

# An evaluation of the *EarthSky en Español* Facebook Page and short format videos

The screenshot shows the Facebook profile of 'EarthSky en Español'. The 'ABOUT' section includes the text: 'Publicamos las mejores noticias sobre el fascinante mundo de la ciencia.' and the website 'http://espanol.earthsky.org/'. The 'PHOTOS' section displays a grid of images related to space and science. The main post is a video titled 'lima lovebrain' from EarthSky PRO, dated January 20. The video content shows a man in a yellow shirt and hat looking at a large blue and black bird. The video description asks '¿En qué parte del cerebro se encuentra el amor? | La Humanidad | EarthSky en Español' and provides the website 'espanol.earthsky.org'. The post has 4 likes and 1 share, and reached 811 people.

## Report for EarthSky Communications

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*Knight Williams Inc.*

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# Table of Contents

|  |    |
|--|----|
| <b>Study 1: Overview of <i>EarthSky en Español</i> Facebook Page audience and engagement metrics</b> .....                               | 3  |
| <b>Introduction</b> .....  | 3  |
| <b>Findings</b> .....  | 4  |
| 1.1 How many Likes did the Facebook Page generate? .....   | 4  |
| 1.2 Who Liked the Facebook Page?.....  | 5  |
| 1.3 What were the primary referring sites to the Facebook Page? .....  | 7  |
| 1.4 What types of posts were made to the Facebook Page? .....  | 8  |
| 1.5 How many Engaged Users did the Facebook Page draw? .....   | 12 |
| 1.6 What was the Reach of the Facebook Page?.....  | 13 |
| 1.7 How many Impressions did the Facebook Page generate? .....   | 14 |
| 1.8 What types of posts achieved the greatest Reach and Impressions? .....   | 15 |
| 1.9 How many Consumers did the Facebook Page generate? .....   | 16 |
| 1.10 How many Consumptions did the Facebook Page generate?.....  | 17 |
| 1.11 What types of posts drew the most Engaged Users, Consumers, and Consumptions?.....  | 18 |
| 1.12 How much negative feedback did the Facebook Page generate?.....   | 19 |
| <b>Conclusions</b> .....   | 20 |
| Challenges and limitations of working with Insights.....   | 20 |
| Summary of findings.....   | 20 |
| Discussion .....   | 23 |
| <b>Study 2: Exploratory study of short-format videos with an <i>EarthSky en Español</i> online audience</b> .....                        | 26 |
| <b>Introduction</b> .....  | 26 |
| <b>Evaluation goals</b> .....  | 28 |
| <b>Method</b> .....  | 29 |
| Videos used for the evaluation .....   | 29 |
| Evaluation procedure.....  | 30 |
| Questionnaires .....   | 31 |
| Data analysis and reporting.....   | 32 |
| <b>Sample information</b> .....  | 33 |
| Viewer participant demographics/background .....   | 33 |
| Control participant demographics/background .....  | 34 |
| Participants' use of the <i>EarthSky en Español</i> Facebook Page.....   | 34 |
| <b>Findings</b> .....  | 38 |
| 2.1 How did Viewers rate the videos in terms of overall appeal, content interest, clarity,<br>and personal learning value?.....          | 39 |
| 2.2 How did Viewers respond to the scientists and science and health information featured in the videos?.....                            | 42 |
| 2.3 How important was it to Viewers that future videos feature Hispanic scientists?.....   | 45 |
| 2.4 How much did Viewers feel they learned from the videos? .....  | 48 |
| 2.5 What did Viewers identify as the videos' main messages and what else did they learn of interest? .....                               | 49 |
| 2.6 What was the impact of the <i>Mosquitoes</i> video on Viewers' knowledge of mosquitoes as compared to Control<br>participants? ..... | 55 |

2.7 To what extent were Viewers interested in learning more about information featured in the videos  
and felt they were likely to seek this information out? .....58

2.8 Did Viewers share additional feedback on the videos? .....59

**Conclusions** .....61

    Summary of findings .....61

    Discussion .....63

**References**..... 70

## Introduction

In 2010 EarthSky Communications Inc. was awarded a broad implementation grant from the National Science Foundation (NSF) entitled *Proyecto de Implementacion Amplia EarthSky en Español* (*EarthSky* in Spanish Broad Implementation Project). In partnership with the Spanish media company Univision Communications Inc. and a national Advisory Committee of Hispanic scientists, educators, and media experts, *EarthSky* proposed to present science information and scientist interviews to Spanish-preferring U.S. Hispanics via short video programs distributed on television and the Internet. The proposal made the case that the project would increase the number of short format science video programs available to U.S. Latinos via television and online media as well as the representation of Latino scientists within these media. As reflected in the proposal text below, the project team expected that the videos would increase viewers' familiarity with and understanding of the science concepts presented and motivate them to both engage in conversations with friends or family about what they viewed and seek out additional information about content of interest:

*This work will bring short-format science video programs to millions of U.S. Latinos - via traditional and new media – who might not otherwise be exposed to science. It will increase the amount of Spanish-language science content available in mainstream and new media and increase the representation of Latino scientists in U.S. media. It can be expected to increase familiarity with and understanding of science concepts among U.S. Latinos, while resulting in engagement activities such as talking with friends/family about the presented topics and/or seeking out additional information. Over the long term, the project should contribute to creating more science-informed Latino citizens and inspiring some young Latinos to pursue science as a career.*

The proposal qualified that while little research existed on the impact of short video programs in either online or television media, some studies indicated that exposure to science in the media could lead to positive outcomes, including a 2008 study by Hwang & Southwell that suggested that the simple presence of science-focused local TV news stories predicts positive beliefs about science. Additionally, the project team pointed to previous independent evaluations of *EarthSky* Spanish video products (Jimenez & Russell, 2009) that also suggested positive outcomes, with focus group participants reporting that *EarthSky* video products inspired high levels of engagement and understanding and encouraged them to read more about the topics presented and/or discuss the content with friends and family.

Under the Broad Implementation grant, *EarthSky* was able to build on the work completed in prior projects funded by the NSF and continue working with Univision in order to produce science videos in Spanish for the television program *Detras Del Saber*. The Broad Implementation grant also enabled *EarthSky* to expand the reach of the videos and the project's science outreach, in general, to the *EarthSky en Español* website and Facebook page.

This report presents findings from two separate evaluations of deliverables produced as part of the *EarthSky en Español* grant. The evaluations were conducted by the independent evaluation firm Knight Williams Inc., which specializes in the evaluation of informal science media projects serving diverse audiences. The first evaluation (Study 1) focused on the impact of the project's Facebook page by examining the audience and engagement metrics captured during the final 21 months of the grant period, from 9/1/2012 through 5/31/2014. The second evaluation (Study 2), involved an exploratory study of the appeal, clarity, and learning value of three short format STEM videos that aired within a one month period on *Detras del Saber* and appeared in posts featured on the *EarthSky en Español* homepage and Facebook page.



## Study 1: Overview of *EarthSky en Español* Facebook Page audience and engagement metrics

### Introduction

*EarthSky's* Broad Implementation media project, funded by the NSF in 2010, built upon a prior NSF award (0639001) which produced, among other media deliverables, a Spanish-language science news and information website, *EarthSky en Español*. Through the Broad Implementation award, *EarthSky* subsequently increased the amount of Spanish-language STEM content on the website. This new content was largely based on research conducted by Hispanic scientists and spanned a wide range of topics including astronomy, biology, physics, earth science, and engineering.

As part of the Broad Implementation NSF award, *EarthSky* also focused on developing a social media presence designed to reach and engage Hispanic audiences, primarily through Facebook and Twitter. In December 2010, three months into the award period, the project initiated a [Facebook Page](#). To help *EarthSky en Español* better understand visitor engagement with the Page, the independent evaluation team from Knight Williams Inc. collaborated with the project team to conduct an evaluation of the Page during the final 21 months of the grant period, from 9/1/2012 through 5/31/2014.

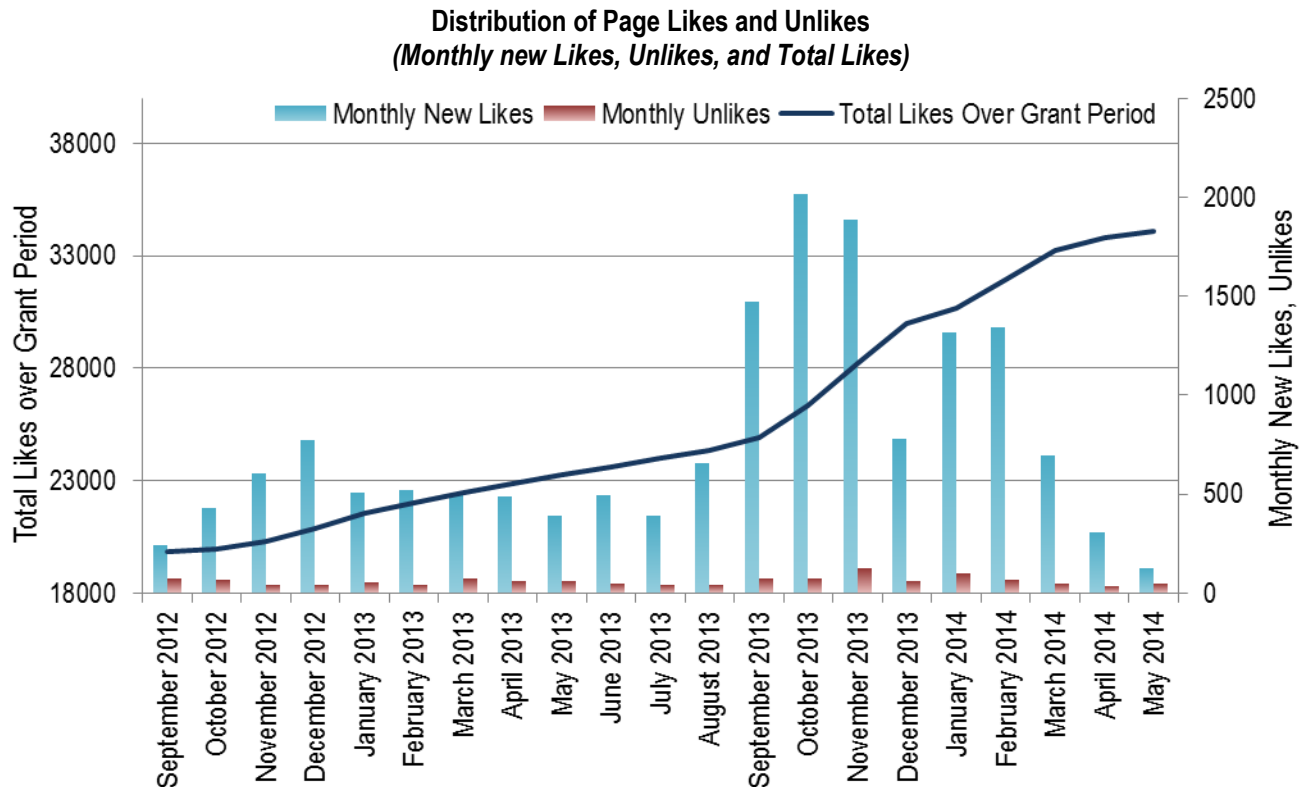
Study 1 provides a summary of the audience and engagement metrics captured for the Facebook Page during this 21-month timeframe, based on the metrics made available by Facebook's analytic service, Insights. The findings for Study 1 are organized under the following twelve questions:

- 1.1 How many Likes did the Facebook Page generate?
- 1.2 Who Liked the Facebook Page?
- 1.3 What were the primary referring sites to the Facebook Page?
- 1.4 What types of posts were made to the Facebook Page?
- 1.5 How many Engaged Users did the Facebook Page draw?
- 1.6 What was the Reach of the Facebook Page?
- 1.7 How many Impressions did the Facebook Page generate?
- 1.8 What types of posts achieved the greatest Reach and Impressions?
- 1.9 How many Consumers did the Facebook Page generate?
- 1.10 How many Consumptions did the Facebook Page generate?
- 1.11 What types of posts drew the most Engaged Users, Consumers, and Consumptions?
- 1.12 How much negative feedback did the Facebook Page generate?

# Findings

## 1.1 How many Likes did the Facebook Page generate?

When a Facebook user “Likes” a Page, it is analogous to subscribing to a magazine or newspaper. The user sees stories from the “Liked” Page in their News Feed. The chart below shows the number of new Likes and Unlikes<sup>1</sup> that the *EarthSky en Español* Facebook Page generated each month, from 9/1/2012 through 5/31/2014. The chart also shows the total number of Likes (Total Likes) accumulated over the 21-month timeframe of the evaluation. Total Likes can be thought of as the total number of people subscribed to the Page, or its direct audience. As Insights defines Total Likes, it comprises: “The total number of people who have Liked your Page (unique users).”



As the chart above shows:

- By September 2012, the Facebook Page had already accumulated 19,811 Likes. By the end of the grant period in May 2014, 21 months later, the number of Likes grew to 34,143, a gain of 73% (14,332 Likes).<sup>2</sup>
- Over the 21-month period, the Page averaged 759 new Likes and 60 Unlikes per month, a ratio of approximately 13:1.
- The Page received the highest number of new Likes during the fall of 2013, peaking in October with a total of 2,016 new Likes. During this month, 94 posts were made to the Page, the 4th highest for the 21-month period.

<sup>1</sup> Refers to when a person unsubscribes or unfollows the Facebook Page.

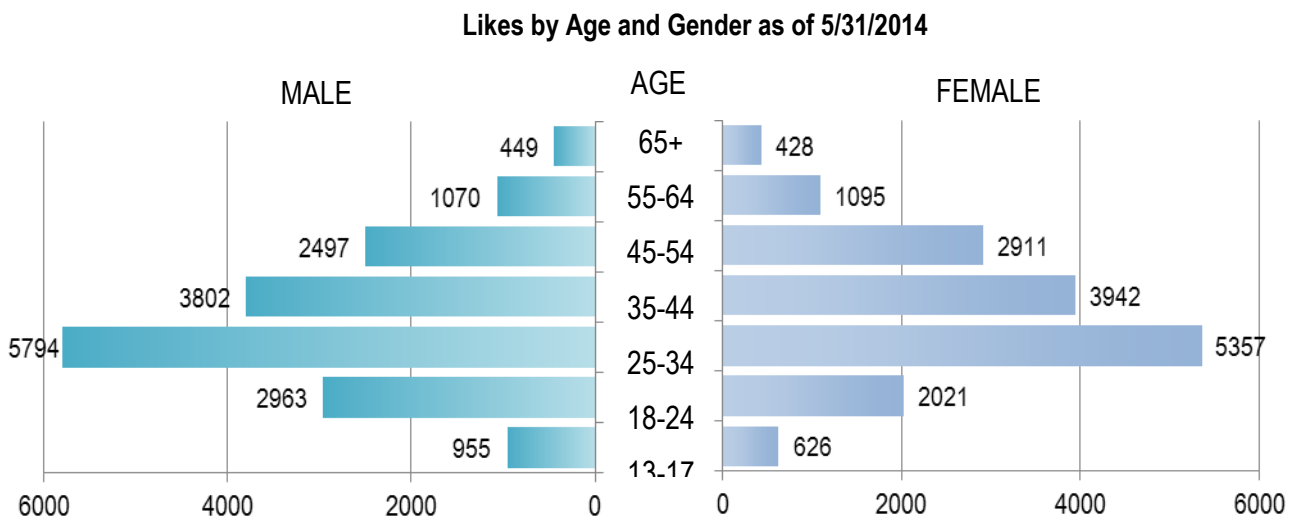
<sup>2</sup> For the purposes of this report, “grant period” refers to the 21-month time frame assessed by the evaluation.

- Other highpoints in new Likes occurred in the late fall/early winter period of 2012 and then again in the winter of 2014, although the number of Likes captured during these periods did not reach the levels recorded in the fall of 2013.
- After the winter of 2014, the number of new Likes per month began to decline, reaching the lowest point in May, with 125 new Likes. May also marked the end of the grant period, resulting in fewer posts, which in turn resulted in less activity on the Page. For context, while 94 posts were made to the Page in October 2013, only 6 were made in May 2014. The decline in posts presumably also led to fewer new Likes.

## 1.2 Who Liked the Facebook Page?

### Age and Gender

As noted in section 1.1, the Facebook Page accumulated a total of 14,332 Likes from 9/1/2012 through to 5/31/2014. The chart below shows the gender and age breakdown of visitors who Liked the Page, as of 5/31/2014, at the end of the grant period.



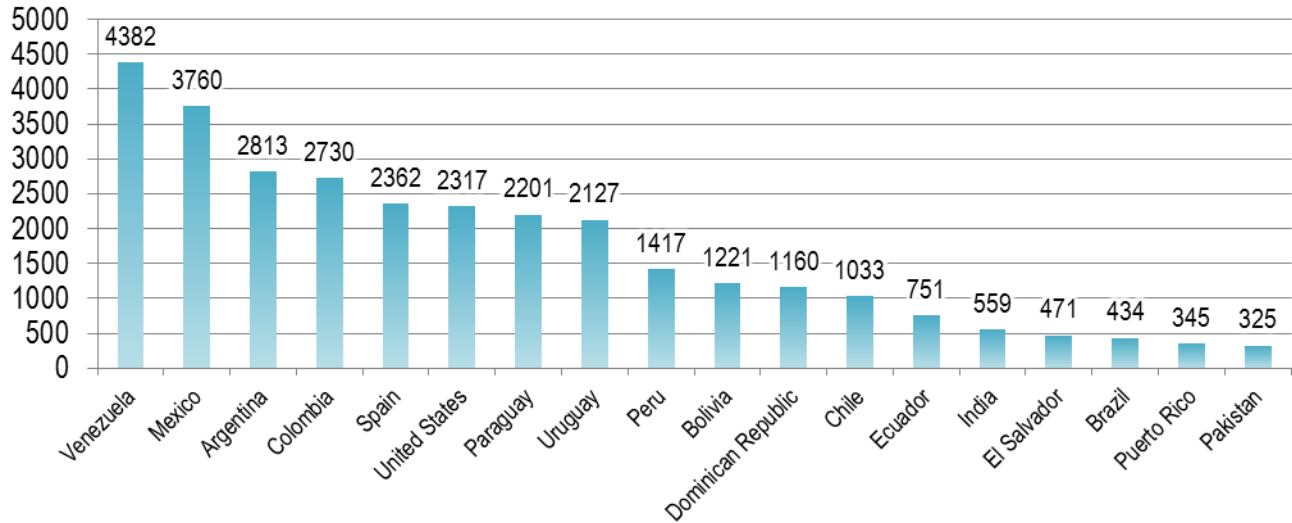
As the chart above shows:

- A comparable number of male and female visitors Liked the Page (Female total 16,380, Male total 17,530). Females accounted for 48% of Likes, while males accounted for 51%. (The remaining 1% were users who declined to provide a gender).
- Among both males and females, the highest number of Likes were contributed by 25-34 year olds (33%), followed by 35-44 year olds (23%), and then 45-54 year olds (16%). The lowest number of Likes in each case were contributed by those in the youngest (13-17) and oldest (65 years or older) age brackets (5% and 3%, respectively).

## Country of origin

The chart below shows Likes displayed by country of origin as of 5/31/2014.

Likes by Country (Top 20) as of 5/3/2014



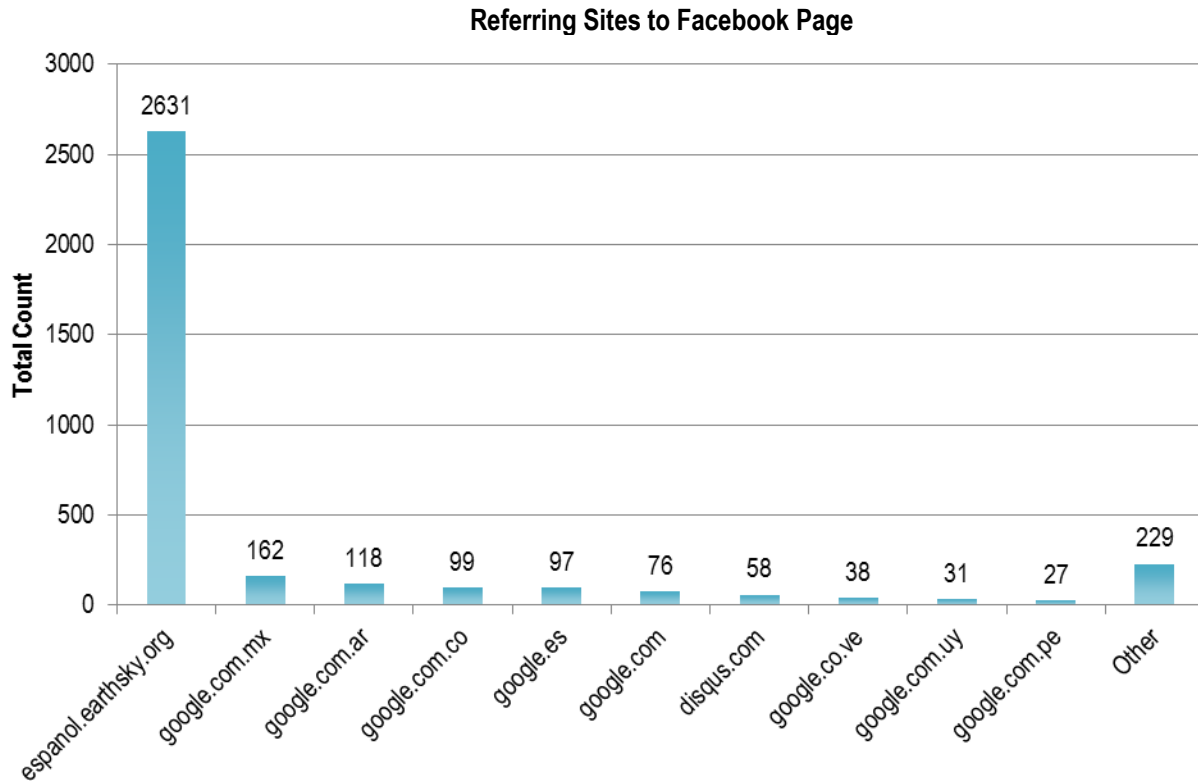
As the chart above shows:

- The largest number of Likes came from Venezuela (4,382), approximately 13% of Total Likes for the Page, followed by Mexico (11%), Argentina (8%), Colombia (8%), and Spain (7%).
- The United States was 6<sup>th</sup> for number of Likes, at 2,317, with approximately 7% of Total Likes for the Page.



### 1.3 What were the primary referring sites to the Facebook Page?

The chart below shows the top ten referring sites to the Facebook Page during the 21-month grant period, accounting for 3566 views as traffic from referring sites.



As the chart above shows:

- The top referring site to the Facebook Page was [espanol.earthsky.org](http://espanol.earthsky.org), with 2,631 referrals.
- Google searches originated from various countries also brought referrals, particularly from Mexico (162), Argentina (118), Colombia (99), and Spain (97).

## 1.4 What types of posts were made to the Facebook Page?

Four types of post were made to the Facebook Page: links to science information via photos (which frequently linked back to the *EarthSky en Español* website), links to articles, video links, and status (text only) posts. Examples of a link to science information via a photo post and a link to an article are pictured below.

### Link to science information via a photo post



### Link to article



EARTHSKY // IMAGEN DEL DIA PUBLICADO: APR 12, 2013

### La luna sonriente después de la puesta del sol

Esta noche puedes ver una luna creciente – como esta – en el cielo nocturno del oeste después de la puesta del sol.



John Reed de la Sociedad Astronómica de Arkansas Central captó esta foto el 11 de febrero, 2013. Gracias John. Imagen ampliada

Una foto bellísima compartida por John Reed de la Sociedad Astronómica de Arkansas Central (Central Arkansas Astronomical Society en inglés). John tomó esta foto el 11 de febrero, 2013.

Mira más Imágenes del Día y seguinnas enviándono las mejores fotos a través de EarthSky en Facebook o e-mail: [imagen@earthsky.org](mailto:imagen@earthsky.org).

EARTHSKY // ARTÍCULOS // GUÍAS ASTRONÓMICAS EarthSky | JUN 01, 2014

### Guía para ver los cinco planetas visibles en junio



Venus y la Vía Láctea gracias a Justin Ng

Se puede observar todos los cinco planetas visibles en junio 2014. Mercurio, Júpiter, Marte y Saturno salen al anochecer. El quinto, Venus, sale en el este mientras que la oscuridad de paso al amanecer.

Se puede observar todos los cinco planetas visibles en junio 2014. Mercurio, Júpiter, Marte y Saturno salen al anochecer. El quinto, Venus, sale en el este mientras que la oscuridad de paso al amanecer.

Mercurio está al final de su mejor aparición de tarde del año para el hemisferio norte. Pero cada día, este planeta está volviéndose rápidamente más borroso y está hundiéndose en el resplandor de la puesta del sol. Mercurio traslada al cielo de la mañana el 23 de junio, 2014. Tu mejor oportunidad de observar Mercurio, el planeta más interior del sistema solar, es durante los primeros días de junio. Utiliza la luna cuarto creciente y el planeta deslumbrante Júpiter como tus guías hasta Mercurio. Binoculares pueden ser necesarios para observar Mercurio en junio 2014.

