provides a unique opportunity. That said, teens had more **expectations around the ability for on-demand questioning, rather than a limited window of an event**. The "Event" through Facebook, however, seemed a less familiar concept. Some users thought it was advertising an in-person event, rather than an online event.

- **Teens are willing to post questions to a forum like the Facebook Event, provided that they *had* a question they were interested in asking.** Prior interest in the content area of expertise was thought to be a major factor in likelihood.

- **There is potential for intimidation in the Facebook Event environment**, however, due to a reluctance to make a comment (feeling the scientist is the expert) and if there is perceived to be a lot of "insider" conversation taking place (such that the teen feels "not smart enough" to engage with the others there). **Although an adult presence was not mentioned as a barrier, per se, the potential for those with in-depth knowledge to dominate the conversation may impact participation by more novice teens.**

End of report: September 10, 2012