Júpiter, Marte, y Saturno saltan a la vista inmediatamente al anochecer durante estas tardes en junio 2014. No es probable que vas a confundir un planeta para el otro. Están en diferentes partes del cielo, y presentan colores diferentes. Júpiter, el objeto-como-estrella más brillante en el cielo de la tarde, parece de color de crema y brilla al anochecer, pero Marte es el más brillante de estos dos mundos. También puedes distinguir Marte rojizo de Saturno dorado por sus colores.



La Luna, Júpiter, Mercurio, y las estrellas de Géminis después de la puesta del sol el 2 de junio.



Examples of a status (text-only) post and a video link are pictured below.

### Status post

### Video link

**EarthSky en Español**  
September 23, 2013

En el hemisferio Norte, hoy es el primer día de otoño. En el hemisferio Sur, de la primavera. ¡Que todos tengan una buena estación!

Like · Comment

Carlos Alberto Alzate Gonzalez, Elsa Alicia Cuesta, Lae Esba and 155 others like this.

24 shares

**Addad R Jorge** buen día  
September 23, 2013 at 7:05am

**Jose Manuel Mora Fernandez** WINTER IS COMING...  
September 23, 2013 at 8:10am · 1

**Nicolas Pastorino** excelente!! gracias!  
September 23, 2013 at 8:15am

**Mark Farley @EarthSky en Español:** ¡Igualmente! 😊  
September 23, 2013 at 10:03am

**Fernando Troccoly** la maravillas de las declinaciones  
September 23, 2013 at 10:14am

**Belladira Mtz** Me tendré k ir al SUR 😊  
September 23, 2013 at 10:34am

**José Luis McCartney Goldsmith** Por aqui ya es primavera 😊  
September 23, 2013 at 12:06pm

**Miriam Marin** Ya estamos disfrutando el otoño 😊  
September 23, 2013 at 12:44pm

**Eva Miq** Gracias!  
September 23, 2013 at 1:30pm

**Eva Miq Pd.** Igualmente : )  
September 23, 2013 at 1:30pm · 1

**EarthSky en Español** shared a link.  
November 4, 2013

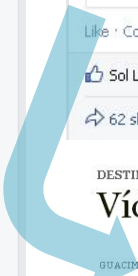


**Vídeo: los cielos más increíbles de La Palma**  
Recorrido entre nubes y estrellas por esta isla de frondosos bosques y paisajes volcánicos y marítimos  
ABC.ES | BY GUACIMARA MEDINA

Like · Comment · Share

Sol Luna, Dani Alvarez, Prabhusingat Kaur Khalsa and 257 others like this.

62 shares



## DESTINOS Vídeo: los cielos más increíbles de La P:

GUACIMARA MEDINA | Día 04/11/2013 - 19:48h

► Recorrido entre nubes y estrellas por esta isla de frondosos bosques y paisajes volcánicos y marítimos



La Isla de La Palma, localizada en la parte noroccidental del archipiélago canario, es conocida como **la Isla Bonita** o la Isla Verde, debido a su riqueza natural, marcada por los **frondosos bosques y los paisajes volcánicos y marítimos**. Es uno de los lugares del mundo de mayor diversidad biológica y su belleza paisajística la convierten en un refugio de exuberantes bosques y extraordinarias bellezas naturales en medio del Atlántico.

Poseedora de un Parque Nacional, La Caldera de Taburiente, la declaración de la totalidad de su territorio como Reserva Mundial de la Biosfera y su amplia red de senderos convierten a La Palma en un lugar atractivo para disfrutar de sus **extraordinarias bellezas naturales** y de la hospitalidad de su gente. Mucho de todo eso puede verse en este vídeo realizado por [Daniel López](#).

COMENTARIOS

IMPRIMIR

COMPARTIR



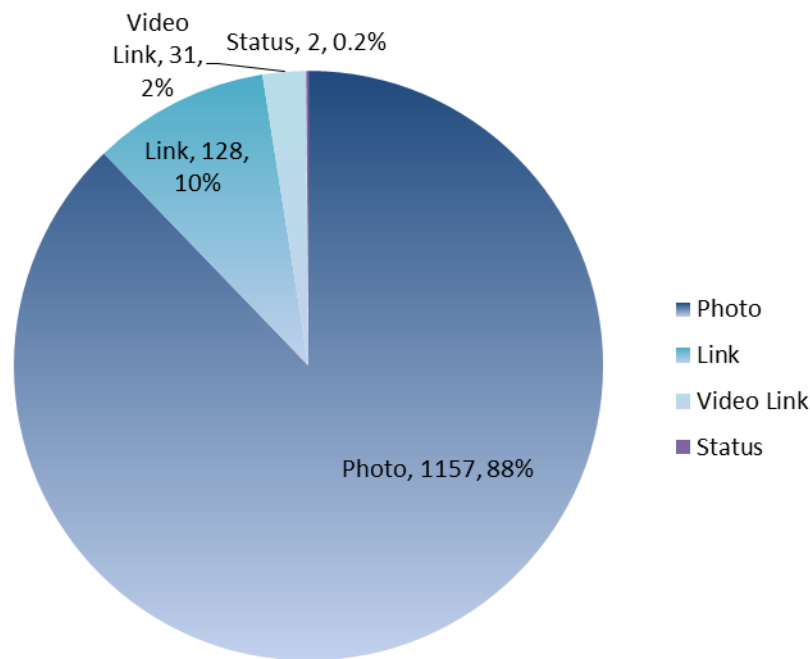
Enviar por e-mail

Noticias relacionadas

Más fotos

The chart below shows the frequency with which the four types of posts were made to the Page over the 21-month period.

**Types of posts made to the Facebook Page**

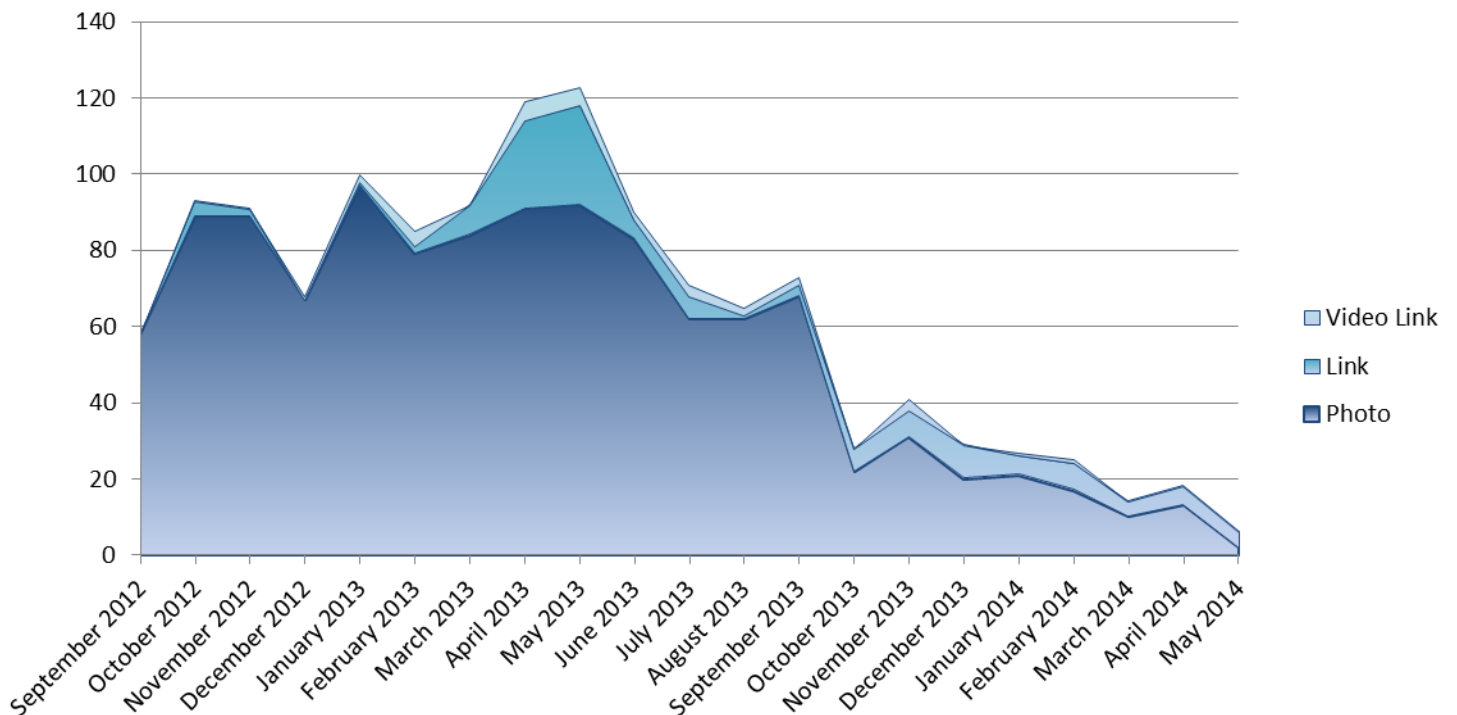


As the chart above shows:

- Science information via photos (called 'photos' in the chart above and hereafter in this report) made up nearly nine-tenths (88%) of all posts to the Page, with 1157 such posts made.
- Links to articles (called 'links' in the chart above and hereafter in this report) made up one-tenth of the posts (10%), with 128 posted to the Page.
- There were relatively few video links (2%), with 31 posted over the 21-month period. Status (text only) posts were the least common type of post (.2%), with only 2 posted over the same period.

The chart below shows the monthly distribution of the three main post types made to the Page over the 21-month period.<sup>3</sup>

**Post types made to the Page by month**



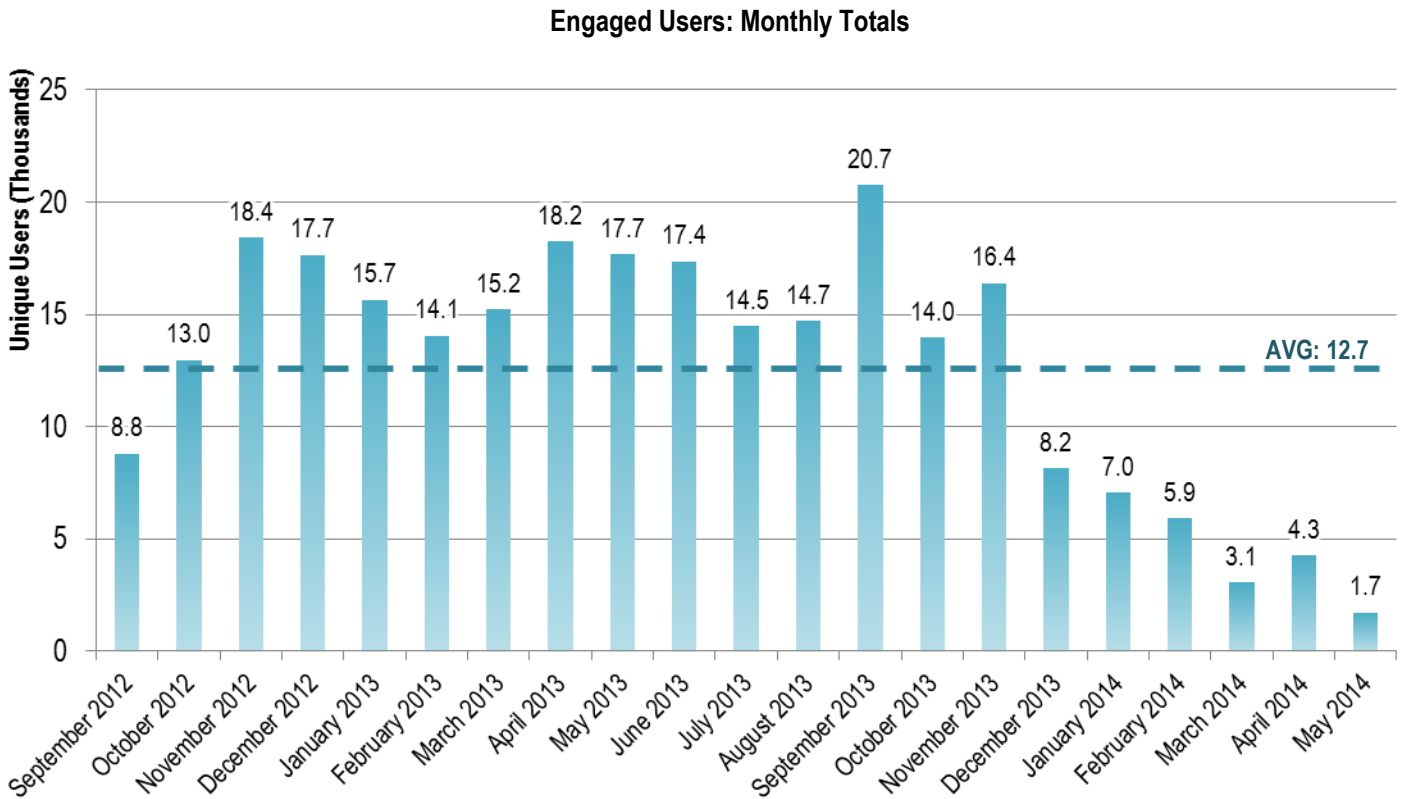
As the chart above shows:

- In each case, the number of posts made to the Page increased from September 2012 to May 2013, at which time the total post count peaked at 123 posts (92 photos, 26 links, and 5 video links).
- After May 2013, for each of the three main post types, there was a decreasing trend in post count through May 2014, with 6 posts in the final month of the project (2 photos, 4 links, and 0 video links).

<sup>3</sup> Status posts are not included in the following post charts in the report due to the small number of posts of this type.

## 1.5 How many Engaged Users did the Facebook Page draw?

The chart below shows the number of monthly Engaged Users, or the number of unique people who clicked on, Liked, commented on, or shared the Facebook Page each month. Using Insights language, Engaged Users refers to “The number of people who clicked anywhere in your posts (unique users).”

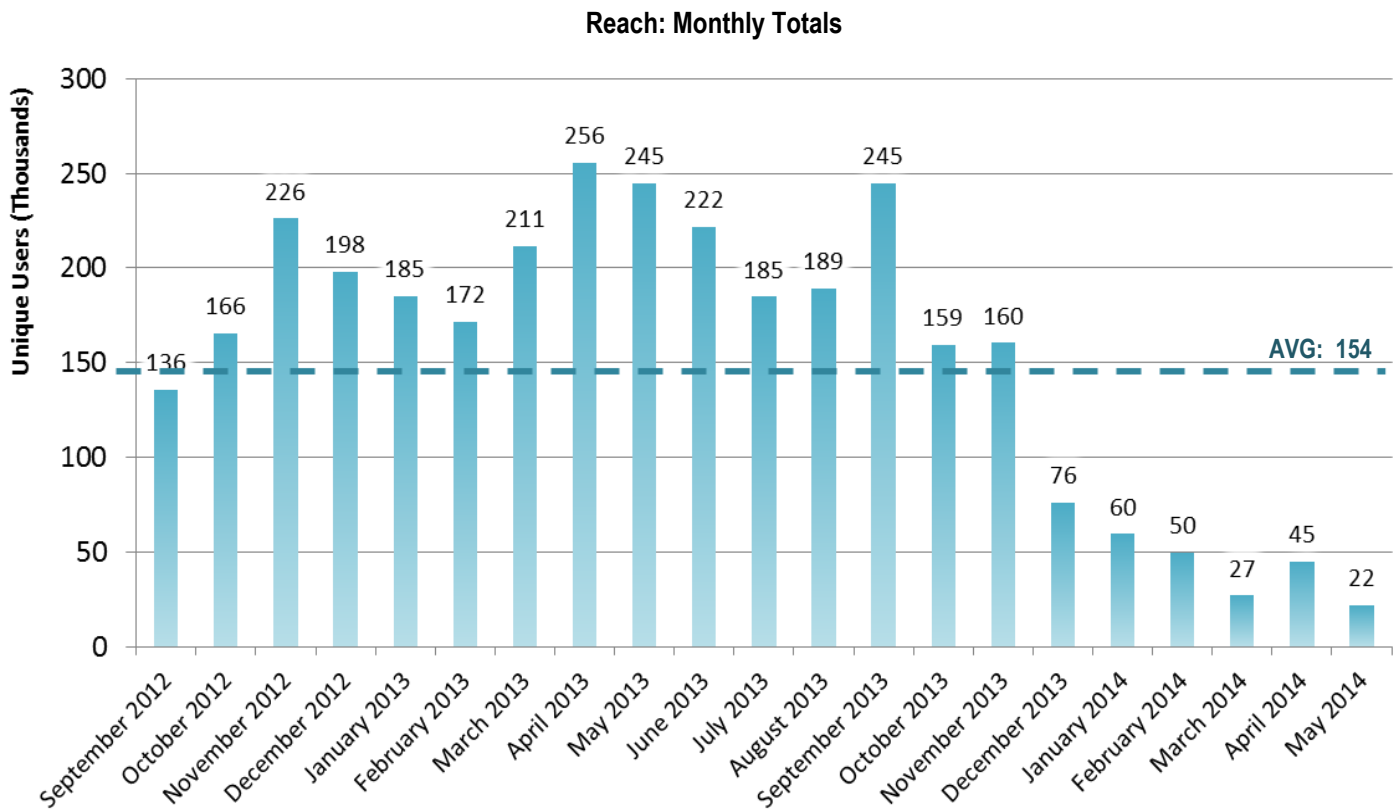


As the chart above shows:

- During the 21-month grant period, the Page averaged 12,700 Engaged Users per month.
- While the month with the highest number of Engaged Users was September 2013 (20,700), other months also had relatively high numbers, particularly in late 2012 and again in the spring of 2013.
- While most months of the grant period had Engaged User numbers that were around or above the monthly average of nearly 12,700 users, the numbers generally began to decline in December 2013, through to May 2014, marking the near end of the grant period. The final month had the lowest number of Engaged Users of all months (1,700).

## 1.6 What was the Reach of the Facebook Page?

The chart below shows the Reach of the Facebook Page, or the number of unique people who saw any content associated with the Page over the 21-month period. Using Insights language, Reach is the number of unique users who “received impressions of a Page post.”



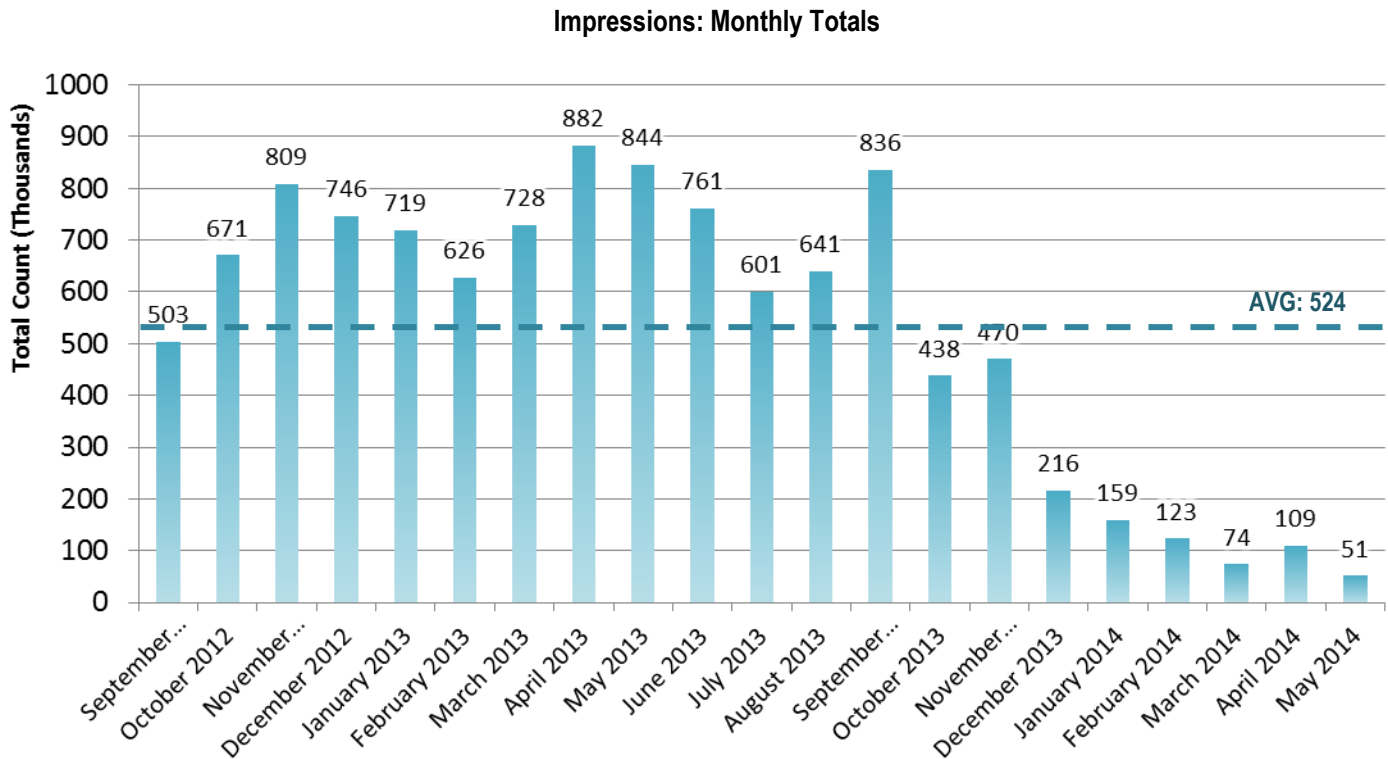
As the chart above shows:

- The Page’s average monthly Reach was 154,000 unique users.
- The Reach totals were generally highest in the spring of 2013, peaking in April with 256,000 unique users, although the fall of 2012 and fall of 2013 also recorded numbers that were well above the average monthly Reach.
- While most months generated Reach numbers that were around or above the monthly average of 154,000 unique users, the numbers generally began to decline in December 2013, through to May 2014, marking the near end of the grant period. The final month had the lowest level of Reach of all months with 22,000 unique users.



## 1.7 How many Impressions did the Facebook Page generate?

The chart below shows the monthly number of Impressions (total count) of any content associated with the Page. Using Insights language, Impressions refers to “*The number of times a post from your Page is displayed, whether the post is clicked or not. People may see multiple impressions of the same post. For example, someone might see a Page update in News Feed once, and then a second time if their friend shares it.*”



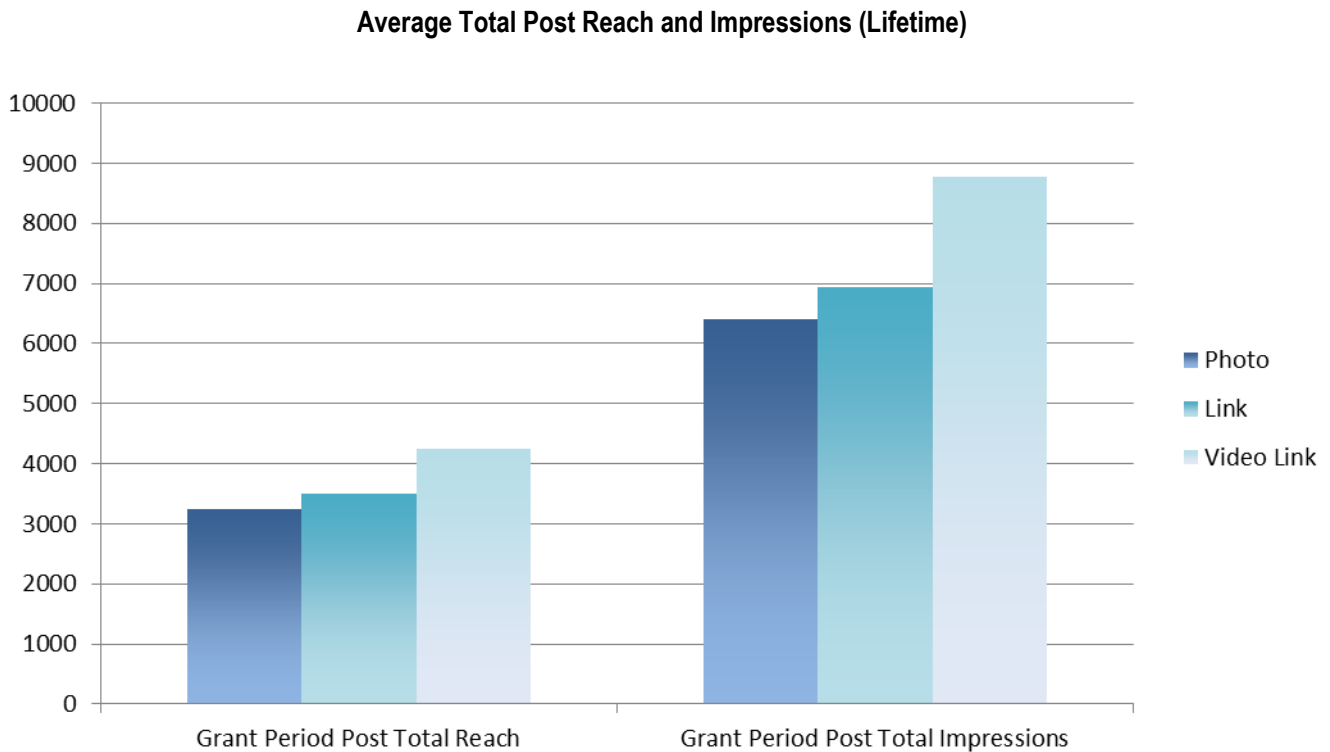
As the chart above shows:

- The Page’s average number of Impressions was 524,000 per month over the 21-month period.
- The number of Impressions was generally highest during the spring of 2013, peaking in April with 882,000, although the fall of 2012 and the early fall of 2013 also recorded numbers that were well above the average monthly number of Impressions.
- While most months of the grant period had Impression numbers that were around or above the monthly average of 524,000, the numbers began to decline in December 2013, through to May 2014, marking the near end of the grant period. The final month had the lowest level of Impressions of all months, with 51,000 unique users.
- On average, Impressions values were 3.2 times higher than Reach. This means that Facebook users who saw content saw the content approximately 3 times on average. Relating this back to how Insights defines and compares Impressions to Reach, Insights further delineates: “*Reach is the number of unique people who received impressions of a Page post. Reach might be less than impressions since one person can see multiple impressions.*”



## 1.8 What types of posts achieved the greatest Reach and Impressions?

The chart below shows the average Total Reach and average Total Impressions for the three main types of posts made to the Page over the 21-month period.

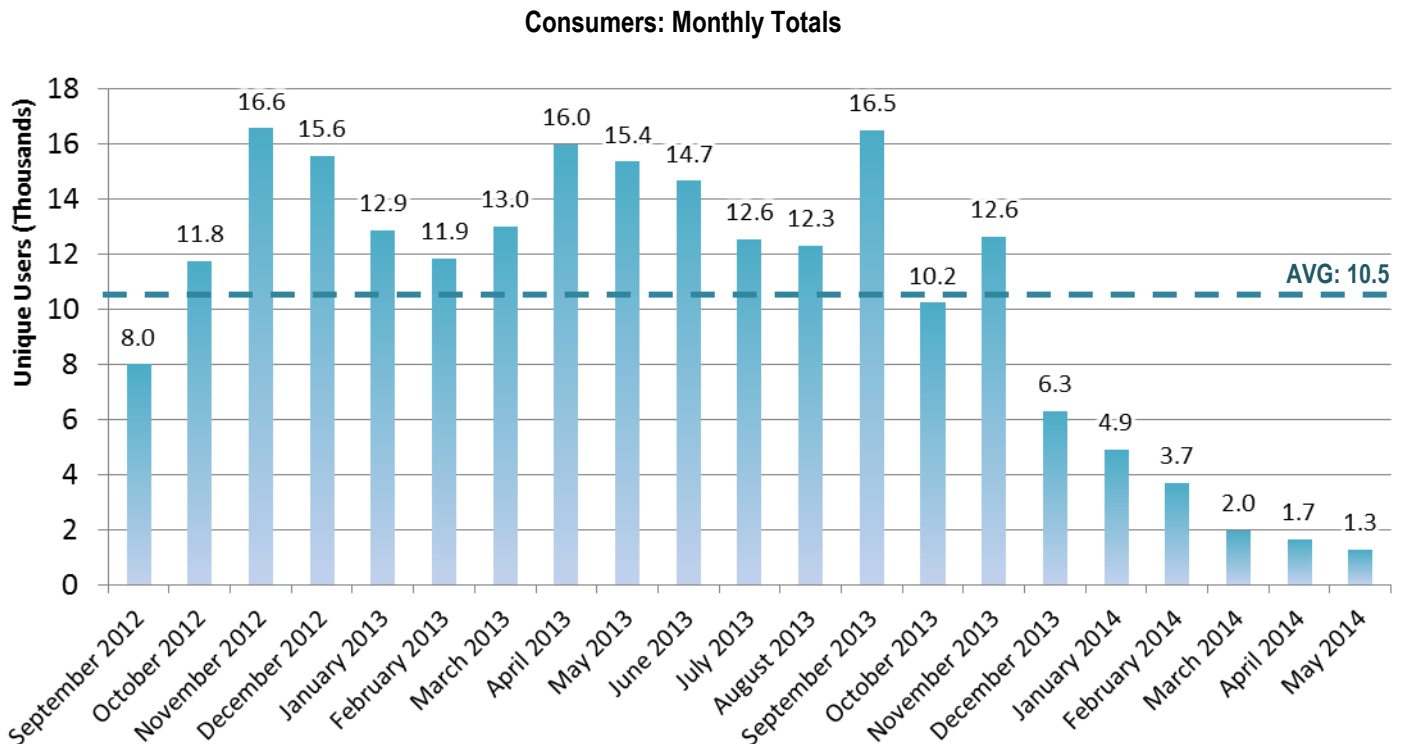


As the chart above shows, among the three post types:

- Video links performed the best with respect to Reach and Impressions. The average Reach for video link posts was 4,255 while the average Impressions was 8,766.
- Links performed second best. The average Reach for link posts was 3,506 while the average Impressions was 6,934.
- Of the three main types of posts, photos performed the least well. The average reach for photo posts was 3,237 while the average Impressions was 6,414. Both Reach and Impressions are heavily influenced by EdgeRank, Facebook’s algorithm for determining what content shows up in a user’s News Feed, or “who sees what.” Post type is part of the algorithm, as well as the popularity of the content (as determined by engagement and other factors). The smaller Reach and Impressions for photos can be partially attributed to this algorithm. For example, during the 21-month period, links generated significantly more shares (on average) than photos, which, in turn, likely increased the Reach and Impressions of these kinds of posts.

## 1.9 How many Consumers did the Facebook Page generate?

The chart below shows the number of Consumers, or the number of people who clicked on any of the Facebook Page content, each month. Using Insights language, Consumers refer to: “*The number of people who clicked anywhere in your post without generating a story (unique users).*”<sup>4</sup> Insights, in turn, defines stories as “*The number of stories generated about your Page post, by story type, i.e. Likes, comments, and shares (total count).*” Stated more simply, stories amount to any way a person can interact with a Facebook Page, such as Liking it, Liking a post, tagging the Page, commenting on a post, and sharing a post.



As the chart above shows:

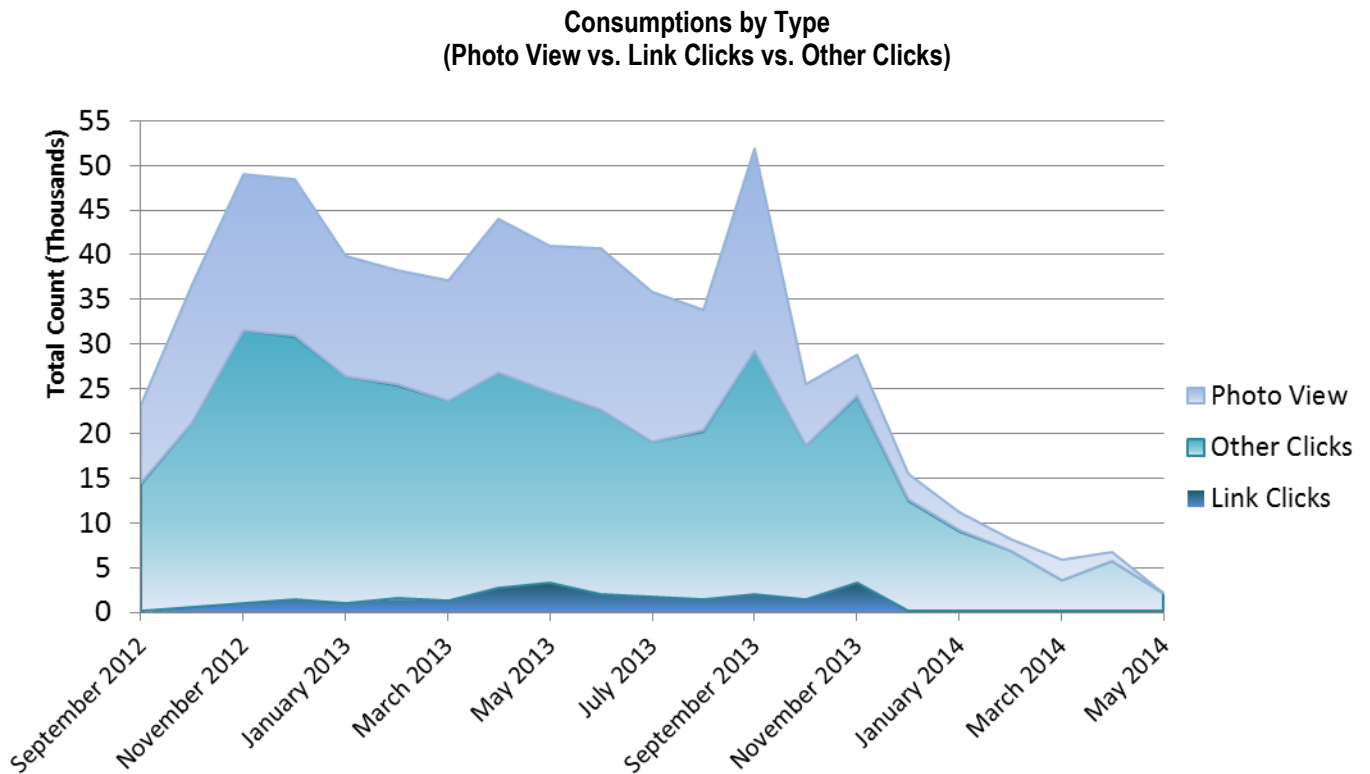
- The Page’s average number of Consumers was 10,500 per month.
- The number of Consumers was highest in the late fall/early winter of 2012, peaking in November with 16,600, although the spring and early fall of 2013 also recorded numbers that were well above the monthly average.

While most months recorded Consumer numbers approximate to or above the monthly average of 10,500, the numbers steadily declined from December 2013 (6,300) through May 2014 (1,300), marking the near end of the grant period.

<sup>4</sup> Clicks that create stories are included in “Other Clicks.” Stories that are created without clicking on Page content (e.g., Liking the Page from timeline) are not included (Unique Users). Consumers is limited to posts, so any click on post content that creates a story (Liking it, etc.) is included as “Other Clicks.”

## 1.10 How many Consumptions did the Facebook Page generate?

The chart below shows the number of Consumptions, or the number of clicks on any Page content, that the Page generated each month. Using Insights language, Consumptions refer to: “*The number of times people clicked anywhere in your posts (total count).*”<sup>5</sup> The three types of Consumption displayed in the chart include: Photo View, Link Clicks, and Other Clicks. Photo View refers to someone clicking on a photo to view it; Link Clicks refers to a person clicking on a link to view it; and Other Clicks refers to a person clicking on some other part of a post. Video was excluded from the chart analysis since nothing was technically posted as a video; rather, videos were posted as links.



As the chart above shows:

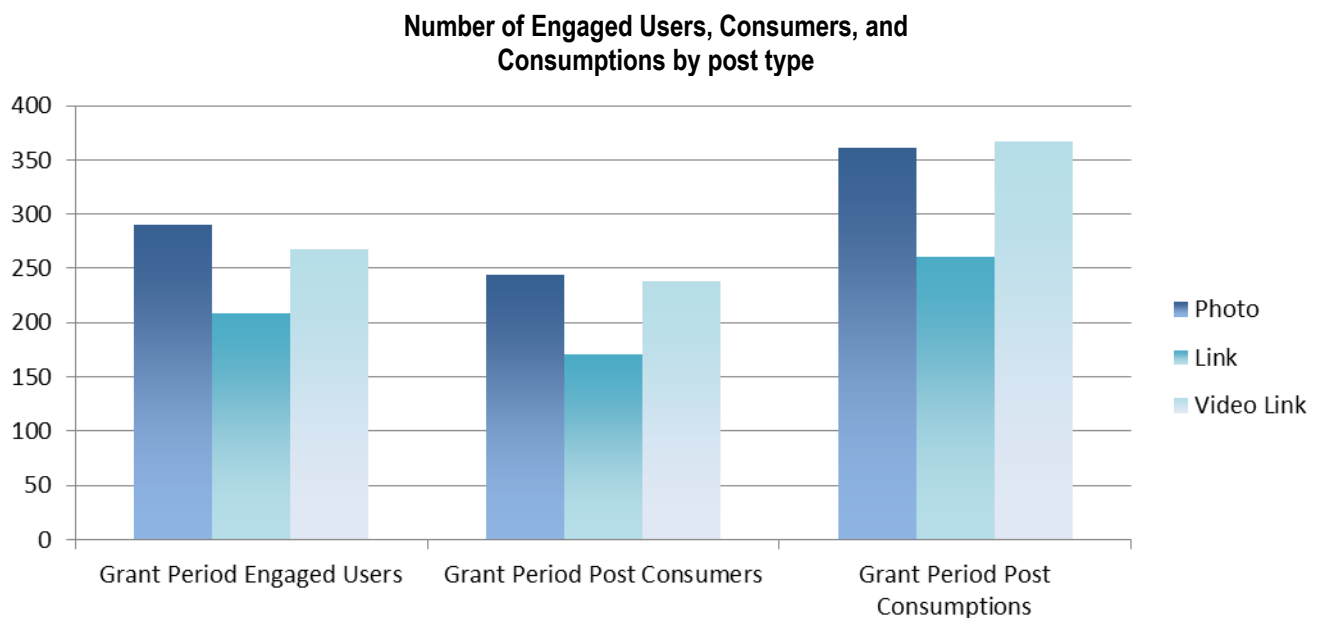
- During the 21-month period, the most Consumptions each month came from Other Clicks.
- The number of Photo Views and Other Clicks both peaked in the fall of 2012 and again in the spring and fall of 2013. In November 2012, the number of Total Consumptions (all three types of Consumptions combined) was 49,086, and in September 2013 it climbed to a high point of 51,870.
- The number of Photo Views and Other Clicks began to decline in December 2013 (Total Consumptions was 15,530) and generally declined until Total Consumptions reached a low point in May 2014 (2,348), the end of the grant period.

<sup>5</sup> Clicks generating stories are included in "Other Clicks." Stories generated without clicks on Page content (e.g., Liking the Page in Timeline) are not included.

- The number of Link Clicks was consistently low during the grant period in relation to the other types of Consumptions, under 5,000 per month.
- Considering the Consumer data shown in section 1.9 (approximately 10,500 monthly consumers on average) with the Consumptions data shown in the chart on the previous page (approximately 29,700 monthly Consumptions on average), the Total Consumption values were 2.8 times higher on average than the number of Consumers, meaning that each user “consumed” content approximately 3 times on average.

### 1.11 What types of posts drew the most Engaged Users, Consumers, and Consumptions?

The chart below shows the total number of Engaged Users, Consumers, and Consumptions for the three main types of posts made to the Page over the 21-month period.

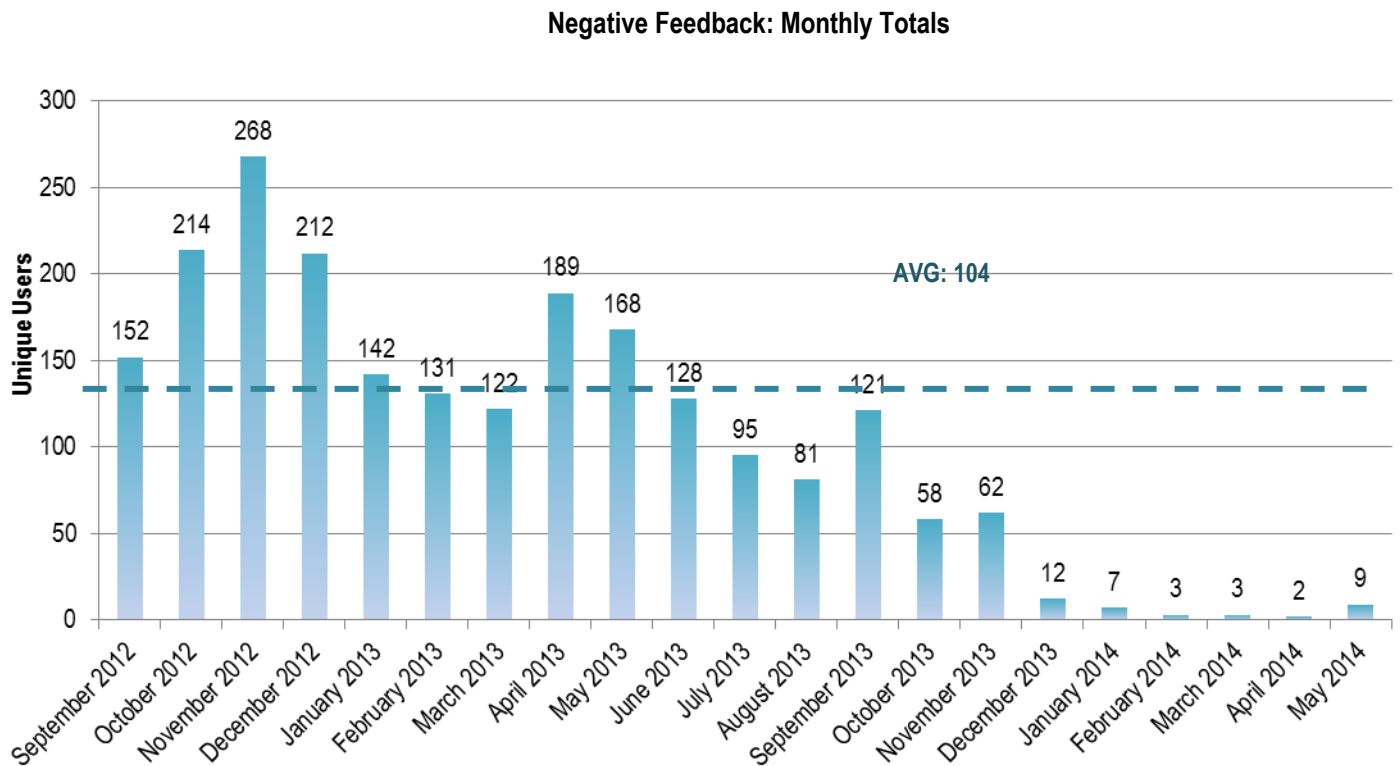


As the chart above shows, photo and video link posts performed similarly on all three metrics, while link posts performed at a lower level in each case, as follows:

- Photo posts had the highest number of Engaged Users and Consumers, and the second highest number of Consumptions by a narrow margin. The average number of Engaged Users for photo posts was 290, the average number of Consumers was 244, and the average number of Consumptions was 361.
- Video links had the highest number of Consumptions, and the second highest number of Engaged Users and Consumers. The average number of Engaged Users for video links was 268, the average number of Consumers was 238, and the average number of Consumptions was 367.
- Links had the lowest number of Engaged Users, Consumers, and Consumptions. The average number of Engaged Users was 209. The average number of Consumers was 170, and the average number of Consumptions was 261.

## 1.12 How much negative feedback did the Facebook Page generate?

The chart below shows the number of unique users who gave negative feedback during the 21-month period. Negative feedback can occur in different ways. For example, users have the option when they see a post to hide all posts from the Page, hide that one specific post, report the post as spam, and Unlike the Page.



As the chart above shows:

- On average, 104 users provided negative feedback each month.
- Negative feedback per month was highest during the fall of 2012 (peaking in November at 268 users) and then again in the spring of 2013 (peaking in April at 189).
- Negative feedback began declining below the monthly average starting in the fall of 2013. It continued to decline toward the lowest point in April 2014 (2 users), as the end of the grant period approached.

## Conclusions

### Challenges and limitations of working with Insights

Although useful information was gleaned about the *EarthSky en Español* Facebook Page using Facebook's analytic service, Insights, a number of challenges and limitations were encountered when applying the available metrics to the current project. The main challenges encountered during the analysis are briefly summarized below.<sup>6</sup>

- At the time the analysis was conducted, exported data was limited to spreadsheets that cover 180 days or less for every graph other than Likes. This feature is not well suited to projects that need to combine continuous data over a 21-month period (or any period of more than approximately 6 months), particularly as tally categories vary month to month. For example, the number of visitors referred from YouTube may be in column 10 in one spreadsheet and column 15 in another. Thus, all of this information must be adjusted in Excel before it can be added together.
- The task of combining the spreadsheets to obtain demographic data (for engagement metrics other than Likes) may not be cost-effective for every project. In the short term, for someone who is actively managing a Page, Insights is probably a useful service. For the long-term analysis of a Page (as with this project), the amount of time required to spend with Insights, for reasons described above, may cause a bottleneck in terms of the depth of analysis.
- Time on Page is a less valuable metric for Facebook than for other websites. For example, a user who leaves a Page open for an hour without clicking anything is less engaged (and contributes less to audience growth) than a user who stays for 15 minutes and shares 3 videos. However, Time on Page can generally be a useful metric to supplement other metrics.
- Insights does not provide an analysis of post content. Thus, in the short term, Page managers must be able to assess how posts are received in real time and adjust their outreach strategy on an as-needed basis. For the long-term analysis of a Page (as with this project), the amount of time required to assess a lengthy history of individual posts qualitatively (in terms of tone, post content, comment content, and administrator engagement with Facebook users, among other factors) may not be a cost-effective evaluation strategy.

### Summary of findings

*EarthSky's* Broad Implementation media project, funded by the NSF in 2010, built upon a prior NSF award (0639001) which produced, among other media deliverables, a Spanish-language science news and information website, [EarthSky en Español](#). In addition to using the Broad Implementation award to increase the amount of Spanish-language STEM content on their website, *EarthSky* also focused on developing a social media presence designed to reach and engage Hispanic audiences, primarily through Facebook and Twitter. In December 2010, three months into the award period, the project initiated a [Facebook Page](#). To help *EarthSky en Español* better understand visitor engagement with the Page, the independent evaluation team from Knight Williams Inc. collaborated with the project team to conduct an evaluation of the Page during the final 21 months of the grant period, from 9/1/2012 through 5/31/2014. Part 1 provides a summary of the audience and engagement metrics

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<sup>6</sup> It is important to note that Insights is a free service that is regularly updated, so some of the challenges encountered in this analysis may no longer apply.

captured for the Facebook Page during this 21-month timeframe, based on the metrics made available by Facebook's analytic service, Insights.

### **1.1 How many Likes did the Facebook Page generate?**

In September 2012, the beginning of the 21-month evaluation period, the *EarthSky en Español* Facebook Page had 19,811 Likes. By May 2014, the number of Likes had grown to 34,143, a gain of 73% (14,332 Likes). Over the 21-month period, the Page averaged 759 new Likes and 60 Unlikes per month.

The Page received the highest number of new Likes during the fall of 2013. Other highpoints occurred in the late fall/early winter period of 2012 and then again in the winter of 2014. After the winter of 2014, the number of new Likes per month began to decline, reaching the lowest point in May 2014.

### **1.2 Who Liked the Facebook Page?**

A comparable number of male and female visitors Liked the Page, with females accounting for 48% of Likes and males accounting for 51%. (The remaining 1% were users who declined to provide a gender). Among both males and females, 25-34 year olds contributed a third of Likes (33%), 35-44 year olds contributed just under a quarter of Likes (23%), and 45-54 year olds contributed about one-sixth (16%). Less than a tenth of Likes each were contributed by those in the youngest (13-17) and oldest (65 years or older) age brackets (5% and 3%, respectively).

The largest percentage of Likes came from Venezuela (approximately 13% of Total Likes for the Page), followed by Mexico (11%), Argentina (8%), Colombia (8%), and Spain (7%). The United States generated the 6<sup>th</sup> highest number of Likes (7%).

### **1.3 What were the primary referring sites to the Facebook Page?**

The top referring site to the Facebook Page was [espanol.earthsky.org](http://espanol.earthsky.org), with 2,631 referrals. Google searches originated from various countries (particularly Mexico, Argentina, Colombia, and Spain) also brought referrals.

### **1.4 What types of posts were made to the Facebook Page?**

Four types of post were made to the Facebook Page: links to science information via photos (which frequently linked to the *EarthSky en Español* website and are hereafter called 'photo' posts), links to articles (hereafter called 'link' posts), video links, and status (text only) posts. Photos made up nearly nine-tenths (88%) of all posts to the Page, and links made up one-tenth of the posts (10%). There were relatively few video links (2%). Status (text only) posts were the least common type of post (.2%).

For the three main kinds of posts (photo, link, and video), in each case the number of posts made to the Page increased from September 2012 to May 2013, at which time the total post count peaked at 123 posts (92 photos, 26 links, and 5 video links). After May 2013, for each of the three main post types, there was a decreasing trend in post count through May 2014.

### **1.5 How many Engaged Users did the Facebook Page draw?**

Engaged Users refers to the number of unique users who clicked on, Liked, commented on, or shared the Facebook Page each month. During the 21-month grant period, the Page averaged 12,700 Engaged Users per month. While the month with the highest number of Engaged Users was September 2013 (20,700), other months also had relatively high numbers, particularly in late 2012 and again in the spring of 2013. The number of Engaged Users declined significantly from December 2013 through May 2014.

## **1.6 What was the Reach of the Facebook Page?**

Reach refers to the number of unique users who saw any content associated with the Page over the 21-month period. The Page's average monthly Reach was 154,000 unique users. Reach totals were generally highest in the spring of 2013, peaking in April with 256,000 unique users, although the fall of 2012 and fall of 2013 also recorded numbers that were well above the average monthly figure. Reach declined significantly from December 2013 through May 2014.

## **1.7 How many Impressions did the Facebook Page generate?**

According to Insights, Impressions refers to "*The number of times a post from your Page is displayed, whether the post is clicked or not. People may see multiple impressions of the same post. For example, someone might see a Page update in News Feed once, and then a second time if their friend shares it.*" On average, Impressions values were 3.2 times higher than Reach, meaning that the Facebook users who saw content saw the content approximately 3 times on average. The *EarthSky en Español* Page's average number of Impressions was 524,000 per month over the 21-month period. The number of Impressions was generally highest during the spring of 2013, peaking in April with 882,000, although the fall of 2012 and the early fall of 2013 also recorded numbers that were well above the monthly average. After the early fall of 2013, there was a decreasing trend in Impressions through May 2014.

## **1.8 What types of posts achieved the greatest Reach and Impressions?**

Of the three main types of posts, video links performed the best with respect to Reach and Impressions, followed by link posts and photo posts.

Both Reach and Impressions are heavily influenced by EdgeRank, Facebook's algorithm for determining what content shows up in a user's News Feed, or "who sees what." Post type is part of the algorithm, as well as the popularity of the content (as determined by engagement and other factors). The smaller Reach and Impressions for photo posts can be partially attributed to this algorithm. For example, during the 21-month period, links generated significantly more shares (on average) than photos, which, in turn, likely increased the Reach and Impressions of these kinds of posts.

## **1.9 How many Consumers did the Facebook Page generate?**

Consumers refers to the number of people who clicked on any of the Facebook Page's content without creating a story. (Stories describe any way a person can interact with a Facebook Page, such as Liking it, Liking a post, tagging the Page, commenting on a post, and sharing a post.)

The Page's average number of Consumers was 10,500 per month. The number of Consumers was highest in the late fall/early winter of 2012, peaking that November with 16,600, although the spring and early fall of 2013 also recorded numbers well above the monthly average. Consumers declined significantly from December 2013 through May 2014.

## **1.10 How many Consumptions did the Facebook Page generate?**

Consumptions are the number of clicks on any Page content, including Photo View, Link Clicks, and Other Clicks. Photo View refers to someone clicking on a photo to view it; Link Clicks refers to a person clicking on a link to view it; and Other Clicks refers to a person clicking on some other part of a post, including clicks that generated stories. Video was excluded from the analysis because nothing was technically posted as a video; rather, videos were posted as links.

During the 21-month period, the most Consumptions each month came from Other Clicks. The number of Photo Views and Other Clicks both peaked in the fall of 2012 and again in the spring and fall of 2013, and then generally



declined from December 2013 through May 2013. The number of Link Clicks was consistently low during the grant period in relation to the other types of Consumptions.

### **1.11 What types of posts drew the most Engaged Users, Consumers, and Consumptions?**

Over the 21-month period, photo posts had the highest number of Engaged Users and Consumers, and the second highest number of Consumptions by a narrow margin. Video links had the highest number of Consumptions, and the second highest number of Engaged Users and Consumers. Links had the lowest number of Engaged Users, Consumers, and Consumptions.

### **1.12 How much negative feedback did the Facebook Page generate?**

Negative feedback can occur in different ways. For example, users have the option when they see a post to hide all posts from the Page, hide that one specific post, report the post as spam, and Unlike the Page. Over the 21-month period, on average, 104 users provided negative feedback each month. Negative feedback per month was highest during the fall of 2012 and again in the spring of 2013. Negative feedback began declining below the monthly average in the fall of 2013. It continued to decline toward the lowest point in April 2014, near the end of the grant period approached.

## **Discussion**

The monthly engagement metrics captured by Insights point to some revealing trends in activity. In chronological order:

- The fall of 2012 saw significantly higher than average Engaged Users (unique people who clicked on, Liked, commented on, or shared the Facebook Page), Reach (unique users who saw any content associated with the Page), and Impressions (defined by Insights as “*the number of times a post is displayed, whether it is clicked on or not*”). The number of Consumptions (defined by Insights as “*The number of times people clicked anywhere in your posts (total count)*”) also peaked during this time, and the Page saw the highest number of Consumers (unique users who click on posts without generating a story). Finally, there was a bump in Page Likes in the fall of 2012.
- The spring of 2013 was another period of growth for the Page. The Page’s Reach and Impressions saw high points, with both metrics peaking in April. There were also higher than average numbers of monthly Engaged Users and Consumers during this time, and a peak in Consumptions.
- The fall of 2013 had the highest number of Engaged Users and Consumptions of the 21-month period. Also during this time, the Page’s Reach, Impressions, and Consumers were well above each engagement unit’s average monthly figure. Additionally, the fall of 2013 through the winter of 2014 saw the largest growth in terms of Page Likes.
- From December 2013 through May 2014, Engaged Users, Reach, Impressions, and Consumers all declined to figures well below each engagement metric’s respective monthly average. Consumptions per month declined during this time as well, eventually reaching a Total Consumptions low point in May 2014. From March 2014 through May 2014, the average number of Likes per month also lowered significantly.

When these and other trends were brought to the attention of the *EarthSky en Español* project team, the team provided additional information about the project’s social media outreach efforts. Specifically:

- When asked about the highs and lows of the engagement metrics (general highs in the fall of 2012 and the spring and fall of 2013, lows from late 2013 through May 2014), an *EarthSky* team member pointed to two primary influences:
  - First, she noted that the success of *EarthSky*'s online presence is often tied to the night sky, elaborating, *"Some of the highs and lows we're seeing here are likely tied to night sky events. For example, the highs in the fall of 2012 are probably tied to three meteor showers that occur in the autumn months: the Orionids in October, the Leonids in November and the Geminids in December. In the April and May of 2013, Venus and Jupiter - the two brightest planets - were near each other with Mercury joining in May 2013 for a planetary trio (three planets fit within a circle with a 5-degree, or smaller). People hear about these events, or see the planets, for example, in the night sky and come to us looking for information."* In terms of the night sky event(s) that might have impacted the boost in engagement in the fall of 2013, a 2012 article from the online space news website SPACE.com titled *"Look up! 13 Must-See Stargazing Events in 2013"* points to some fall 2013 events that could have helped drive traffic to the Page, including a penumbral eclipse of the moon on October 18<sup>th</sup> and a hybrid eclipse of the Sun on November 3<sup>rd</sup>.<sup>7</sup>
  - Second, the team member noted that user engagement with the Page declined toward the end of the project, as posts became less frequent. Specifically, she said that, *"In our experience, media on the Internet operates within one very strict rule: 'energy in-energy out.' The more you post, the more you're excited about what you're posting, the more people visit the Page, click the like button, and comment...The Internet is just such a human endeavor. A change in mood can perhaps account for the steep decline when EarthSky staff learned, beginning in fall 2013, the project would not be continuing. Some of our staff began looking for other jobs, and we began having to shift people to the Facebook Page who were perhaps not as experienced or skilled at running it as previous employees had been. That's probably a natural decline in any project, but, on the Internet - with the 'energy in-energy out' rule operating - it's very noticeable."*

Her informal *"energy in-energy out"* observation highlights a situation that was also likely compounded by the algorithm Facebook uses when determining which content to show individual users. As described in the April 2014 TechCrunch article *"Why is Facebook Page Reach Decreasing? More Competition and Limited Attention,"* Facebook's goal is to show the most engaging posts to each user.<sup>8</sup> Though Facebook looks at more than 100,000 factors when determining what is shown in a user's News Feed, the five most powerful determinants are: (1) the interest of the user in the post's creator; (2) the post's performance among other users; (3) the performance of past posts by the creator; (4) the type of post the user generally prefers; (5) and how recently the post was shared. Thus, a decrease in posts that are shared by engaging content creators leads to less exposure for future posts, and less engagement with users and knowledge of user interests.

- On a related note, though photos linking to science information were the most common type of post on the Page (88% of all posts), they had the lowest average Reach and Impressions relative to link and video link posts. As described in section 1.8, Reach and Impressions are both heavily influenced by Facebook's algorithm for determining the content that shows up in a user's News Feed – thus, as links generated more shares (on average) than photos, the Reach and Impressions of link posts likely increased as well. However, the photos that were seen by users were still generally popular, as photos had the highest number of Engaged Users and Consumers, and the second-highest number of Consumptions (after video links) by a narrow margin. According to Facebook's strategic partnerships manager Libby Leffler, *"We tell non-profits all*

<sup>7</sup> For more information, please visit: <http://www.space.com/19062-best-stargazing-events-2013.html>

<sup>8</sup> For more information, please visit: <http://techcrunch.com/2014/04/03/the-filtered-feed-problem/>

*the time: Photos are everything...visual imagery is huge. That can be a photo, a video or and Instagram.”*<sup>9</sup> Thus, though *EarthSky en Español*'s Facebook team may have noticed that their photo posts generated relatively low Reach and Impressions, it seems they were popular enough in other ways (and applicable to the subject of the Page and the mission of the non-profit, particularly given that the *EarthSky* website shares science information via a photo of the day) to merit a high frequency of posts.

- The *EarthSky*'s en *Español*'s team member was also asked if she could comment on the Page's international popularity. As noted above, the largest number of Page Likes came from Venezuela (13%), Mexico (11%), Argentina (8%), Colombia (8%), Spain (7%), and the United States (7%). Based on this, the staff member speculated that a self-supporting Spanish language website may not be able to rely solely on Spanish-speaking Hispanics in the U.S., adding, *“The radio and television aspects of this project did draw U.S. audiences, because the products were delivered on U.S. radio and television broadcast outlets. But the online component does seem to have drawn a large international audience. When we originally proposed this project we provided some evidence that, in Spanish-preferring Hispanic households in the U.S., the radio and television listening and viewing preferences were generally controlled by the older people in the house...Online media consumption may be different, since it involves an individual sitting alone at a computer. Perhaps younger U.S. Hispanics use computers more than their parents and simply don't seek out information in Spanish. Meanwhile, in other Spanish-speaking countries, people are seeking science information and hence were drawn to our online products.”* Given that more than half of the people who Liked the Facebook Page were under 44 years of age, her reasoning regarding Internet use, age, and language preferences may hold some merit, though additional research would be needed to learn more about the language preferences of different demographics of social media users in the U.S.

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<sup>9</sup> For more information, please visit: <http://mashable.com/2013/03/21/facebook-non-profits/>



## Study 2: Exploratory study of short-format videos with an *EarthSky en Español* online audience

### Introduction

*EarthSky's* Broad Implementation media project, funded by the NSF in 2010, built upon a prior NSF award (0639001) which produced, among other media deliverables, a Spanish-language science news and information website, *EarthSky en Español*. Through the Broad Implementation award, *EarthSky* subsequently increased the amount of Spanish-language STEM content on the website, and in particular, highlighted research conducted by Hispanic scientists on a wide range of STEM topics including astronomy, biology, physics, earth science, and engineering.

As part of this effort, *EarthSky* co-produced with Univision a series of short-format videos 1-3 minutes in length, many of which featured interviews with Spanish-speaking scientists or researchers. These videos were both distributed through the television program *Detras del Saber* on Galavisión, a Univision subsidiary, and posted on the *EarthSky en Español* website. Some also appeared on the *EarthSky en Español* Facebook Page. An announcement of the videos premiere appeared on the *EarthSky* website, as captured in the screenshot to the right.



## Detras del Saber

*Detras del Saber* is a half-hour television program that airs in a prime time slot between Mondays and Thursdays. Described on the *Detras del Saber* [Facebook Page](#) as a “Ciencia-Entretenimiento” genre, the program combines information and entertainment to explore explanations of how things work. As described in an Univision announcement of the program’s premiere on Galavision on YouTube in 2010, the program features a host, José Ramón Blanch, and covers a wide range of STEM topics of personal relevance to viewers:

*This is a hosted half-hour show, where information and entertainment come together. Everything has an explanation, and this is where our viewers will come to find the answers, from the flight of an airplane, to the building of a wine bottle cork, to the strength bite of a shark. A fast paced and entertaining show, devoted to illustrate in a visual and practical sense how things work, how things are manufactured. Five days a week, prime time on Galavision. <http://www.youtube.com/watch?v=6K2T-9URfE0>*

Viewers can find out more about the program in the [Entertainment section](#) of the Univision website, as captured in the screenshot below.

The screenshot shows the Univision website's Entertainment section. At the top, there are navigation tabs for Internet, Univision, Videos, and Foros. Below this is a search bar with a 'Buscar' button. A secondary navigation bar includes links for Entretenimiento, Shows, Chismes, Fotos, Videos, Novelas, Uforia Música, NBL-U, Cine, Foros, and Boutique. The main content area is titled 'ENTRETENIMIENTO > DETRAS DEL SABER'. On the left, there is a promotional image for the show with the text 'Lunes a viernes 10:30PM/ 9:30 Centro'. The main content features a large video player with the title 'Detras del Saber: Aprende sobre las comun...' and a description: 'Detras del Saber te enseña el mundo de las comunicaciones ultra-realistas, que son muy revolucionarias porque puedes comunicarte con gente más naturalmente.' Below this are six smaller video thumbnails with titles and descriptions: 1. 'Aprende sobre la energia solar y renovable' (Learn about solar and renewable energy), 2. 'Detras del Saber con nuevos capitulos' (Detras del Saber with new chapters), 3. 'Instalaron la pirotecnia en Premios Juventud' (They installed fireworks at Premios Juventud), 4. 'Sistema de comunicaciones de Premios Juventud' (Communication system of Premios Juventud), 5. 'Cámara rápida cómo se montó la escenog...' (Fast camera how the scenog... was built), and 6. 'Vacuna contra los tumores cerebrales' (Vaccine against brain tumors). On the left side of the main content, there is a 'Foros Top 10' section listing topics like Crepúsculo, Cine Club, Harry Potter, High School Musical, Narnia, and Twilight. Below that is a 'Cumpleaños Feb.' section listing '(01) Tego Calderón'.

The short format videos that were broadcast as part of *Detras del Saber* (Behind Knowledge) were inserted as interstitial segments within the half-hour program format, typically but not always accompanying related programming content.

## Evaluation goals

As part of the NSF award, Knight Williams Inc. conducted an exploratory study of the appeal, clarity, learning value, and motivational impact of the *EarthSky en Español* short format videos. To examine the impact of the videos as experienced by the broadcast and online audiences for whom they were designed, the evaluation team evaluated a sampling of three videos that aired on *Detras del Saber* over a one month period with visitors of the *EarthSky en Español* homepage and Facebook Page.<sup>10</sup>

The evaluation specifically explored:

- Viewers' reactions to the three videos in terms of their perceived appeal, clarity, learning value, and personal relevance;
- The extent to which viewers reported an intention to discuss and follow up on topics covered in the videos as a result of viewing;
- The potential learning impact of the short video format as determined by any differences that may be found between viewers and non-viewers of one of the three videos on a short learning "quiz" addressing key content featured in the video; and
- Whether and how the *EarthSky en Español* website and Facebook visitors used the Facebook Page as an informal science education resource.

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<sup>10</sup> The evaluation, *EarthSky*, and Univision staff that collaborated on the evaluation considered the opportunities for and requirements involved in gathering feedback from viewers of the short-format videos as presented on *Detras del Saber*, including, for example, extending evaluation invitations to *Detras del Saber* viewers who visit the social media offerings related to the series. The team encountered a number of marketing, legal, and logistical requirements that needed to be addressed in order for this type of evaluation to occur that could not be resolved during the evaluation timeframe. Building on this experience, the three teams prepared a subsequent proposal to the NSF that built in a timeline and process for this to occur.



## Method

### Videos used for the evaluation

The three videos used for the evaluation include (as internally titled by the project team): *Sugar Brain*, *Love Brain*, and *Mosquitoes*. All three videos were less than 2 minutes in length and featured Spanish-speaking scientists talking about their work or the work of others. Screenshots of scenes from each video are shared below.

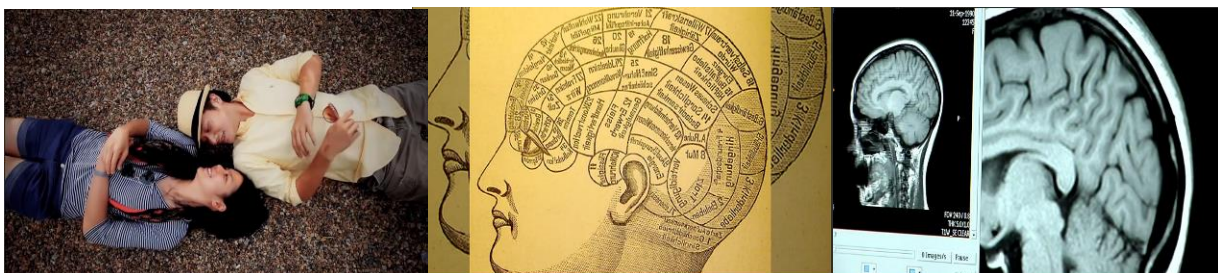
***Mosquitoes*** highlighted the effects of mosquito bites and prevention as well as the dietary habits of mosquitoes and their role in the ecosystem.



***Sugar Brain*** addressed the effects of fructose on the brain and highlighted a research study with mice on the protective functions of Omega-3s.

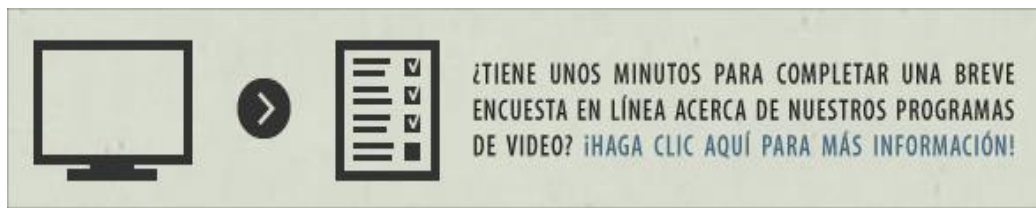


***Love Brain*** focused on the role of the brain in emotions like love and the contributions of the field of neuroscience in furthering our understanding.



## Evaluation procedure

The evaluation team invited *EarthSky en Español* Facebook and homepage visitors to participate in a survey about their interest in and knowledge of topics featured in videos produced by *EarthSky en Español* and Univision. The survey invitation was intermittently placed on both websites (“pinned” on Facebook) for a total of twelve weeks over a six month period from December 2012 to June 2013. The following screenshot shows the introduction banner that *EarthSky* created to appear on [Espanol.earthsky.org](http://Espanol.earthsky.org), as well as a pop-up window that appeared to first-time visitors of the site. The same image was pinned to the *EarthSky en Español* Facebook Page.



Interested participants then clicked to a short online consent form, hosted by Knight Williams Inc., that provided information about the evaluation procedure and asked for basic background information, including participants' ages to ensure they were 18 years or older. Participants were also informed that: a) they would be randomly assigned to receive different versions of a survey, b) that their participation in the evaluation was voluntary and they could quit at any time, and c) that their responses were confidential and would be reported in the aggregate.

For those who chose to participate, the evaluation process then incorporated an online sampling mechanism developed by Knight Williams Inc. that randomly assigned participants to one of four online surveys. Three were “Viewer” surveys that asked visitors to watch one of the three videos (*Mosquitoes*, *Love Brain*, or *Sugar Brain*) and answer questions about that video's appeal, clarity, and learning value, including a short set of “quiz” type questions about the main topics addressed. The fourth survey asked participants to complete the same quiz asked of viewers of the three videos, but these visitors did not view any videos. This non-viewing “Control group” was asked an additional set of questions about their use of the *EarthSky en Español* social media that were produced as part of the NSF grant.

The above evaluation procedure yielded viewer feedback on all three videos with respect to appeal, clarity, and learning value. The procedure also enabled the evaluation team to look for significant differences between the Viewer and Control groups with respect to the kinds of information gains acquired from one video (*Mosquitoes*) selected for further analysis (see *Questionnaires* on page 31 for additional information). The evaluation design used for this additional level of testing was a two-group posttest-only randomized design as it examined recruited participants' experience with the video, as compared to a group of participants who didn't view the video but who completed the same set of demographic/background questions and a “quiz” on the main content presented in the video.<sup>11</sup>

<sup>11</sup> Although all participants completed background and demographic questions, administering a content-based pretest and posttest to the same group of participants in this case was neither a) practical given the challenges of maintaining participant cooperation, nor b) desirable given the specialized nature of the content addressed in the program and the potential for the pretest to sensitize Viewers to the program's content and affect their posttest performance given the short duration evaluation timeframe. Typically, the shortcomings with the separate-sample design involve its failure to control for history, maturation, mortality, and their interaction. However, in the case of this program treatment, where the Viewer and Control



## Questionnaires

All four questionnaires and related correspondence to these questionnaires were conducted in Spanish. To illustrate the online form and questions used in the evaluation, the *Mosquitoes* Viewer questionnaire may be viewed at this [link](#). In each case, the questionnaire was designed to be completed within 10 minutes. Honoraria of \$10 were provided to evaluation participants to help encourage completion of the evaluation activities.

The Viewer questionnaires included:

- A small set of appeal and clarity ratings that were asked to gauge the extent to which Viewers liked the videos, found the content appealing, and found the videos clear.
- A series of agree-disagree statements that asked Viewers to reflect on: the amount and level of science featured in the videos, the extent to which they found the science and health information featured personally relevant, and the extent to which each video increased their interest in and/or concern about the topic. This section also explored the extent to which the Viewers enjoyed watching the featured scientist, whether they viewed the scientist as an effective communicator, and how important it was to them that future videos feature Hispanic scientists.
- Multiple question types that explored viewer learning from the videos. From a qualitative standpoint, Viewers of each video completed a combination of self-report and open-ended questions about how much they felt they learned from the video and what they perceived to be the message of the video they viewed, and what else they learned of interest. The learning impacts of the *Mosquitoes* video were further evaluated using a combination of open-ended and forced-choice objective content-based assessment items relating to the video's featured content. Participants in both the Viewer and Control groups were asked to complete a 15 point assessment consisting of: 4 true/false, 1 multiple choice, and 2 open-ended questions. Each question was assigned a point value based on the relative importance the video placed on the content addressed.

These content assessment items were developed through an iterative process that involved collaborating with the project team, reviewing the proposal goals, and reviewing the script and video programs. The evaluation team also relied on piloting the questions since it was not possible to use established or validated measures for the evaluation given the specific nature of the content covered and the lack of prior work on short format videos used in informal science contexts.

The Control questionnaire included the content quiz items described above and an additional set of questions about participants' experience with the *EarthSky en Español* Facebook Page to provide the *EarthSky* team with insight about the nature and frequency of their website and Facebook visitors' use of the Facebook Page.

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group respondents completed the evaluation activities over a matter of minutes, group changes of this nature are a non-issue. The separate-sample design controls for the main and interactive effects of testing and was deemed in this case a useful and cost-effective strategy for evaluating the program.

## Data analysis and reporting

Statistical analyses were conducted on all quantitative data generated from the evaluation. To explore for possible significant differences within and between the Viewer and Control groups, T-tests, Chi-Square, Kruskal-Wallis, and Mann-Whitney tests were applied as appropriate.<sup>12</sup> Statistically significant findings (hereafter referred to as “significant”) at  $p \leq .05$  are reported in the text.<sup>13</sup> To help determine whether a significant difference was a difference of practical concern, effect sizes were also computed and reported in the text where appropriate.<sup>14 15</sup> As explained by Thalheimer and Cook (2002) “*whereas statistical tests of significance tell us the likelihood that experimental results differ from chance expectations, effect-size measurements tell us the relative magnitude of the experiment treatment. They tell us the size of the experimental effect.*”<sup>16</sup>

Content analyses were performed on the qualitative data generated in the open-ended questions. All analyses were conducted by two independent coders. Each coder independently coded randomly ordered open-ended responses, blind to group assignment. The analysis was both deductive, drawing on the video’s objectives, and inductive, by looking for overall themes, keywords, and key phrases. Any differences that emerged in coding were resolved with the assistance of a third coder.

Note that while similar content assessment quiz type questions were asked of all three video groups to ensure comparable survey length and completion experience, due to project priorities and budget constraints with respect to translation and analysis, the pre/post comparison analyses only focused on one of the three videos, *Mosquitoes*, which was randomly chosen for analysis among the three videos.

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<sup>12</sup> When applying the two-independent-samples *T*-test, Levene's test was first used to determine whether the separate-variance *t* test or pooled-variance *t* test was appropriate for testing the means of the measured variables. If the test indicated the variances were significantly different, the separate-variance *t* test was used.

<sup>13</sup> Given the exploratory nature of the study, the analysis used unadjusted tests at the .05 level of significance except in the case of post-hoc tests. For example, to investigate why a Kruskal-Wallis *H* test yields a statistically significant difference on an appeal rating for the groups, a post-hoc analysis using Mann-Whitney *U* tests would be conducted. As this post-hoc test involves multiple pairwise comparisons among the groups, the level of significance is adjusted to compensate for the inflated Type 1 error risk (typically by using the Bonferroni adjustment procedure for a small number of pairwise comparisons).

<sup>14</sup> Following Cohen's (1992) interpretation, for T-tests  $d=.2$  indicates a small effect,  $.5$  a medium effect, and  $.8$  a large effect. For non-parametric tests,  $r=.10$  indicates a small effect,  $.3$  a medium effect, and  $.50$  a large effect.

<sup>15</sup> Cohen, J. (1992). A Power Primer. *Psychological Bulletin*, 112 (1), 155-159.

<sup>16</sup> Thalheimer, W. and Cook, S. (2002). How to Calculate Effect Sizes from Published Research: A simplified methodology, *Work-Learning Research*, p. 2.

## Sample information

During the evaluation period, the evaluation gathered feedback from a total of 113 *EarthSky en Español* homepage and Facebook visitors.<sup>18</sup> The table to the right summarizes the demographic and background information for the final group of participants randomly assigned to one of the three Viewer questionnaires or the Control questionnaire.

Chi-square analyses confirmed that the two groups did not differ significantly with respect to the measured variables with the exception of country of residence.<sup>19</sup> A possible reason for the higher percentage of participants from other countries in the Control group is that some participants outside of the U.S. reported experiencing difficulty accessing the video links on Vimeo, which would have effectively lowered the size of the Viewing group as these participants were unable to complete the surveys.

### Viewer participant demographics/background

The Viewer portion of the sample included:

- A higher proportion of males (66% to females 34%).
- A wide range of ages, spanning 18-80 years, with a mean age of 40.
- A majority of participants who resided in the U.S. (77%).
- A majority of participants who were employed (56%), with the remaining participants classifying themselves as students (17%), retired (11%), unemployed (5%), homemakers (8%), or homeschoolers (3%).
- A combination of high school through graduate level-educated participants, including: 64% with a college level education, 16% with a graduate level education, and 20% with a high school education or less.
- A somewhat lower percentage of (U.S based) participants who watched *Detras del Saber* occasionally or regularly (41%) versus seldom or never (59%).

| <b>Sample demographic/background information</b>                                     |                               |                   |                   |
|--|-------------------------------|-------------------|-------------------|
| Demographic/<br>background<br>factor   | Categories                    | Control<br>(N=49) | Viewers<br>(N=64) |
| <b>Gender</b>  | Female                        | 25%               | 34%               |
|  | Male                          | 75%               | 66%               |
| <b>Age group</b>   | Age range                     | (18-77)           | (18-80)           |
|  | Mean                          | 38                | 40                |
| <b>Highest level of<br/>education</b>  | High school or less           | 31%               | 20%               |
|  | College education             | 45%               | 64%               |
|  | Graduate education            | 24%               | 16%               |
| <b>Country of<br/>residence</b>  | U.S.                          | 41%               | 77%               |
|  | Other countries <sup>17</sup> | 59%               | 23%               |
| <b>Occupational<br/>status</b>   | Employed                      | 49%               | 56%               |
|  | Homemaker                     | 2%                | 8%                |
|  | Retired                       | 8%                | 11%               |
|  | Unemployed                    | 0%                | 5%                |
|  | Student                       | 26%               | 17%               |
|  | Homeschooler                  | 2%                | 3%                |
| <b>Frequency of<br/>watching <i>Detras<br/>del Saber</i><br/>(US residents only)</b> | Regularly                     | 15%               | 10%               |
|  | Occasionally                  | 35%               | 31%               |
|  | Seldom                        | 25%               | 29%               |
|  | Never                         | 25%               | 30%               |
| <b>Interest in<br/>science topics</b>  | Very interested               | 57%               | 62%               |
|  | Moderately interested         | 37%               | 28%               |
|  | A little interested           | 6%                | 8%                |
|  | Not interested                | 0%                | 2%                |
| <b>Frequency of<br/>looking for<br/>science<br/>information<br/>online</b>           | Regularly                     | 47%               | 58%               |
|  | Occasionally                  | 41%               | 36%               |
|  | Seldom                        | 8%                | 6%                |
|  | Never                         | 0%                | 0%                |
|  | Blank                         | 4%                | 0%                |
|  |                               |                   |                   |

<sup>17</sup> While 69 participants were from the U.S., the remaining participants were from the following countries, listed in order of descending frequency: Colombia (12), Mexico (9), Spain (9), El Salvador (4), Chile (3), Venezuela (2), and one participant from Argentina, Bolivia, Ecuador, Guatemala, and Uruguay.

<sup>18</sup> The evaluation used a standard of 100% completion of basic demographic and objective content assessment items for inclusion in the analysis and 80% of all other questions to count as a complete record. A total of 41 submitted surveys were not included in the data set, 26 due to partial completions and 15 due to illegible

<sup>19</sup> A 2x2 chi-square test indicated that the relationship between group and country of residence was significant,  $\chi^2(1, N=113)=14.9, p < .001$ .

- A high percentage of participants who were very or moderately interested in science topics (90%).
- A majority of participants who looked for science information online regularly (58%) or occasionally (36%), with few saying they seldom did this (6%).

## Control participant demographics/background

The Control group portion of the sample included:

- A much higher proportion of males (75%) to females (25%).
- A wide range of ages, spanning 18-77 years, with a mean age of 38.
- A higher percentage of participants who resided in countries other than the U.S. (59%).<sup>20</sup>
- A high percentage of participants who were employed (49%), with the remaining participants classifying themselves as students (26%), retired (8%), homemakers (2%), or homeschoolers (2%).
- A combination of high school through graduate level-educated participants, including: 45% with a college level education, 24% with a graduate level education, and 31% with a high school education or less.
- A balance of (U.S.-based) participants who watched *Detras del Saber* occasionally or regularly (50%) versus seldom or never (50%).
- A high percentage of participants who were very or moderately interested in science topics (94%).
- A majority of participants who looked for science information online regularly (47%) or occasionally (41%), with few saying they seldom did this (8%) or leaving the item blank (4%).

## Participants' use of the *EarthSky en Español* Facebook Page

As part of their survey experience in lieu of watching videos, Control participants were asked several questions about their experience with the *EarthSky en Español* Facebook Page to provide the *EarthSky* team with insight about the nature and frequency of their website and Facebook visitors' use of the Facebook Page.

The findings from this group are presented in the table to the right. Note that this Control group of visitors did not differ significantly from the Viewer group with respect to the background and demographic factors measured above (presented in the table on the previous page), with the exception of country of residence, as detailed in footnote 17.

| Visitors' use of the <i>EarthSky en Español</i> Facebook Page   |                       |                |
|---|-----------------------|----------------|
|   | Categories            | Control (N=49) |
| Frequency of visiting Facebook  | Daily                 | 55%            |
|   | 1 to 2 times a week   | 4%             |
|   | 3 to 5 times a week   | 14%            |
|   | Less than once a week | 21%            |
|   | Never                 | 6%             |
| Frequency of visiting <i>EarthSky en Español</i> Facebook Page  | Daily                 | 6%             |
|   | 1 to 2 times a week   | 14%            |
|   | 3 to 5 times a week   | 18%            |
|   | Less than once a week | 37%            |
|   | Never                 | 22%            |
| Frequency of talking with friends or family about something on <i>EarthSky en Español</i> Facebook Page | Regularly             | 20%            |
|   | Occasionally          | 25%            |
|   | Seldom                | 22%            |
|   | Never                 | 33%            |
| Frequency of following up on information presented on <i>EarthSky en Español</i> Facebook Page          | Regularly             | 22%            |
|   | Occasionally          | 29%            |
|   | Seldom                | 16%            |
|   | Never                 | 31%            |
|   | Blank                 | 2%             |
| Whether the <i>EarthSky en Español</i> Facebook Page is a good source for learning about science (n=37) | Yes                   | 97%            |
|   | No                    | 3%             |

<sup>20</sup> The most likely reason for the higher percentage of participants from other countries as opposed to the U.S. is that some participants noted difficulty accessing the videos links on Vimeo outside of the U.S., which effectively lowered the size of the Viewing group as these participants were not able to complete the surveys.

### **Frequency of visiting Facebook**

Three-quarters indicated they were frequent Facebook users, with more than half saying they visited daily (55%) and almost one-fifth (18%) saying they visited between 1-5 times a week. The remaining one-quarter said they visited less than once a week (21%) or never (6%).

### **Frequency of visiting *EarthSky en Español* Facebook Page**

Not quite two-fifths (38%) of the group said they visited the *EarthSky en Español* Facebook Page at least weekly with one-third (32%) saying they visited between 1-5 times a week and less than one-tenth (6%) saying they visited daily. The remaining participants said they visited less than once a week (37%) or never (22%). Several of those who indicated they didn't visit the page further explained they couldn't access the page as they didn't use Facebook or gave some other reason.

### **Frequency of talking with others about something from the *EarthSky en Español* Facebook Page**

When asked how frequently they talked with friends or family about something they noticed on the *EarthSky en Español* Facebook Page, almost half said they did so or regularly (20%) or occasionally (25%), while smaller groups said they did so seldom (22%) or never (33%).

### **Frequency of following up on something from the *EarthSky en Español* Facebook Page**

When asked if they ever followed up on information presented in the *EarthSky en Español* Facebook Page half said they did so regularly (22%) or occasionally (29%), while remaining groups said they did so seldom (16%), never (31%), or left the question blank (2%).

Those who indicated they *did* follow-up on information were asked what topics they followed up on. Most of these visitors pointed to looking up information about the solar system or NASA or said they consulted a search engine to find more information about topics of interest. A sampling of the participants' responses follow:

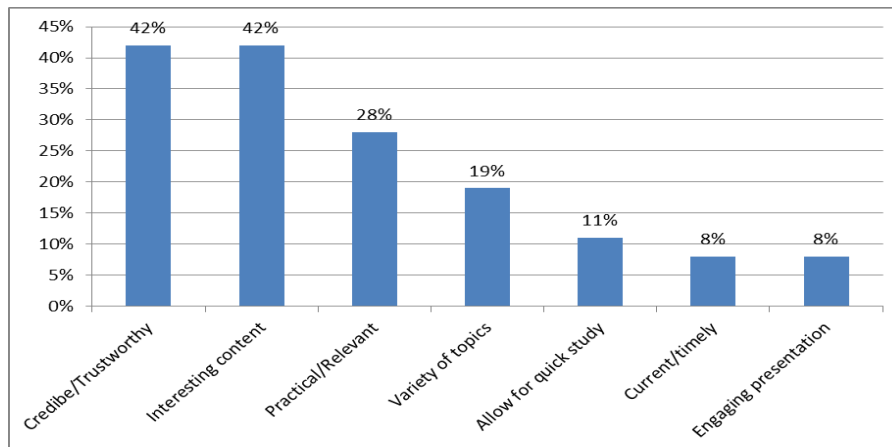
- ▶ *Planets, universes, galaxies, exo-planets, and sky orbit.*
- ▶ *Meteor shower of the day January 3, 2012 and also sought information from Google.*
- ▶ *Recently, the topic of the Mayan calendar, EarthSky and searched Google more info on what they told others. I visited Wikipedia, and read an article that debunked fears about the end of the world.*
- ▶ *Falling stars and NASA.*
- ▶ *A recent search was the alignment between Saturn, Venus and Mercury; also looked for information in other pages, but I cannot remember the names of the pages.*

### **Whether the *EarthSky en Español* Facebook Page was a good source of science and why**

Those who visited the *EarthSky en Español* Facebook Page (n=37) were asked if they felt it was a good source for learning about science. All but one participant (97%) said they felt it was, with the one individual who disagreed commenting that the page didn't provide enough information for his/her taste.

Those visitors who indicated the Facebook Page was a good place to learn science were asked to explain why. As shown in the chart on the next page, more than two-fifths (42%) of this group either pointed to the page being *credible* and *trustworthy* and/or mentioned that the content of the page was *interesting*. More than a fourth (28%) found the page to have *practical and relevant* information while about a fifth (19%) thought that the *variety of topics* offered on the page made it a good place to learn science. More than a tenth (11%) said that the page allowed for quick study and less than a tenth (8%) either saw the page to be current and timely and/or thought it had an engaging presentation of topics.

**Why those who visited the *EarthSky en Español* Facebook Page felt it was a good source of science (n=37)**



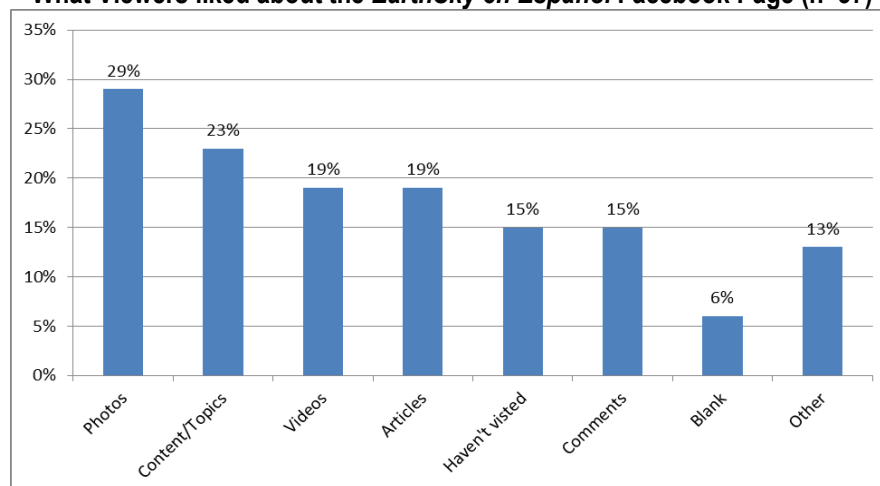
A sampling of responses from the participants follow:

- ▶ *Yes, it is very good site with interesting articles where one learns new things, easy to understand and is not boring.*
- ▶ *Because it is well varied and above all, it is complete.*
- ▶ *The articles are easy to understand and practice in life.*
- ▶ *Has good and reliable information.*
- ▶ *They have good references in their presentations.*
- ▶ *It is a very good site and is an honest source of information.*

**What was liked about the *EarthSky en Español* Facebook Page**

Participants were asked what was most appealing about the *EarthSky en Español* Facebook Page. As shown in the chart below, more than a fourth (29%) responded that the photos held the most appeal, while less than a fourth (23%) found the content and topics featured on the Facebook Page interesting. About a fifth (19%) each found the videos and/or articles to be appealing, while less than a fifth (15%) each found the comments interesting or said they had not visited the Facebook Page. Less than a tenth (6%) left the question blank, while the remaining 13% responded with an answer other than those above.

**What Viewers liked about the *EarthSky en Español* Facebook Page (n=37)**



A sampling of participants' responses follow:

- › *I have never entered that page.*
- › *All articles, videos and photos about science and space.*
- › *Everything, in particular, the comments.*
- › *Videos and links to articles in general, I like all the information on the page.*
- › *I have not visited.*
- › *I paid attention to the posts.*
- › *I didn't know some things, but in the future, I will revisit this webpage, I think it has many interesting articles.*

#### **What participants were doing when they saw the survey link**

When participants' were asked what they were doing prior to seeing the survey link, more than half (52%) said that they were looking up information on a subject or topic, while less than a sixth (15%) were looking for *new* or *newsworthy* things. Less than a tenth (8%) said they were checking email, while a tenth (10%) left the question blank, and the remaining 17% responded with a response other than those above. A sampling of participants' comments follow below:

- › *I was looking for information about the winter solstice on the web.*
- › *I was reading the news when I saw a study of the brain.*
- › *I was just browsing.*
- › *Checking mail, but more on my Facebook account.*
- › *I was reading a report on CNN Mexico on technology that brought me to this site.*
- › *Reading the article, "When did the age of Aquarius begin?"*

#### **Suggestions for improving the Facebook Page**

Finally, when participants who had visited the Facebook Page were asked if they had any suggestions for the page, most indicated they had none. A few visitors asked that the page include more resource links so they could explore additional information or suggested more advertising of the Facebook Page through different mediums to target a greater audience. A sampling of participants' comments follow below:

- › *Have more links to information.*
- › *Inform me of things that are relevant to real life.*
- › *As I've just seen this recently, I have no suggestions, but so far I have liked what I've seen.*
- › *Make it more known because I hadn't heard of it before.*
- › *More formal links to articles as well as recognized science journals.*
- › *No, I think the page is excellent how it is.*
- › *It has good information, videos and photos.*
- › *Promote it more.*

## Findings

This section includes findings on the overall appeal, clarity, personal relevance, and learning value of the *EarthSky en Español* videos as determined by the recruited Viewers and, in some instances, Control group participants' responses on the questionnaires completed for the evaluation. The findings for Study 2 are organized under the following eight questions:

- 2.1 How did Viewers rate the videos in terms of overall appeal, content interest, clarity, and personal learning value?
- 2.2 How did Viewers respond to the scientists, science, and health information featured in the videos?
- 2.3 How important was it to Viewers that future videos feature Hispanic scientists?
- 2.4 How much did Viewers feel they learned from the videos?
- 2.5 What did Viewers identify as the videos' main messages and what else did they learn of interest?
- 2.6 What was the impact of the *Mosquitoes* video on Viewers' knowledge of mosquitoes as compared to Control participants?
- 2.7 To what extent were Viewers interested in learning more about information featured in the videos and felt they were likely to seek this information out?
- 2.8 Did Viewers share additional feedback on the videos?



## 2.1 How did Viewers rate the videos in terms of overall appeal, content interest, clarity, and personal learning value?

Viewers generally liked the videos and thought they featured interesting content and were clear/easy to follow. Viewers also indicated they learned a lot from watching the videos.

Viewers were asked to rate the *EarthSky en Español* videos for overall appeal, content interest, clarity and personal learning value. The table below presents the median ratings based on a scale from 1.0 (rated the lowest) to 7.0 (rated the highest).

| Overall median Viewer ratings of <i>EarthSky en Español</i> videos (N=64) |     |     |     |     |     |     |                        |                           |
|---|-----|-----|-----|-----|-----|-----|------------------------|---------------------------|
|   | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0                    |                           |
| Disliked very much  |     |     |     |     |     |     | 7.0<br>(range 4.0-7.0) | Liked very much           |
| Very boring content   |     |     |     |     |     |     | 7.0<br>(range 4.0-7.0) | Very interesting content  |
| Very confusing/difficult to follow  |     |     |     |     |     |     | 7.0<br>(range 5.0-7.0) | Very clear/easy to follow |
| Learned nothing   |     |     |     |     |     |     | 7.0<br>(range 2.0-7.0) | Learned a lot             |

While there were some differences of opinion among Viewers as evidenced by the range of ratings in each case, the median ratings indicated that Viewers generally liked the videos (Mdn = 7.0). The ratings further indicated that Viewers generally felt that the videos contained interesting content (Mdn = 7.0), were clear/easy to follow (Mdn = 7.0) and that they learned a considerable amount from watching (Mdn = 7.0).

The median values for each of the three individual videos (*Love Brain*, *Sugar Brain*, and *Mosquitoes*) were also 7.0 for each of the above appeal, clarity, and learning value ratings, with the exception of the rating for the amount of learning reported from *Love Brain*, which was 6.0. A Kruskal-Wallis *H* test showed that there were no statistically significant differences between the different Viewer groups for any of the ratings.

In addition to providing ratings, Viewers were also invited to explain their ratings. Examples of Viewers' comments for each of the three videos follows below.

## **Mosquitoes**

When invited to explain their ratings, many Viewers of *Mosquitoes* praised the video's overall appeal and style of presentation, noting that it was *direct, coherent, and/or well explained*, although a few suggested that the video could have been more to their liking if it went more into depth or focused on a different topic. Others praised the narrator and/or practical nature of the topic. A sampling of Viewers' responses follow:

- ▶ *It's interesting because I didn't know that mosquitos were attracted to pregnant women, blood type and people that drink alcohol.*
- ▶ *I liked it and should (if possible) go over other studies.*
- ▶ *I really liked the way of the presentation, the simple steps to learn, the images, colors, and sounds that correspond with the themes presented, the narration explained everything clearly and understandably.*
- ▶ *As an informed and avid horticulturist person I already knew many of the facts presented. This informed me though that there are many more species than previously estimated and that it never hurts to acquire new information. Thank you.*
- ▶ *It's an interesting, educational video, and gave me more information about precautions I should take to prevent the plague from spreading.*
- ▶ *It was a short and very practical, direct and information necessary for understanding the subject video.*
- ▶ *I liked the video and the way they explain everything. Visually it was great especially when mosquitoes were dissected out and then the specialist talking about the different species. I liked the voice of the narrator, that makes the video more interesting*

## **Love Brain**

When invited to explain their ratings, Viewers of *Love Brain* generally expressed interest in the video's topic or something new they learned from watching, with several Viewers raising new questions that the video generated for them, or areas they would have liked to see the video cover in more depth. A sampling of Viewers' responses follow:

- ▶ *While science answers many of the questions of human beings and neuroscience has contributed the most in recent times, I feel like science and this video both never answer what love is, only the effects it has on humans.*
- ▶ *I would have liked knowing the title or specialty of the speaker on mental behavior, but apart from that, they covered the theme relatively well.*
- ▶ *With the video I learned a lot more about love and how each person feels love due to the brain, and it explained very well what love is and the process that follows falling in love, and everything in this video was clearly explained in this video.*
- ▶ *Good video, very detailed and very good quality.*
- ▶ *The content is clear and easy to understand also would not consider science boring, quite the opposite!*
- ▶ *First of all it is an excellent video in which we can learn a bit more depth of our brain. - The explanation is perfect and understandable. It is interesting because it is something new...I learned a lot and it is great to know all that our brain handles.*
- ▶ *Incredible, fascinating, an informative video that helps me to appreciate the different aspects of our brain in what helps us to keep, operate, manage, establish, coordinate, evaluate the movements of our different organs of the body.*
- ▶ *I learned a lot more about love and how each person feels love ... because the brain and it explains well what love is. It was clear too how everything was explained in the video*

## ***Sugar Brain***

When invited to explain their ratings, Viewers of *Sugar Brain* consistently expressed interest in the video's topic and their appreciation for learning about the effects of fructose on the brain, which many indicated was new information for them. A few Viewers pointed out that the video presentation was clear and professional, with one praising the video for being *condensed* and another suggesting the use of text to help highlight the points explained. Their responses included:

- › *The topic is very interesting I learned a lot, did not know about fructose and how it affects the brain*
- › *The subject is very interesting because it investigates a product that we consume every day*
- › *The video was clear and easy to follow. The subject is interesting and the terms used are explained well so I had no problem understanding the scientific approach.*
- › *It is interesting for those who intend to stay healthy and prevent disease as well as for those who are not aware of the association between fructose and the effect on the brain, but it would be a little hard to follow topic for someone who has been familiar with many foods that contain fructose in the table and the amount/ dose that could be consumed without adverse effects.*
- › *The information is presented in a professional, clear and condensed form. Would share it with my friends.*
- › *I liked it because it made me reflect upon what I eat, it was clear that no medical terms was used. What it contains is interesting because it is our health and I learned something new because even though I had the idea I did not know exactly how much and in what form our memory was damaged.*
- › *I suggest adding some text to help highlight points explained*
- › *I may not like it because science is not my thing*
- › *All that relates to health interests me, especially because both parents have any issues regarding the brain (Parkinson's and senile dementia)*

## 2.2 How did Viewers respond to the scientists and science and health information featured in the videos?

Overall Viewers of all three videos strongly agreed that they enjoyed watching the featured scientist talk about his research and that the scientist was an effective communicator. Viewers also tended to agree that the information covered in the segment was relevant to their everyday life and that the video they watched increased their concern about or interest in the science or health content featured. They tended to be neutral about whether the amount of science presented in the video was too basic and whether the levels of scientific explanations were too advanced.

Viewers were asked to indicate their level of agreement with a series of items about the scientists featured in the videos as well as the science and health information presented, using a scale from 1.0 (strong disagree) to 7.0 (strongly agree), with 4.0 being neutral. As shown in the table below, although there were some differences of opinion as evidenced by the range of ratings in each case, generally speaking, the Viewers of all three videos strongly agreed that they enjoyed watching the scientist talk about his research (Mdn = 6.5) and that the scientist was an effective communicator (Mdn = 7.0). Viewers tended to agree that the information covered in the video was relevant to their everyday life (Mdn = 6.0) and that the video increased their concern about or interest in the science or health content presented (Mdn = 5.5 – 7.0 depending on video) They tended to be neutral about whether the amount of science covered was too basic (Mdn = 4.0) and the levels of scientific explanations were too advanced (Mdn = 4.0).

| Median Viewer ratings of <i>EarthSky en Español</i> videos (N=64)                                       |                          |                 |                          |                        |                       |                        |                        |
|---|--------------------------|-----------------|--------------------------|------------------------|-----------------------|------------------------|------------------------|
|   | Strongly Disagree<br>1.0 | Disagree<br>2.0 | Somewhat Disagree<br>3.0 | Neutral<br>4.0         | Somewhat agree<br>5.0 | Agree<br>6.0           | Strongly agree<br>7.0  |
| I enjoyed watching the scientist talk about his research  |                          |                 |                          |                        |                       | 6.5<br>(Range 4.0-7.0) |                        |
| I found the scientist to be an effective communicator   |                          |                 |                          |                        |                       |                        | 7.0<br>(Range 3.0-7.0) |
| The video featured too much science/was science heavy   |                          |                 |                          | 4.0<br>(Range 1.0-7.0) |                       |                        |                        |
| The scientific explanations provided in the segment were too basic                                      |                          |                 |                          | 4.0<br>(Range 1.0-7.0) |                       |                        |                        |
| The information covered in the video was relevant to my everyday life                                   |                          |                 |                          |                        |                       | 6.0<br>(Range 4.0-7.0) |                        |
| The video increased my concern about the effects of fructose on the brain<br>( <i>Sugar brain</i> only) |                          |                 |                          |                        |                       |                        | 7.0<br>(Range 2.0-7.0) |
| The video increased my interest in the science of the brain ( <i>Love Brain</i> only)                   |                          |                 |                          |                        |                       | 6.0<br>(Range 4.0-7.0) |                        |
| The video increased my concern about the effects of mosquito bites ( <i>Mosquitoes</i> only)            |                          |                 |                          |                        |                       | 5.5<br>(Range 1.0-7.0) |                        |

A Kruskal-Wallis  $H$  test showed that there were no statistically significant differences between the different Viewer groups for all of the ratings in the table except for the statement "*The information covered in the video was relevant to my everyday life.*"<sup>21</sup> Post hoc test using Mann-Whitney with Bonferroni correction indicated that Viewers of *Sugar Brain* more strongly agreed with the statement than did Viewers of *Love Brain* (Mdn = 7.0 vs. Mdn = 6.0).<sup>22</sup>

The following section presents the median ratings for each of the three videos and examples of Viewer explanations of their ratings, where provided.

### ***Mosquitoes***

Generally speaking, Viewers of *Mosquitoes* agreed that they enjoyed watching the featured scientist talk about his research (Mdn = 7.0) and that he was an effective communicator (Mdn = 7.0). Viewers also generally agreed that the information covered in the video was relevant to their everyday life (Mdn = 6.0) and that the video increased their concern about the effects of mosquito bites (Mdn = 5.5). They tended to be neutral or slightly disagree that the video featured too much science (Mdn = 3.5) or that the scientific explanations (Mdn = 3.5) were too basic.

When invited to explain their ratings, the *Mosquito* Viewers tended to explain that they found the science information well-balanced and easy to understand, and that they appreciated the practical information provided about preventing disease from mosquitos. A few claimed they previously knew the information provided in the video or said they found it somewhat basic or wanted more depth, but nevertheless most perceived the video to be a good resource. Finally several Viewers praised the scientist featured in the video, describing him as an effective explainer. A sampling of the Viewers' responses follow:

- ▶ *As distracted human beings, we need this type of information like this to react, to establish a better and healthy way of life for the environment, and the wellbeing of the community. This has led me to be more aware of a proliferation issues that can affect the health of myself and others around me.*
- ▶ *The video and explanation were very good.*
- ▶ *I'm already well aware of the negative effects; however I find it very useful for many people.*
- ▶ *The information was somewhat basic, more scientific vocabulary could help.*
- ▶ *Not everyone can understand the explanations.*
- ▶ *I think the video is owed to add more explanations and more content as it is very short and left me wanting to learn more; however, the scientist is very good at explaining*
- ▶ *The segment moderately increased my concern about bites. At present our pets (Canines) receive a monthly dose that protects against intestinal parasites and various other harmful insects when walking out of the house. I find it funny that we humans depend only cosmetics to get rid of the insects. So my family and I prefer winter.*
- ▶ *I think the video is owed to add more explanations and more content is very short and left me wanting to learn more. but the scientist is very good at explaining*
- ▶ *Sharing information about the dangers of mosquito bites is now very important for preventing the growth of dengue fever.*
- ▶ *Not too much science or science, is instructive. The explanations were precise and not too basic,, well explained*

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<sup>21</sup>  $\chi^2(2)=7.63, p=0.22$ .

<sup>22</sup> ( $U = 108, p=.007, r=.42$ ).

## **Love Brain**

Generally speaking, Viewers of *Love Brain* agreed that they enjoyed watching the featured scientist talk about his research (Mdn = 7.0) and that he was an effective communicator (Mdn = 7.0). Viewers also generally agreed that the information covered in the video was relevant to their everyday life (Mdn = 6.0) and that the video increased their interest in the science of the brain (Mdn = 6.0). They tended to be neutral or slightly disagree that video featured too much science (Mdn = 3.5) and be neutral about whether the scientific explanations were too basic (Mdn = 4.0). When *Love Brain* Viewers were asked to explain their ratings, those who elaborated typically responded that they liked the video and the balance of science information provided such that the science did not go overboard, yet provided adequate explanation. A few Viewers, however, indicated a preference for *more* science with one suggesting that the featured scientist could have been presented with more credibility if he was provided with an introduction or explanation of his official title. Others praised his clear and understandable presentation. A sampling of the Viewers' comments follows:

- ▶ *I think that understanding the cognitive development of scientific information is very important in my daily life.*
- ▶ *The scientist could have been presented a bit more credible if he had given an introduction or explained his title.*
- ▶ *I really liked the narration of the scientist because it was clear, precise and in understandable language for the general public.*
- ▶ *The science presented does not seem too much, but rather adequate, as scientific, basic explanations in perspective are easy to follow and increase interest.*
- ▶ *I am very interested in the video I want to know more about the brain and the world that investigates.*
- ▶ *Increased my interest in brain science as it is a very important organ in our body and vital information was obtained in the video, and I see the power of the brain to send commands.*

## **Sugar Brain**

Generally speaking, Viewers of *Sugar Brain* agreed that they enjoyed watching the featured scientist talk about his research (Mdn = 6.5) and that he was an effective communicator (Mdn = 6.0). Viewers also agreed that the information covered in the segment was relevant to their everyday life (Mdn = 7.0) and that the video increased their concern about the effects of fructose on the brain (Mdn = 7.0). They tended to be neutral about whether the video featured too much science (Mdn = 4.0) and slightly disagreed or were neutral that the scientific explanations were too basic (Mdn = 3.5). When invited to explain their ratings Viewers of *Sugar Brain* tended to focus on the importance and personal relevance of the information presented about fructose's effects on the brain, noting in all but a couple of cases that the findings were *revealing, striking, and/or concerning*. A sampling of Viewers' responses follow:

- ▶ *Really is a revealing study.*
- ▶ *The information covered in the segment was relevant to my daily life, I agree.*
- ▶ *It is an issue which I had already heard, so it was good to reinforce that knowledge, but did not increase my concern about it, because the effect reported in rats seemed to have not a drastic effect, since they still managed to complete the task, only in a longer time.*
- ▶ *I had heard about the negative effects of corn syrup, and this video convinced me even more.*
- ▶ *The scientific level of the video is very interesting, should be published for the whole community to see him because they are things that affect us in everyday life.*
- ▶ *It increased my concern as I did not know how bad it was, now I want to investigate more on this topic.*
- ▶ *As human beings we need striking distracted information like this to react, and to act for a better healthy lifestyle for the environment, our home and the welfare of the community. This has led me to be more aware of the proliferation of issues that may affect my health and those around me.*

## 2.3 How important was it to Viewers that future videos feature Hispanic scientists?

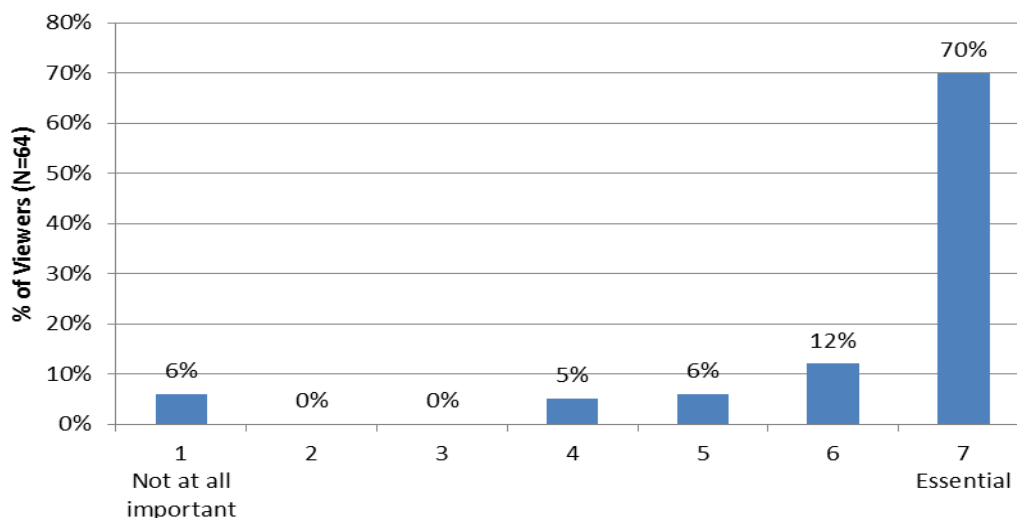
Viewers generally thought it was essential that future videos feature Hispanic scientists because they rarely have an opportunity to see Hispanic scientists in this role, adding that they find it *engaging*, a source of *pride*, and/or an aspect of viewing that adds *credibility* and/or *personal relevance* to the science content presented in the videos. Many Viewers made the point that they felt the inclusion of Hispanic scientists was important for inspiring Hispanics, and Hispanic youth in particular, as their inclusion may motivate youth to pay more attention to the health or science content mentioned in the videos, and to career opportunities that exist in STEM.

*Es muy importante pues mucha gente que requiere de estos conocimientos no habla inglés y no está consciente de muchos temas. El contribuir con divulgación de la ciencia en varios idiomas, entre ellos el español, uno de los más hablados en el mundo, es bueno para lograr llegar a grupos sociales que también tienen derecho a estar informados sobre actividades que mejoren su salud y calidad de vida.*

Viewers of all three videos were asked to reflect on the fact that the video they watched featured an Hispanic scientist's research, and to rate how important it was to them that future *EarthSky en Español* videos feature Hispanic scientists using a scale from 1.0 (not at all important) to 7.0 (essential).

Although there were some differences of opinion within the group as evidenced by the range of ratings, which ranged from a low of 1.0 to a high of 7.0, overall Viewers indicated it was essential (Mdn = 7.0). The chart below shows the distribution of ratings for the three groups combined.

How important Viewers felt it was that the videos featured Hispanic scientists (N=64)



The median ratings for each of three individual videos was also 7.0, and a Kruskal-Wallis H test showed that there were no statistically significant differences between the different Viewer groups.



When invited to explain their ratings, most Viewers chose to elaborate. The majority explained that it was important to them to see Hispanic scientists because they rarely have an opportunity to do so, adding that they find the experience *engaging*, a source of *pride*, and/or an aspect of viewing that adds *credibility* and/or *personal relevance* to the science content presented in the videos. Many Viewers made the point that they felt the inclusion of Hispanic scientists in the videos was important for inspiring Hispanics, and Hispanic youth in particular, as their inclusion may motivate youth to pay more attention to the health or science content mentioned in the videos, and to career opportunities that exist in STEM.

Some Viewers focused on the fact that the Hispanic scientists spoke Spanish in the *EarthSky en Español* videos, noting that the use of Spanish language is an important aspect of the videos because Spanish-speaking scientists can help popularize science in parts of the world that primarily speak Spanish and help engage potential viewers who would not otherwise watch or be exposed to the same videos in English, for example. Several Viewers focused on the Spanish language aspect of the videos without specifically mentioning the Hispanic scientists. These Viewers either noted that Spanish was their native and/or only language, so they were more likely to watch Spanish language videos, or indicated that they preferred watching native Spanish language speakers rather than having to listen to a video that had been dubbed from another language to Spanish.

Finally, a few Viewers indicated that they *didn't* find the use of Hispanic scientists to be an important feature in future videos either because the content or message of the video is what they tend to focus on or because they tend to be more focused on the person and how that scientist presents him/herself.

A sampling of the Viewers' comments follow below:

#### The inclusion of Hispanic scientists is important

- ▶ *It's a source of pride to hear a scientist speak in Spanish and also has more impact than listening to another non-Hispanic scientist speak of these issues as they always do.*
- ▶ *This information for the most part is more available in English-speaking countries, we need to bring this information to Latin American countries where these products are sold and people can use them in confidence. Science and technology not only developed in English-speaking countries, Spanish-speaking countries in very good science also develops and often is not taken into account*
- ▶ *It is important because many people who need this information do not speak English and are not aware of such issues. This contributes to the divulging of science in different languages, including Spanish, which is one of the most spoken in the world. It is also great because it can bring about different groups who are entitled to be informed about actions that can improve their health and quality of life.*
- ▶ *It is important that we have qualified scientists to help our people.*
- ▶ *In reality, the source of the scientist does not matter, but being Hispanic, he or she inspires many people who at times need a little motivation and inspiration.*
- ▶ *Aside from issues and necessities for good health, we have educated people interested in science itself, which act as role models for Hispanic children.*
- ▶ *It's essential, because if the scientists speaks Spanish well, Hispanic scientist could appeal more to the Latin American community and feel more established within the community, leaving people excited to see the videos.*
- ▶ *Unfortunately, since the Spanish speaking population seems less informed, these segments are of great importance and can be effective in schools. The well informed young generation would be able to guide their parents.*
- ▶ *In the case of people who do not understand English, it is helpful and useful to have Hispanic scientists, especially since most EarthSky videos are in English.*

- *In every investigation and presentation, I hear the names of European or American scientists highlighted, and occasionally some Indian or African, it needs to be known that all human beings are able to develop scientific skills.*
- *Hispanic scientists are primary in the establishment of the educational foundation of the community that knows only the language they share [Spanish]. In these videos, the population is educated without the burden of perusing books or scientific magazines or even a direct conversation with a scientist.*
- *It is necessary for all Hispanics to know there are Hispanic scientists that are doing these types of complex yet extraordinary investigations.*
- *I believe that Hispanic kids need to see people of their ethnic heritage have jobs like the ones presented.*
- *I am proud that a Hispanic scientist has made this study.*
- *The narrative made by Spanish speakers would make people understand more clearly the message, especially minors, who may be benefit the most from the information and at the same time be the best managers for the spread of it.*
- *Actually, no matter the source of the scientist, but being Hispanic, inspires a lot of people that sometimes need that push.*
- *Hispanic scientists are paramount in the educational foundation of the community known only language they share. In these videos they can educate the population without books or magazines, it's like a direct conversation with a scientist.*
- *It is essential for all Hispanics to know that Hispanic scientists are doing this kind of research that is very complex, yet extraordinary.*
- *It is one of the reasons why we must be informed Spanish speakers, and more in our own language, a thousand thanks for this nice scientific information, I feel completely satisfied. Hispanic children I think people need to see their ethnic group work like that.*
- *We need more examples of professionals in various fields, especially intellectuals.*

#### It is more a function of including Spanish language than a Hispanic scientist

- *It is very important to understand the explanations and to see the images simultaneously on any video and among everything in the case of educational videos. Having to read subtitles alone are boring, and in my case, I am capable of viewing if the theme interests me a lot.*
- *You just need someone to explain well and speak good Spanish.*
- *Because I do not understand English.*
- *This is my native tongue, so it is easier for me to understand.*
- *In your language that you understand*
- *I can read English and Spanish, so either language is perfect.*
- *My native language is Spanish*

#### The inclusion of Hispanic scientists is not important

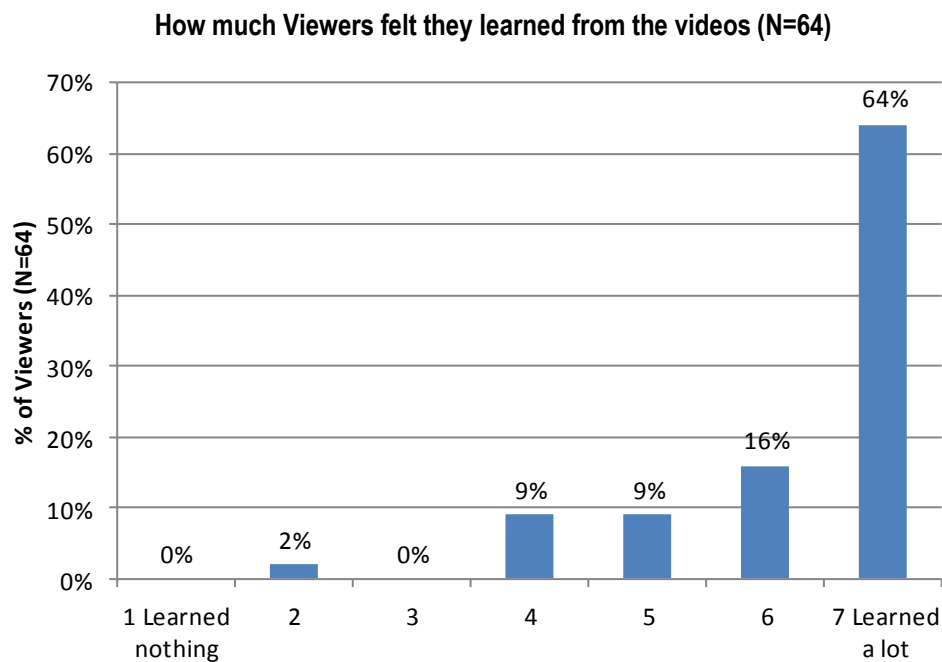
- *Although it was nice seeing Hispanic explaining information found in scientific research, it is not the bottom line for me. For me, it is important to find the answers to problems that man faces, and they don't necessarily need to be found by a Hispanic.*
- *I chose that nothing was important, because in reality, the important part is the content and the message that the video conveys, not the race of the person or scientist that discusses it. If you want to be politically correct, if you are Hispanic, you should offer videos available in Spanish.*
- *Race does not matter to me, it's the person and the way in which it is expressed.*

## 2.4 How much did Viewers feel they learned from the videos?

Viewers generally felt they learned a lot from watching the videos.

Viewers rated *EarthSky en Español* videos for the amount they felt they learned on a scale from 1.0 (learned nothing) to 7.0 (learned a lot). As noted in Section 2.1, although there were some differences of opinion within the group as evidenced by the range of ratings, which ranged from a low of 2.0 to a high of 7.0, overall Viewers across the three videos indicated they learned a considerable amount (Mdn = 7.0).

The chart below presents the distribution of ratings for the three Viewer groups combined.



The median values for *Sugar Brain* and *Mosquitoes* were also 7.0 for learning value, while the median rating for *Love Brain* was 6.0, although a Kruskal-Wallis *H* test showed that there was no statistically significant difference between the different Viewer groups.

## 2.5 What did Viewers identify as the videos' main messages and what else did they learn of interest?

The Viewers of *Love Brain* most often reflected that the main message was that the brain was responsible for love. Those who watched *Mosquitoes* pointed to the importance of protection against mosquitos or preventing mosquito reproduction. Viewers of *Sugar Brain* most often said that the main message was that fructose/sugar is bad for the brain and/or mental processing. When Viewers of each video were asked to share what else they learned of interest, they pointed to a variety of different issues.

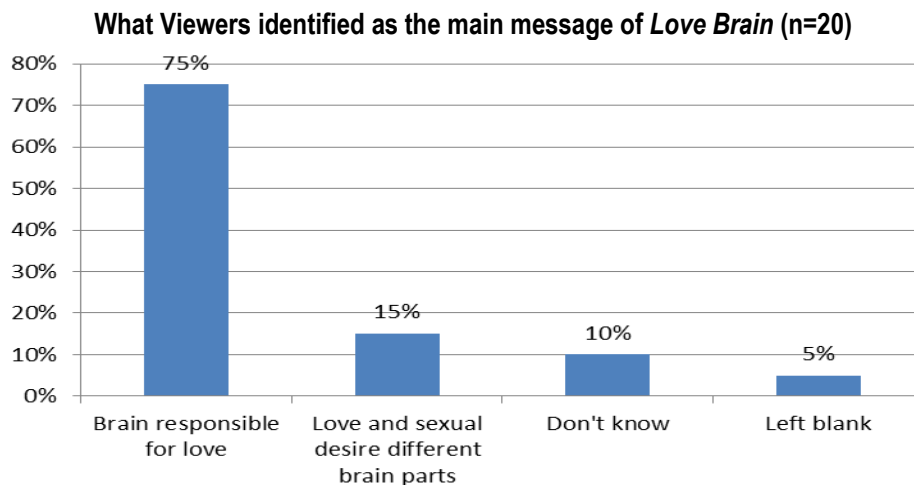
As the content for each video differed, the findings in this section are presented separately for each video.

### *Love Brain*

#### What Viewers identified as the main message

*Yo entendi que el cerebro es el que siente el amor. No es realmente el corazon como decimos, pero que el cerebro manda mensajes a todo el cuerpo, incluso el corazon. Por eso late mas rapido el corazon cuando besamos a alguien que amamos.*

Most of the Viewers of *Love Brain* (75%) explained that the main message of the video was that the brain is responsible for love, while almost one-fifth (15%) explained that the message was that love and sexual desire are triggered in different parts of the brain. One tenth (10%) responded they did not know what the main message was, while the remaining 5% left the result blank.



A sampling of the Viewers' responses follow:

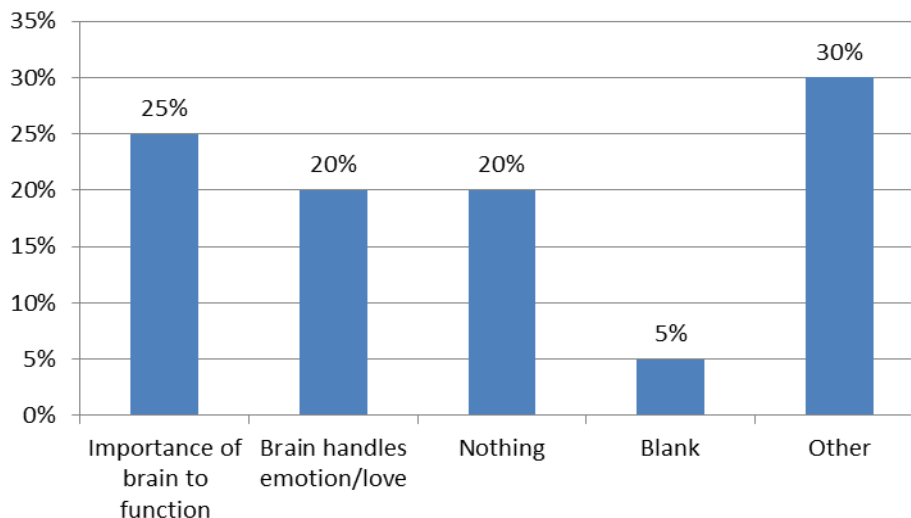
- ▶ *That emotions like love are in the brain not the heart.*
- ▶ *Contrary to what most people believe, this scientist found that the brain controls all physical and emotional feeling, including love.*
- ▶ *Sexual love is different than romantic love.*
- ▶ *A physiological explanation of love and its relationship with the brain, such as how it is the organ where emotion resides.*

## What else Viewers learned of interest

*Una explicación de la confusión existente en la sociedad de atribuir el sentimiento de amor al corazón cuando es el cerebro el que manda, y que se debe a que el cerebro, en primera instancia, ordena la secreción de hormonas que activan diferentes órganos, entre ellos el corazón, que es lo que las personas detectan; de ahí la confusión. También que amor y deseo sexual comparten su activación en una determinada parte del cerebro, pero en otras no. El mecanismo que activa el deseo sexual, más primario e inmediato, se asemeja a otras emociones que producen placer, como la comida, y es más fácil de posicionar y estudiar que el del amor, ya que este último tiene una parte cognitiva que tiene que ver con las experiencias vividas y aprendidas.*

When Viewers of *Love Brain* were asked to share what else they learned of interest, they pointed to a variety of different issues. One-fourth (25%) said they learned about the importance of the human brain for human functioning, while a fifth (20%) said they learned about how the brain handles emotion and love. Just under a third (30%) pointed to another topic, while a fifth (20%) stated they had learned nothing else of interest and 5% left the question blank.

**What else Viewers learned of interest from *Love Brain* (n=20)**



A sampling of the Viewers' responses follow:

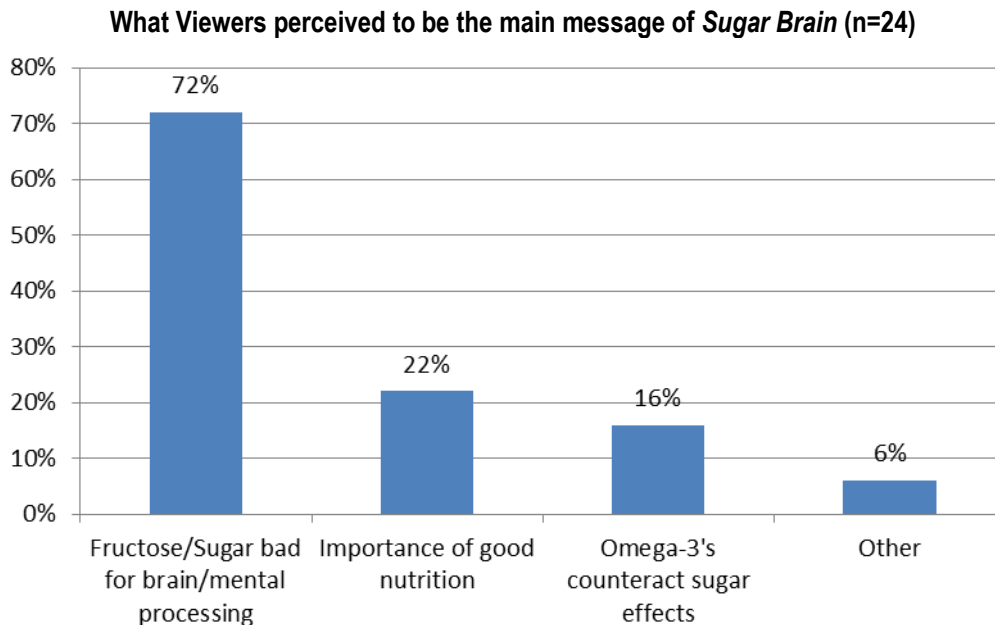
- ▶ *That love is one of the emotions that still needs to be studied more in depth.*
- ▶ *I had no clue about the different parts of the brain and its functions.*
- ▶ *The importance of the brain is its functions, its command, and the signaling of hormone release to increase heart rate.*
- ▶ *There is no difference between males and females where the sexual desire attraction stems from.*
- ▶ *I learned that it is the brain that transmits the signal when you fall in love and not the heart as I had understood. It is interesting how the brain handles the emotions of each individual.*
- ▶ *That sometimes one believes that love or other emotions come from the heart, yet science everyday demonstrates that it is not. These emotions come from the brain; however more research is needed on the brain, since these emotions stem and begin from our human brain.*

## Sugar Brain

### What Viewers identified as the main message

*Se debe consumir Omega-3 para contrarrestar los efectos del azucar en el cerebro.*

Most Viewers of *Sugar Brain* described the message of the videos in one of three ways. Nearly three-fourths (72%) of Viewers said the main message was that fructose/sugar is bad for the brain and/or mental processing, while just over one-fifth (22%) said the message more broadly focused on the importance of good nutrition. A smaller group (16%) took the message to be that Omega-3s counteract the effects of sugar, while the remaining 6% gave another response.



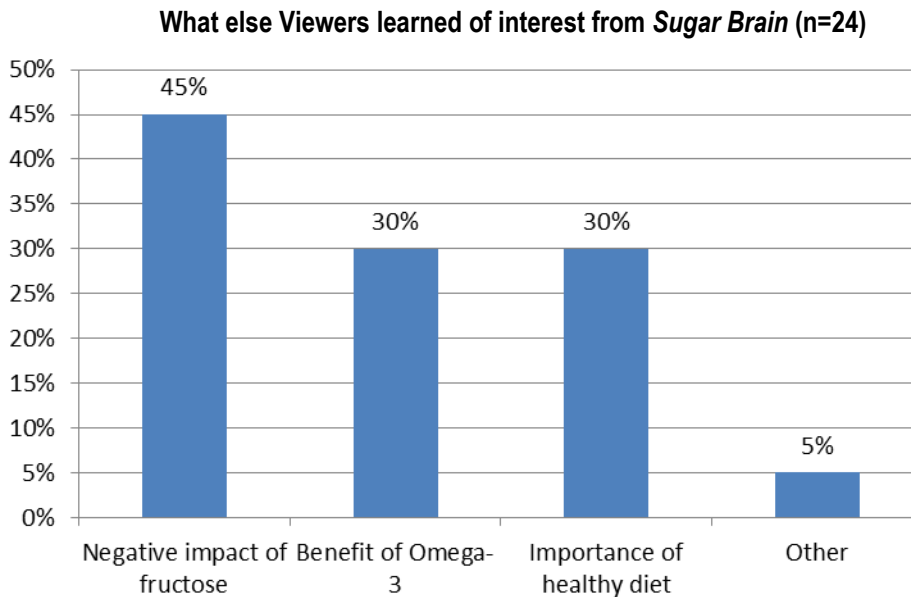
A sampling of the Viewers' responses follow:

- *Fructose and its effects on mental abilities.*
- *That fructose adversely affects the brain.*
- *The omega three fatty acids help memory.*
- *I have to pay attention to what I eat.*
- *The omega three fatty acids help memory.*
- *What to eat healthy and not eat many sugars.*

## What else Viewers learned of interest

*Desconocia el impacto sobre las neuronas cerebrales, pero si pude recordar una platica que escuche en television diciendo que los niños que desayunaban con algo dulce en se mantenian mas tiempo despiertos en el salon de clases.*

When Viewers of *Sugar Brain* were asked to share what else they learned of interest, nearly half (45%) of the Viewers pointed to the negative impact of fructose while less than a third (30%) mentioned the benefits of Omega-3s. Another near-third (30%) pointed to the importance of a healthy diet while the remaining 5% explained that they learned something other than the topics listed above.



A sampling of the Viewers' responses follow:

- ▶ *That Omega-3s helps retain memory and that some fish and nuts have Omega-3.*
- ▶ *That excessive consumption of sugar leads to other sicknesses, such as diabetes.*
- ▶ *Consume fatty acids like Omega-3, Omega-6 and Omega-9 that come from salmon, krill, and other sources.*
- ▶ *We are what we eat.*
- ▶ *That fatty acids like Omega-3 improve the health of the brain.*
- ▶ *Many consumer foods have corn syrup and many times we are not aware of this fact.*

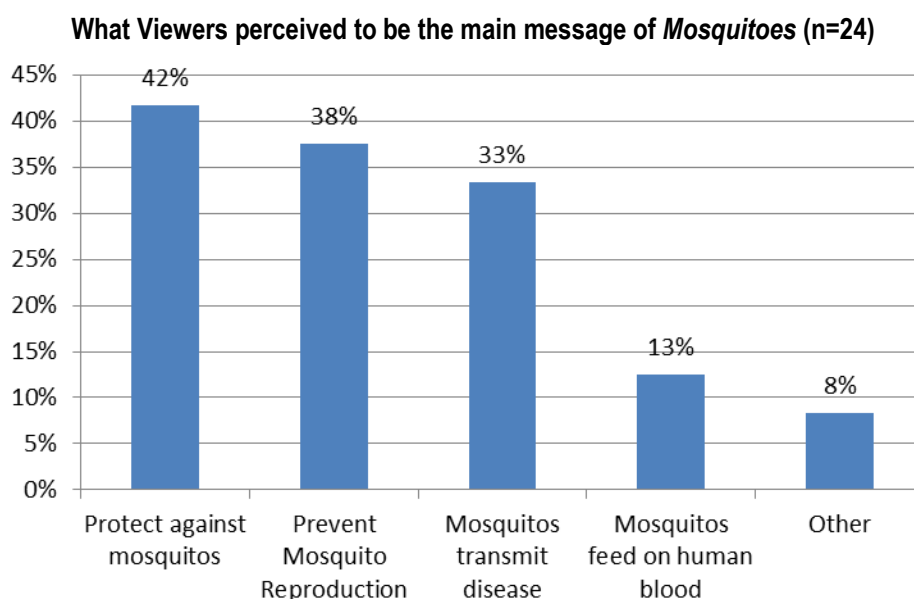


## Mosquitoes

### What Viewers identified as the main message

*El mensaje principal que tome de el video es que; los mosquitos son un tipo de insectos que tienen una gran diversidad y que se alimentan de la sangre de los humanos, y en casos son transmisores de enfermedades que pueden afectarnos, pero solo una pequena cantidad de la variedad de los mosquitos son los que pican, y solo las hembras.*

Most Viewers of *Mosquitoes* described the message of the videos in one of four ways. A little more than two-fifths (42%) of the group pointed to the importance of protection against mosquitos, while almost another two-fifths (38%) pointed to preventing mosquito reproduction. One-third (33%) focused on the ability of mosquitos to transmit disease while just over one-tenth answered that it's important to know that mosquitos feed on human blood (13%). Another 8% responded with an answer other than those listed above.



A sampling of the Viewers' responses follow below:

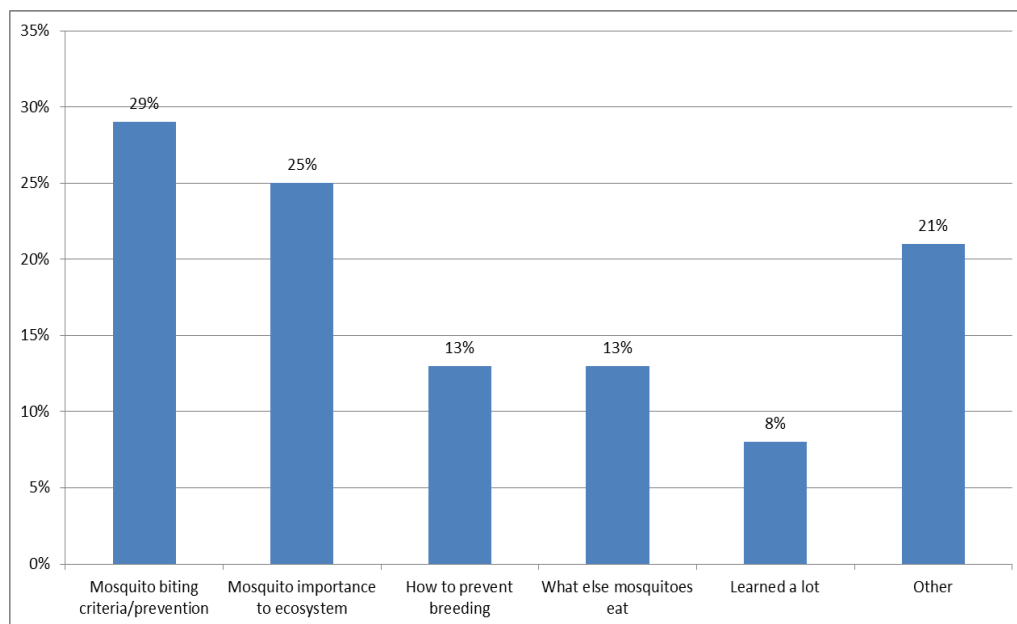
- ▶ *Mosquitoes survive by feeding on human blood, fruit and water.*
- ▶ *The message is intended to raise awareness about the diseases that can transmit through mosquito bites.*
- ▶ *Being aware of the act and consequences of mosquito to defend our health and prevent disease, and find ways to defend it acts as agent.*
- ▶ *If you are allergic to mosquitoes you should try not to drink alcohol, but also in places where mosquitoes abound.*
- ▶ *The main message I took from the video is that; Mosquitoes are a type of insect that have a great diversity and that feed on the blood of humans, and in some cases are transmitters of only diseases that can affect us, but only a small amount of the variety of mosquitoes are biting, and or single females.*

## What else Viewers learned of interest

*Bueno, por más que no nos guste, son parte del ecosistema, pero el tener la información clara y precisa como ustedes lo ponen, es una luz en medio de la oscuridad hablando de la calidad de programas que ofrece cualquier televisora.*

When Viewers of *Mosquitoes* were asked to share what else they learned of interest, nearly a third (29%) pointed to the prevention and understanding of what mosquitoes look for before biting. Exactly a fourth (25%) were interested in the importance of mosquitoes to the ecosystem, while more than a tenth each (13%) pointed to either how to prevent mosquitoes breeding or to the fact that mosquitoes eat items other than human blood. Just under a tenth (8%) explained that they had learned a lot, while the remaining near-fifth (21%) focused on a topic other than those listed above.

What else Viewers learned of interest from *Mosquitoes* (n=24)



A sampling of the Viewers' responses follow:

- ▶ *My blood type is O and now I know why mosquitoes bite me but not others around me.*
- ▶ *It taught how to prevent disease.*
- ▶ *The order and cleanliness of the environment is necessary for a healthy and well-lived life.*
- ▶ *The scientific process, alongside the simple and logic way of living with science for the wellbeing of our lives.*
- ▶ *That not all mosquitoes bite, and as there are thousands of species, only a small amount of mosquitoes need to chew. They also enjoy the nectar and other food sources other than human blood.*

## 2.6 What was the impact of the *Mosquitoes* video on Viewers' knowledge of mosquitoes as compared to Control participants?

Viewers significantly outperformed Control group participants on a content quiz designed to evaluate the impact of the *Mosquitoes* video on Viewers' knowledge of mosquitoes. Out of a total possible score of 15, the Viewer group averaged 12 correct responses, while the Control group averaged 6 correct responses. The resulting effect size was considered a very large effect.

### Group comparability

As noted under Methods, the evaluation gathered feedback from a total of 113 *EarthSky en Español* homepage and Facebook visitors. To explore the potential impact of the *Mosquitoes* video on Viewers' knowledge of the main content covered, the evaluation team first addressed the unbalanced group sizes by randomly selecting an equal number of Control group participants to match the *Mosquitoes* Viewer group, stratified by gender, age, and education. This yielded 24 participants per group in order to compare findings for the content "quiz" questions.

The table to the right summarizes the demographic and background information for the final group of participants in both groups. Chi-square analyses confirmed that the two groups did not differ significantly with respect to the measured variables with the exception of country of residence.<sup>23</sup>

As noted under Methods, the analysis of the content assessment items looked for significant differences between the Viewer and Control groups with respect to any information gains acquired from the video.

| Sample demographic/background information                  |                       |                   |   |
|--|-----------------------|-------------------|---|
| Demographic/<br>background factor                          | Categories            | Control<br>(n=24) | Viewers<br>( <i>Mosquitoes</i> )<br>n=24) |
| <b>Gender</b>  | Female                | 29%               | 29%                                       |
|  | Male                  | 71%               | 71%                                       |
| <b>Age group</b>   | 41 and younger        | 50%               | 50%                                       |
|  | 42 and older          | 50%               | 50%                                       |
| <b>Highest level of education</b>                          | High school or less   | 21%               | 21%                                       |
|  | College education     | 58%               | 58%                                       |
|  | Graduate education    | 21%               | 21%                                       |
| <b>Country of residence</b>                                | U.S.                  | 46%               | 83%                                       |
|  | Other countries       | 54%               | 17%                                       |
| <b>Occupational status</b>                                 | Employed              | 58%               | 58%                                       |
|  | Homemaker             | 4%                | 4%  |
|  | Retired               | 17%               | 17%                                       |
|  | Unemployed            | 4%                | 4%  |
|  | Student               | 12%               | 12%                                       |
|  | Homeschooler          | 4%                | 4%  |
| <b>Interest in science topics</b>                          | Very interested       | 58%               | 62%                                       |
|  | Moderately interested | 33%               | 37%                                       |
|  | A little interested   | 8%                | 0%  |
|  | Not interested        | 0%                | 0%  |
| <b>Frequency of looking for science information online</b> | Regularly             | 37%               | 63%                                       |
|  | Occasionally          | 42%               | 33%                                       |
|  | Seldom                | 12%               | 4%  |
|  | Never                 | 0%                | 0%  |
|  | Blank                 | 8%                | 0%  |

<sup>23</sup> A 2x2 chi-square test indicated that the relationship between group and country of residence was significant,  $\chi^2 (1, N=48)=7.38, p=.007$ .

## Overall findings

The Viewer group significantly outperformed the Control group on the content quiz that focused on the following three topics: mosquitoes' dietary habits and value to the ecosystem, the effects of mosquito bites, and methods for preventing mosquito bites. Out of a total possible score of 15, Viewers averaged 12 correct responses while Control participants averaged 6 correct responses.<sup>24</sup> The effect size in this case was considered a very large effect ( $d=2.09$ ).

## Item results

The table below shows, for each group, the percentage of participants that correctly answered the true/false and multiple choice questions.<sup>25</sup>

| Percentage of correct answers to true/false and multiple choice questions about content from <i>Mosquitoes</i> video |  |               |
|--|--|---------------|
| Control (n=24)   |  | Viewer (n=24) |
| <b>True/false questions</b>  |  |               |
| 25%  | The U.S. Centers for Disease Control recommends repellants containing DEET, picaridin, and oil of eucalyptus (T)   | 88%           |
| 87%  | Mosquito saliva can carry the human diseases yellow fever, dengue fever, and encephalitis (T)  | 96%           |
| 58%  | Mosquitoes are hazardous and add nothing of value to the ecosystem (F)   | 79%           |
| 38%  | Most mosquitoes must feed on blood to survive (F)  | 75%           |
| <b>Multiple choice questions</b>   |  |               |
| 4%   | What factors might make one person a more attractive target to mosquitos than another person? Please click on all that apply. (Correct options: drinking alcohol, having a certain blood type being pregnant, Incorrect option: none of the above) | 67%           |

Looking across the five questions listed in the table, overall, the average percentage difference between the Viewer and Control groups was 38%. On the individual questions, the percentage differences ranged from a low of 9% to a high of 63%, as follows:

- For the question *Mosquito saliva can carry the human diseases yellow fever, dengue fever, and encephalitis* most of the participants in each group correctly answered this to be true (87% Control group, 96% Viewer group).
- For the question *The U.S. Centers for Disease Control recommends repellants containing DEET, picaridin, and oil of eucalyptus*, almost all of the Viewing group (88%) answered this to be true compared to a quarter of the Control group (25%).
- For the question *What factors might make one person a more attractive target to mosquitos than another person* more than two-thirds (67%) of the Viewing group correctly answered all of the above (drinking

<sup>24</sup>  $t(46)=7.24, p<.001, 95\% CI [4.15, 7.35], d=2.09, [1.39, 2.79]$

<sup>25</sup> Each T/F question earned a total possible score of 1.5 and the multiple choice question earned a total of 2 points.

alcohol, having a certain blood type and being pregnant compared to a small number of Control group participants (4%)

In addition to the 5 true/false and multiple choice questions presented in the preceding table, both Viewer and Control group participants were asked to answer 2 open-ended questions relating to mosquito bites and prevention. These findings are summarized below.

**What causes the itchy red bump when a mosquito bites**

Both Viewer and Control group participants were asked to answer the following question: *What causes the itchy red bump you get when a mosquito bites you?*<sup>26</sup> The table to the right shows a breakdown of the answers the two groups provided. Where more than two-thirds (67%) of Control participants indicated they didn't know the answer to this question, more than four-fifths (83%) of Viewers offered an answer that was at least partially correct. Specifically:

- One-quarter (25%) of Viewers and none of the Control participants fully answered that the bump is due to a reaction of the immune system to saliva.
- One-quarter (25%) of Viewers and one-fifth (21%) of Control participants gave a less complete answer that either included mention of saliva acting as an anticoagulant or that there is an immune system reaction, but didn't put these two aspects together.
- Finally, one-third (33%) of Viewers and one-tenth (12%) of Control participants just mentioned the word saliva without elaborating.

| Viewer and Control group responses to the question: <i>What causes the itchy red bump when mosquitoes bite?</i> |  |               |
|---|--|---------------|
| Control (n=24)  | Response mentioned                                     | Viewer (n=24) |
| 0%  | Reaction of immune system to saliva.                   | 25%           |
| 21%   | Saliva acts as anticoagulant or immune system reaction | 25%           |
| 12%   | Saliva only  | 33%           |
| 67%   | Don't know   | 17%           |

**Most effective action to keep down mosquito population**

Both Viewer and Control group participants were asked to answer the following two-part question:

- a) *What is the most effective action you can take around your home/property to keep mosquito populations down?*
- b) *Why this is effective?*<sup>27</sup>

The table to the right shows the answers the participants most frequently listed. All of the Viewers (100%) and just over half (54%) of the Control participants correctly answered that the most effective action was to dump out standing water around the home. When asked to explain why this action was effective nearly four-fifths (88%) of Viewers compared to half (50%) of Control participants correctly identified that mosquitoes lay eggs or breed in standing water.

| Viewer and Control group responses to the question: <i>What is the most effective action you can take around your home/property to keep mosquito populations down?</i> |                                     |               |
|--|-------------------------------------|---------------|
| Control (n=24)   | Most effective action               | Viewer (n=24) |
| 54%  | Dump out standing water around home | 100%          |
| Why effective  |                                     |               |
| 50%  | Mosquitoes lay eggs/breed           | 88%           |

<sup>26</sup> This question earned a total possible score of 3. Mentioning saliva only earned 1 point, mentioning either saliva acts as an anticoagulant or immune system reaction earned 2 points, and mentioning reaction of immune system to saliva earned 3 points.

<sup>27</sup> This question earned a total possible score of 4 points, 2 points per section.

## 2.7 To what extent were Viewers interested in learning more about information featured in the videos and felt they were likely to seek this information out?

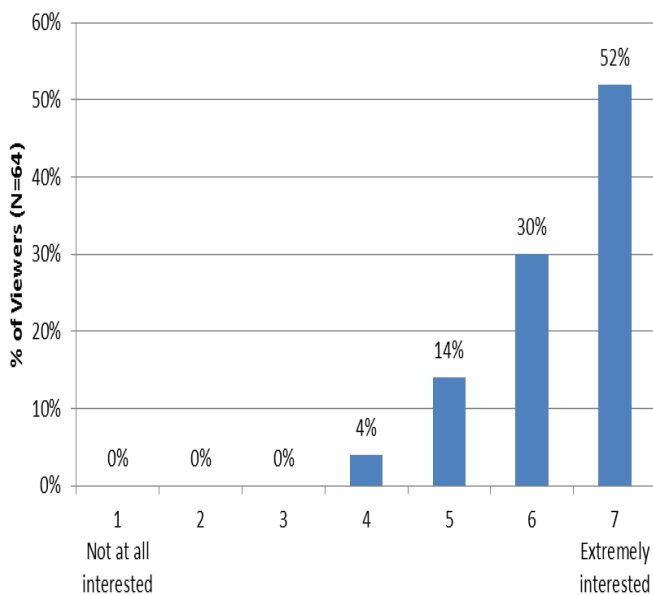
Viewers of all three videos generally indicated that they were extremely interested in learning more about the featured topics and that they were most likely to seek this information out within the next week.

To explore the motivational impact of viewing the videos, Viewers of the three videos were asked to rate:

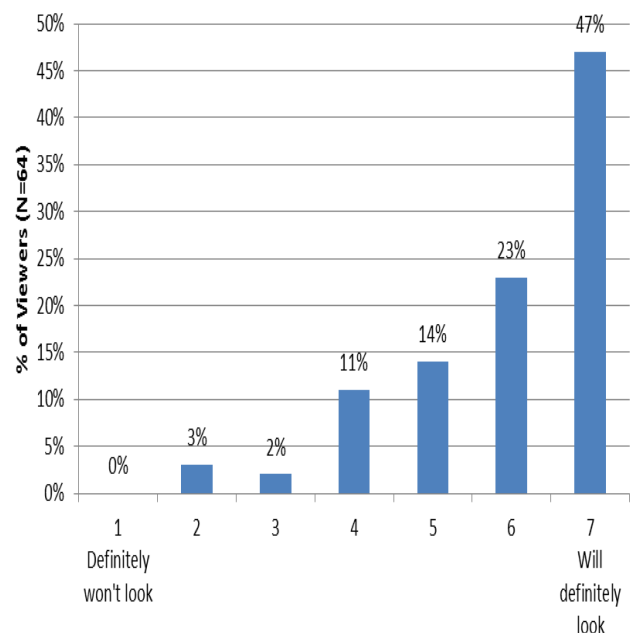
- Their level of interest in learning more about the topics/information presented using a scale from 1.0 (not at all interested) to 7.0 (extremely interested); and
- The likelihood that they would seek out this information within the next week using a scale from 1.0 (definitely won't) to 7.0 (definitely will).

Across the three videos, Viewers generally indicated they were extremely interested in learning more about the featured topics (Mdn = 7.0) and that they would most likely seek out the information within the next week (Mdn = 6.0).<sup>28</sup> A Kruskal-Wallis  $H$  test showed that there were no statistically significant differences between the different Viewer groups for either of these two ratings.

Viewers' interest in learning more about featured topics (n=24)



Viewers' likelihood of following up on information (n=24)



<sup>28</sup> The ratings ranged from 4.0-7.0 and 2.0-7.0 respectively.

With respect to each individual video:

- Viewers of *Sugar Brain* generally indicated they were extremely interested in learning more about the featured content (Mdn = 7.0) and would definitely seek out the information in the next week (Mdn = 7.0).<sup>29</sup>
- Viewers of *Mosquitoes* generally indicated they were also extremely interested in learning more about the featured content (Mdn = 7.0) and would most likely seek out the information in the next week (Mdn = 6.0).<sup>30</sup>
- Viewers of *Love Brain* generally indicated they were very interested in learning more about the featured content (Mdn = 6.0) and would most likely seek out the information in the next week (Mdn = 6.0).<sup>31</sup>

## 2.8 Did Viewers share additional feedback on the videos?

**When given the opportunity to provide additional feedback on the *EarthSky en Español* videos, Viewers tended to: (i) describe actions they felt motivated to do as a result of viewing, (ii) reflect on the content as being personally relevant, (iii) praise the videos as being clear and engaging, or (iv) point to a desire for additional information or depth of information in the videos.**

Finally, when Viewers were invited to share anything else about the videos that came to mind, about half chose to comment. Their comments tended to fall under one of four themes as several Viewers each: (i) described actions they felt motivated to do as a result of viewing, (ii) reflected on the content as being personally relevant, (iii) praised the videos as being clear and engaging, or (iv) pointed to a desire for additional information or depth of information in the videos. Examples of their comments in each area follow below.

### Felt motivated to take some action as a result of viewing

- ▶ *I am a teacher and mother and I am keen to see more scientific information on TV channels in Spanish.*
- ▶ *I'll be cutting down my daily sugar consumption thanks to this video.*
- ▶ *I will make an effort to look for my work without delay.*
- ▶ *Gave me concerns that lead me to further investigate these issues, and apply and learn every day more valuable information.*

### Found content/presentation personally relevant

- ▶ *This type of information is important in determining the health of our children*
- ▶ *Very educational for our health and our families*
- ▶ *I found very good and interesting video in general, the theme is consistent with the concerns that I have about health and the food we eat.*
- ▶ *The management of pictures put into perspective the theme and makes you feel that something is really happening and is part of your everyday life. Very good!*
- ▶ *The videos talk about everyday issues and show the scientific form of something we live every day.*

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<sup>29</sup> The ratings ranged from 4.0-7.0 in each case.

<sup>30</sup> The ratings ranged from 4.0-7.0 and 2.0-7.0 respectively.

<sup>31</sup> The ratings ranged from 5.0-7.0 and 2.0-7.0 respectively.



#### Found presentation clear and/or engaging

- › *The video is something that enters the mind and makes us become interested and want to share the information just learned, excellent video.*
- › *It is quite clear and easy to understand.*
- › *very clear what happens with hormonal release for a person who is not understood in the art.*
- › *It was very easy to understand and grasp the interest from the start.*

#### Desired additional information/depth of content

- › *The video is good, but I would like to have more information.*
- › *I suggest include links to find more information*
- › *I personally wanted some numbers or numeral form of information to make it look more scientific for me.*

#### Other

- › *Encourage the publication of more articles with science developed in Spanish-speaking countries*
- › *I liked seeing the ethnic diversity in actors: Latin or Hispanic many we forget that we come from different backgrounds.*

## Conclusions

As part of the *EarthSky en Español* NSF award, Knight Williams Inc. conducted an exploratory study of the appeal, clarity, learning value, and motivational impact of three short format STEM videos that aired within a one month period on *Detras del Saber* and appeared in posts featured on the *EarthSky en Español* homepage and Facebook Page.

During the evaluation period, a total of 113 adults who were visiting the *EarthSky en Español* homepage and Facebook Page on their own accord agreed to participate in the evaluation. These participants were randomly assigned to receive one of three Viewer surveys, which featured questions about the *Mosquitoes*, *Love Brain*, or *Sugar Brain* videos, respectively, or a Control survey that included objective content assessment questions asked in the Viewer surveys and additional questions about the participants' use of Facebook and the *EarthSky en Español* Facebook Page.

Both Viewer (N=64) and Control (N=49) groups included: a higher proportion of males than females, individuals representing a wide range of ages (18-80 years) with a mean age of 40 and 38, respectively, and a mix of participants who resided in the U.S and other countries, with the Viewer group having a higher percentage of U.S. based participants. Both groups also had a majority of participants who were employed and at least college educated. Finally, both groups included a majority of participants who had experience viewing *Detras del Saber*, were very or moderately interested in science topics, and who looked for science information online occasionally or regularly.

### **Participants' use of the *EarthSky en Español* Facebook Page**

In lieu of watching videos, Control participants were asked several questions about their experience with the *EarthSky en Español* Facebook Page to provide the *EarthSky* team with insight about the nature and frequency of the *EarthSky en Español* website and Facebook visitors' use of the Facebook Page. This Control group of visitors did not differ significantly from the Viewer group with respect to the background and demographic factors measured, with the exception of country of residence wherein a higher percentage of Control participants compared to Viewing participants were from outside the U.S. (59% vs. 23%).

### **Activity engaged in prior to seeing survey link**

When the Control participants were asked what they were doing prior to seeing the survey link, more than half said that they were looking up information on the *EarthSky en Español* website or Facebook Page about a subject or topic of interest, while less than a sixth were looking for *new* or *newsworthy* things. Smaller groups said they were checking email, left the question blank, or responded with an answer other than those above.

### **Use of Facebook and *EarthSky en Español* Facebook Page**

Three-quarters of the Control participants indicated they were frequent Facebook users, and two-fifths indicated they visited the *EarthSky en Español* Facebook Page at least weekly. Approximately half the participants said they regularly or occasionally talked with friends or family members about something they noticed on the *EarthSky en Español* Facebook Page. Similarly, about half said they followed up on information presented on the Facebook Page, most often information about the solar system or NASA, or they said they used a search engine to find more information about topics of interest.

### **Opinion of *EarthSky en Español* Facebook Page as a source of science**

Those who had visited the *EarthSky en Español* Facebook Page were asked if they felt it was a good source for learning about science. All but one participant said they felt it was. When invited to explain their answers,

participants most often pointed to the page being *credible* and *trustworthy* and a source of *interesting* content. Many also liked that the page featured *practical and relevant* information or that it featured a *variety* of topics. Smaller groups liked that the page allowed for quick study, liked that it was current and timely, and/or thought it had an engaging presentation of topics.

### **Most appealing aspects of EarthSky en Español Facebook Page**

When asked to describe the most appealing aspect of the *EarthSky en Español* Facebook Page, participants most often pointed to the photos posted on the page, the interesting topics covered, and/or the engaging videos and/or articles featured. A smaller group found the comments interesting.

When participants who had visited the Facebook Page were asked if they had any suggestions for improving the page, most indicated they had none. A few visitors asked that the page include more resource links so they could explore additional information or suggested more advertising of the Facebook Page through different mediums to target a greater audience.

## **Summary of findings**

This section summarizes the findings on the overall appeal, clarity, personal relevance, and learning value of the *EarthSky en Español* videos as determined by the Viewers and, in some instances, Control group participants' responses on the questionnaires completed for the evaluation.

### **2.1 How did Viewers rate the videos in terms of overall appeal, content interest, clarity, and personal learning value?**

Viewers generally liked the videos and thought they featured interesting content and were clear/easy to follow. Overall, Viewers also indicated they learned a lot from watching the videos. There were no statistically significant differences between the different Viewer groups for these ratings.

### **2.2 How did Viewers respond to the scientists, science, and health information featured in the videos?**

Overall, Viewers of all three videos strongly agreed that they enjoyed watching the featured scientists talk about their research and that the scientists were effective communicators. They tended to be neutral about whether the amount of science presented in the video was too basic and whether the levels of scientific explanations were too advanced. The Viewers also tended to agree that the information covered in the segment was relevant to their everyday life and that the video they watched increased their concern about or interest in the science or health content featured. There were no statistically significant differences between the Viewer groups for these ratings, with the exception of the statement that the information covered in the video was relevant to their everyday life. In this case, Viewers of *Sugar Brain* more strongly agreed with the statement than did Viewers of *Love Brain* (Mdn = 7.0 vs. 6.0).

### **2.3 How important was it to Viewers that future videos feature Hispanic scientists?**

Viewers generally thought it was essential that future videos feature Hispanic scientists and there were no statistically significant differences between the Viewer groups on this item. When asked to explain, Viewers most often observed that they rarely have an opportunity to see Hispanic scientists in this role, adding that they find it *engaging*, a source of *pride*, and/or an aspect of viewing that adds *credibility* and/or *personal relevance* to the science content presented in the videos. Many Viewers made the point that they felt the inclusion of Hispanic scientists was important for inspiring Hispanics, and Hispanic youth in particular, as their inclusion may motivate youth to pay more attention to the health or science content mentioned in the videos, and to career opportunities that exist in STEM.

## **2.4 How much did Viewers feel they learned from the videos?**

Viewers of all three videos generally felt they learned a lot from watching the videos. There were no statistically significant differences between the Viewer groups for this rating.

## **2.5 What did Viewers identify as the videos' main messages and what else did they learn of interest?**

Viewers of *Love Brain* most often reflected that the main message they took away was that the brain was responsible for love. Those who watched *Mosquitoes* pointed to the importance of protection against mosquitos or preventing mosquito reproduction. Viewers of *Sugar Brain* most often said that the main message was that fructose/sugar is bad for the brain/mental processing. When Viewers of each video were asked to share what else they learned of interest, they pointed to a variety of topics in each case.

## **2.6 What was the impact of the *Mosquitoes* video on Viewers' knowledge of mosquitoes as compared to Control participants?**

Viewers significantly outperformed Control group participants on a content quiz designed to evaluate the impact of the *Mosquitoes* video on Viewers' knowledge of mosquitoes. Out of a total possible score of 15, the Viewer group averaged 12 correct responses, while the Control group averaged 6 correct responses. The resulting effect size was considered a very large effect.

## **2.7 To what extent were Viewers interested in learning more about information featured in the videos and felt they were likely to seek this information out?**

Viewers of all three videos generally indicated that they were extremely interested in learning more about the featured topics and that they were most likely to seek this information out within the next week. There were no statistically significant differences between the different Viewer groups for these ratings.

## **2.8 Did Viewers share additional feedback on the videos?**

When given the opportunity to provide additional feedback on the *EarthSky en Español* videos, Viewers tended to describe actions they felt motivated to do as a result of viewing, reflect on the content as being personally relevant, praise the videos as being *clear* and/or *engaging*, or point to a desire for additional information or depth of information in the videos.

## **Discussion**

Taken together, the evaluation findings indicate that the short format videos were very successful in achieving the project's goals with respect to appeal, clarity, learning value, personal relevance, and motivational impact among the *EarthSky en Español* online visitors who chose to participate in the evaluation. This final section highlights key findings relating to the impact of the videos and the role that the Facebook and television viewing contexts, respectively, played in the evaluation, as well as limitations of the evaluation that point to areas for future research and analysis.

### ***Findings relating to the impact of the videos***

- From the vantage point of the evaluation participants, the project team effectively met the challenge of presenting engaging information in the short format videos. Viewers consistently enjoyed the *EarthSky en Español* videos, and praised them for being *direct*, *coherent*, and *personally relevant*, and for providing *new* information and *interesting* content.
- Viewers of all three videos also generally indicated that they were extremely interested in learning more about the featured topics and that they were mostly likely to seek out additional information within a week's time. It is

important to bear in mind though that more than half of the evaluation participants (52%) reported that just prior to seeing the survey link they were looking up information on a subject or topic, while another sixth (15%) were looking for *new* or *newsworthy* things. Additional research would be needed to determine if the surveyed participants were generally more curious or interested in conducting research than the typical audience for the *EarthSky en Español* videos.

- Overall, Viewers indicated they greatly appreciated the presence of Hispanic scientists in the videos. Viewers of all three videos strongly agreed that the scientists were effective communicators and that they enjoyed watching the featured scientists talk about their work. Since the evaluation only focused on three scientist videos, however, it would be important to evaluate a larger sample of videos to determine if the scientists from other *EarthSky en Español* short videos were perceived to be equally engaging and effective.
- The majority of Viewers also considered it *essential* that future videos feature Hispanic scientists, explaining that they rarely have an opportunity to see Hispanic scientists in this role, and that they found it *engaging*, a source of *pride*, and/or that it added *credibility* and/or *personal relevance* to the science content presented in the videos. Meanwhile, several Viewers commented on the Spanish language aspect of the videos without specifically mentioning the Hispanic scientists. Future evaluations might more fully assess the value of featuring a Hispanic scientist in comparison with a Spanish-language narrator or host, for example.
- Viewers consistently reflected that they learned a considerable amount from the videos and that the information presented was generally of interest, indicating that, as a group, they were aware of the videos' informal educational value. In the case of the *Mosquitoes* video, the evaluation further showed impact with respect to content learning. Viewer and Control group responses to open-ended and forced-choice objective content-based assessment questions revealed that the Viewer group significantly outperformed the Control group on all areas of content questions, including: mosquitoes' dietary habits and value to the ecosystem, the effects of mosquito bites, and methods for preventing mosquito bites. Out of a total possible score of 15, Viewers averaged 12 correct responses while Control participants averaged 6 correct responses. The effect size in this case was considered a very large effect.

In considering these findings, it is also important to reflect on the evaluation approach used in Study 2 and the inherent limitations of the study design.

- One limitation of the study design is that it used a self-selected recruitment procedure. As the evaluation team did not have access to a full list of the *EarthSky en Español* website and Facebook visitors or *Detras del Saber* viewer contacts, there is a possibility that there may be systematic and unknown differences between those who responded to the survey and those who did not. The evaluation did, however, recruit directly from among *EarthSky en Español* website and Facebook visitors while they were visiting these online media. These participants then completed the survey while visiting the media, as opposed to responding to an invitation via email or some other method of solicitation while they were engaging in an activity unrelated to *EarthSky's* online media.
- Another limitation is that the evaluation focused on Viewers' experiences with short format videos that were viewed independent of the context in which the videos were intended to be shown – that is, either aired as part of a *Detras del Saber* half-hour television program or viewed online on the *EarthSky en Español* website or Facebook Page. The experience of Viewers watching the videos in the evaluation context - watching a single video on Vimeo - is presumably closest to that experienced by visitors to the *EarthSky en Español* website or Facebook Page, where the videos were, for the most part, available for viewing by clicking on the videos, with minimal surrounding text introduction or media support. The

experience of watching the videos embedded within the context of the 30-minute television program *Detras del Saber*, meanwhile, introduces additional context factors that would almost certainly create a more complex viewing experience.

- Some consideration of the context in which the Viewers experienced the videos is also important for interpreting the learning impacts demonstrated in the study. Given the evaluation's focused and directed viewing context, it is possible that viewers watching the videos on Vimeo would have an easier time recalling the video content than would viewers watching the same videos in the intended context, either on the *EarthSky en Español* website or Facebook Page, or as part of a longer 30-minute *Detras del Saber* television program. On the other hand, it is also conceivable that viewers watching the videos embedded in the television program may recall comparatively more, if, for example, the program covered the same topic as the featured *EarthSky* video, or if the information was repeated or reinforced in some way. Each video's placement within a given *Detras del Saber* episode was at the discretion of the programming staff, so the *EarthSky* and evaluation teams did not play a role in deciding where and how the videos appeared. Future evaluations might look more closely at these variations in context and how they facilitate or impede learning of the featured content.
- Given the evaluation approach used in Study 2, it is also important to note that the evaluation team was unable to gather information about the viewing behaviors exhibited by "actual" viewers who watched the videos on the *Detras del Saber* program or through the *EarthSky en Español*'s website or Facebook page. It is not known, for example, whether these viewers typically viewed the videos all the way through, and/or whether they were multi-tasking and, for example, engaged in other online social media activities.

Understanding the complexities of short format video viewing behavior online will likely become increasingly important in the future. In a 2012 [article](#), Marketing Pilgrim assessed video's role in the online media landscape as follows:

*The rise in video ad spending is certainly being spurred on by the rise in video consumption. Recent numbers from comScore show that 182 million U.S. Internet users watched an average of 23.2 hours of video content per viewer in December.*

Similarly a paper from Krishnan and Sitaraman (2013) reported that more than half of the consumer traffic on the Internet today is related to videos, and that video content is expected to constitute about 85% of consumer Internet traffic by 2016, tripling the levels recorded in 2011. The authors also examined the effectiveness of video ads through the metric of ad completion rates, which may be one of many factors important to consider in understanding viewers' experiences with and opinions of online videos. Future research on the *EarthSky en Español* audiences' video viewing habits could help the *EarthSky* team to help determine if the length of the current short format videos is ideal for television and/or online distribution. The findings could also have implications for similar short format videos produced by other content creators.

- Finally, the development and implementation of the short format *EarthSky en Español* videos were not informed by any particular theoretical framework of multimedia or informal science learning, which would be useful for informing the design of future projects and evaluations. However, the project team did draw on prior work in the field. Early in the grant period, for example, the project team located few studies on the use of short format videos in informal science education settings but did find relevant studies in formal education settings. A study by Fisch (2004), for example, showed that the use of video in math applications increased student enjoyment, demonstrated real-world applications, and motivated greater engagement with mathematical topics. These three outcome types generally map to the appeal, personal relevance, and

motivational impact questions asked about in the current evaluation, and could be used to further interpret the findings.

Similarly, a study commissioned by Cisco Systems, Inc. (Greenberg & Zanetis, 2012) pointed to the value of educational video in terms of individual learning style and pacing. The authors observed:

*Because video combines many kinds of data (images, motion, sounds, text) in a complementary fashion, learning can be adjusted more easily than with other tools to the diverse learning styles and individual learning pace of students. With video, the learner has more control over the information he receives and an additional opportunity for deeper learning by being able to stop, rewind, fast-forward, and replay content as many times as needed.*

The report concluded that the impacts of video can be summarized by three key concepts:

- ▶ Interactivity with content (the learner relates to visual content, whether verbally, by note taking or thinking, or by applying concepts)
- ▶ Engagement (the learner connects to the visual content, becoming drawn in by video, whether on-demand or real-time)
- ▶ Knowledge transfer and memory (the learner may remember and retain concepts better than with other instructional media)

Although these concepts are intended to describe learning in classrooms, they also generally apply to how the short format videos may be experienced by viewers on the *EarthSky en Español* website and Facebook Page. While the concepts of interactivity and retention weren't specifically explored in Study 2, future studies of the *EarthSky* videos could consider these aspect of viewers' experience.

### ***Findings relating to the role of Facebook***

- The evaluation participants who were asked questions about their use of the *EarthSky en Español* Facebook Page indicated that the most appealing aspects were the photos and content/topics, followed by the videos or articles. While this finding provided useful feedback to the project team, additional evaluation is needed to yield a more complete picture of *EarthSky en Español's* Facebook community and participants' use of the page, particularly in terms of "Likes," shares, and comments on content shared by *EarthSky en Español* administrators. At the same time, as noted in Study 1, this information can also be challenging to capture given the amount of time required to quantitatively and qualitatively assess the history of individual posts in terms of tone, post content, comment content, and administrator engagement with Facebook users, among other factors.
- The evaluation findings on the frequency with which videos were posted on the *EarthSky en Español* Facebook page may have implications for future uses of the page. Given that the majority (88%) of Facebook posts were photos that linked to science content (often on the *EarthSky en Español* website), a tenth (10%) were articles, and only a handful (2%) were videos (as described in greater detail in Part 1 of this report), it appears that the project's Facebook administrators might have been able to more effectively engage some users with additional video content. As noted elsewhere, though, additional evaluation would be needed to determine: the kind of video content *EarthSky en Español* audiences are interested in, how short format videos might be used to engage this online audience in the future, and the role of supporting text, articles,



comments, pictures, and other media resources available through Facebook to enhance or extend the viewing experience.

- It is noteworthy that the evaluation participants familiar with the *EarthSky en Español* Facebook Page perceived it to be a valuable informal science education resource. The overwhelming majority of those who had visited the page (97%) thought it was a good source for learning about science, and consistently described the page as *credible* and *trustworthy* and the content to be *interesting*, *relevant*, and *varied*. About half (51%) indicated that they followed up on information presented on the *EarthSky* Facebook Page regularly or occasionally.
  - To help interpret these findings, a [Pew Research Center report](#) from September 2014 described Facebook as the “*obvious news powerhouse among the social media sites*,” explaining that nearly two-thirds of Americans (64%) have Facebook accounts and that almost a third of U.S. adults (30%) get news from the site. Additionally, of Facebook’s news consumers, more than a third (37%) see information about Science and Technology.

As of the writing of this report, relatively little information was available on Hispanics’ Facebook habits (including habits regarding news consumption via social media), although according to a Pew Hispanic Center survey in 2012, about two-thirds (68%) of Hispanic Internet users said they use Facebook, Twitter, or other social networking sites compared to 58% of all U.S. Internet users (Pew Research Center for the People & the Press, 2012a).

Almost all (94%) of the participants in the *EarthSky en Español* evaluation who were asked about their Facebook use indicated they used Facebook, with more than half saying they visited daily (55%) and almost one-fifth (18%) saying they visited between 1-5 times a week. However, it is also important to factor in the source of evaluation participants, as these individuals were already visiting the *EarthSky en Español* Facebook Page or website on their own accord prior to accepting the survey invitation.

- Country of origin is also an issue to consider when interpreting the evaluation findings involving Facebook, as more than half (59%) of the evaluation participants that provided information about their Facebook habits resided outside of the U.S. Study 1 similarly found that the largest number of Likes to the Facebook Page came from other countries, including, in order of descending frequency: Venezuela, Mexico, Argentina, Colombia, and Spain. The United States was 6<sup>th</sup> for number of Likes, with approximately 7% of Total Likes for the Page.

Why the Facebook page attracted proportionally fewer U.S. Likes and a comparatively higher percentage of international visitors could be the focus of a future evaluation. Additional findings from the 2012 Pew study cited above may also help shed light on this issue, as the study found discrepancies between foreign-born and U.S. born Latinos use of social networking sites, as well as language preferences when engaging with the sites:

*Foreign-born Latinos make up 46% of all Latino social networking site users. Among them, more than half (55%) say they mostly or only use Spanish when posting Facebook updates or tweets. By contrast, among U.S.-born Latino social networking site users, 86% say they mostly or only use English when engaging with social media*

Future evaluation efforts of the *EarthSky en Español* online media could further explore these issues, and also perhaps factor in, up front, the unanticipated country of origin finding by recruiting purposefully if the goal is to limit the evaluation to U.S. residents. This can be done, for example, by placing a filter on the survey invitation link to restrict it to browsers reaching the site from within the U.S.

- Looking ahead, the *EarthSky* team could draw on recent trends in U.S. Hispanic audiences' online and social media habits and preferences as this data could help inform the project's future science outreach efforts among Hispanic-Americans. For example:

- According to a 2012 survey by the Pew Research Center Internet & American Life Project, 80% of U.S. Hispanics use the Internet. A survey conducted the same year by Zpryme Research and Consulting (2012) suggested that 70% of Hispanic-Americans own a laptop, more than 51% use a smartphone, and 19% use mobile devices such as tablets. According to Zpryme, the most common activity on these devices among Hispanics is checking social media.
- These types of findings provide useful context, but as the informal science review paper *Learning Science in Informal Environments: People, Places and Pursuits* (National Research Council, 2009) suggests, more studies are needed to understand how underrepresented groups such as Hispanic-Americans interact with science via digital sources. In this regard, a number of relevant questions were posed by the *EarthSky* team early in the grant development process, such as: Will online science videos and news in Spanish help increase understanding of science concepts among Hispanic-Americans? Will Hispanic-American audiences who encounter online information display engagement activities such as talking with friends/family about the presented topics and/or seeking out more information?

The evaluation findings in this report shed some light on these questions. The short format videos successfully met *EarthSky*'s goals with the *EarthSky en Español* online visitors that participated in the evaluation. However, the evaluation did not constitute research and produce generalizable results. Additional studies would be needed to more fully answer these and related questions about *EarthSky*'s use of short format videos for the purposes of sharing STEM-related news and information among U.S. Hispanic audiences as intended, either distributed online or broadcast on television. The findings from this research could both inform the field and benefit other production groups like *EarthSky* looking to develop and build on their Spanish-language STEM content and media.

- Although no specific studies could be located on the use of Facebook as a way to engage Hispanic online audiences with STEM content or news, studies are beginning to emerge on the use of Facebook as a source of news. For example, early findings in a multi-part research project by the Pew Research Center (2013) on the role of news on Facebook and other social media platforms indicated that, as of 2013, about half of U.S. adult Facebook users (47%) ever get news from Facebook. The study further delineated that while adults do not typically seek out news on Facebook, "*news is a common but incidental experience.*" Such findings, though preliminary, can help point *EarthSky*'s Facebook team to opportunities and potential barriers for using short format videos that feature newsworthy and personally relevant STEM stories and/or highlight Hispanic scientists' research and discoveries. Participants in the present study applauded and wanted to see more of both.
- Finally, a procedural note relating to the role that the Facebook findings played in the timing of the evaluation. Although this evaluation report presents Study 2 after Study 1, Study 1 was completed just prior to the end of the grant period, while Study 2 was completed the previous year. Ideally, the two evaluations would have

occurred concurrently, or Study 2 would have occurred after Study 1 so that Study 2 could be grounded in a more thorough understanding of online visitors' use of the *EarthSky en Español* Facebook Page and website over time, drawing on the audience and engagement metrics made available by Insights. This and other data the *EarthSky* team may have been able to provide about viewership of the videos could have been used to help develop Study 2 and inform the resulting report.

### ***Findings relating to the role of television***

- A second target audience for the *EarthSky en Español* project was Hispanic-American adults who watch commercial television in Spanish. The evaluation team did not have an opportunity to explore the potential value of the short video format as part of *Detras del Saber* program, other than to survey participants in Study 2 for their viewing of the program. It is also not known whether viewers of *Detras del Saber* would have responded differently to the videos, although the evaluation did find that most evaluation participants were experienced with *Detras del Saber*; roughly three-quarters (70%) indicated they watched the program, with around two-fifths (41%) indicating they watched it occasionally or regularly.
- Early in the project period, the *EarthSky* team searched for relevant information on the television viewing context for the short format videos, given that Spanish-language television is a dynamic source of news and STEM-related information for many Hispanic-Americans. A 2012 [article](#) in *The New York Times* located by the *EarthSky* team suggested that:

*English-language television executives and advertisers ... desperately want to appeal to the more than 50 million Latinos in the United States (about three-quarters speak Spanish), especially those who are young, bilingual and bicultural, but those viewers seem to want very little to do with American English-language television. They do, however, continue to watch Spanish-language networks in huge numbers.*

The *EarthSky* videos broadcast as part of the 30-minute program *Detras del Saber* aired in a primetime block for Galavision, a Spanish-language cable network owned by Univision. Galavision ranks as the number one cable network, regardless of language, among Hispanic-American adults, according to Nielson. The opportunity to evaluate the impact of the videos in the context of *Detras del Saber* is one that the evaluation and project team initially pursued. As noted under Methods, the viewing context for the evaluation was determined after extensive discussion with the team of evaluation, *EarthSky*, and Univision staff. The team collaborated to consider the opportunities for and requirements involved in gathering feedback from viewers of the short-format videos as presented on *Detras del Saber*, including, for example, extending evaluation invitations to *Detras del Saber* viewers who visit the social media offerings related to the series. The team encountered a number of marketing, legal, and logistical requirements that needed to be addressed in order for this type of evaluation to occur that could not be resolved during the evaluation timeframe.

Building on this experience, the team prepared a subsequent proposal to the NSF that built in a timeline and process for the evaluation to occur in future seasons of *Detras del Saber*. If the above challenges could be resolved, an evaluation of the videos within the series' context could yield valuable findings about one of the key intended uses of the videos. The evaluation could draw on information about the ratings/viewership of the series and explore the impact that viewing the videos as part of the 30-minute format has on the same indicators explored in the current evaluation relating to appeal, clarity, personal relevance, perceptions of the featured scientists, and content learning.

Although few studies on the use of short format STEM videos in television broadcasts were found when preparing this report, in 2006, Miller et al. looked at the recall and information retention of viewers who saw

science and health stories on local television newscasts. The researchers found that, of the 129 million American adults who reported seeing one of the science segments in the study, a markedly smaller group of around 71 million individuals recalled scientific content from the segments, but they concluded that the segments still reached a substantially large population at a relatively low cost per individual. Short format STEM videos such as those produced by *EarthSky en Español* could also have a potentially large reach and impact among Spanish speaking audiences if widely shared through the appropriate television and online channels. Future studies of these impacts could also expand the field's understanding of short format video engagement, reach, and learning value, as well as inform future practice.

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