

Evaluating the Impact of the IRIS EPO Presence at the 2018  
NSTA National Convention  
Atlanta, GA | March 15 – March 18, 2018

Michael Hubenthal – IRIS Education and Public Outreach  
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## Executive Summary

Annually, the IRIS Education and Public Outreach (EPO) program participates in the national conference of the National Science Teachers Association (NSTA). Through participation in the conference, IRIS seeks to increase the science education community's awareness of the IRIS Consortium and the products and programs that it offers, while also encouraging and enabling post-conference use of IRIS's educational resources. IRIS has three primary approaches to achieve these goals.

- Direct work with teachers in hour-long in-person professional development workshops
- Promotion of products and programs as part of share-a-thon sessions
- One-on-one interactions with teachers at the IRIS booth on the convention floor

In 2018, this consisted specifically of three, hour-long workshops, five share-a-thon presentations, and a 10'x10' corner booth on the show floor. Prior to the conference, IRIS staff set the following three performance targets for attendance at the 2018 NSTA. 1) Reach at least 800 attendees at the booth and sessions combined, 2) Collect 200 new badge scans for the Teachable Moments/IRISEd listserv, 3) Optimize programming and costs to keep costs at or below \$19/interaction. In addition, the staff also set the following impact objectives. 1) 90% of attendees of hour-long sessions will indicate the intention to use the featured IRIS resources in their classroom. 2) 80% of booth visitors spending at least 30 seconds with staff would be able to recognize the IRIS logo and name or identify at least one IRIS resource they intend to explore/use.

Pre-show promotions implemented this year appear to be effective as IRIS reached nearly 13% of the 7832 conference attendees (NSTA, 2018), the highest percentage achieved to date. Active traffic on the show floor allowed IRIS staff to reach 343 attendees (4.4%), while attendance at all hour-long sessions was above average for each session (Figure 3), reaching a combined 239 attendees. Attendance at this year's share-a-thons was poor leading to a new attendance low for share-a-thons (Figure 4). As a result, IRIS's total reach for the show was 582 attendees. Unfortunately, this was below the first performance target. IRIS did scan 220 attendee badges for the Teachable Moments listserv a number which exceeds the second performance metric of 200 badge scans due. This was primarily due to the rental of a second scanner which allowed staff to scan both at the booth and at the sessions simultaneously. Finally, flat costs from the previous year, a fourth out of town staff attending the show (because of unusual uncertainty in staffing), and low overall reach resulted in a cost per interaction rate of \$29.97/interaction, well above the third performance target.

While only one-third of the performance targets were met, IRIS did meet both impact objectives. For example, 100% of respondents to post sessions surveys indicated that it was highly likely or likely that they would use IRIS resources from this session in their classroom. Thus, exceeding the first impact objectives. Additionally, IRIS staff met and exceeded the second impact objective. Here, 80% of booth visitors reported recognizing the IRIS logo and 100% reported learning about one or more resources they intend to use or explore.

This evaluation has helped to identify several key recommendations for implementation in 2019.

- Reflect on and re-set performance targets to better account for variability in NSTA attendance
- Develop and implement an evaluation to measure the effectiveness of eblasts
- Continue impact evaluations and explore possible follow-up surveys
- Find alternatives to the traditional share-a-thon
- Offer sessions informed by teacher feedback

- Reduce costs and limit staffing to three, unless local

## Background

Annually, the IRIS Education and Public Outreach (EPO) program participates in the national conference of the National Science Teachers Association (NSTA). Through participation in the conference IRIS seeks to increase the science education community's awareness of the IRIS Consortium and the products and programs that it offers, while also encouraging and enabling post-conference use of IRIS's educational resources. IRIS has three primary approaches to achieve these goals.

- Direct work with teachers in hour-long in person professional development sessions
- Promotion of products and programs as part of share-a-thon sessions
- One-on-one interactions with teachers at the IRIS booth on the convention floor

Participation in the NSTA National Convention is also an opportunity for IRIS EPO to receive feedback, directly from teachers about the products and programs it offers, and to gain an understanding of teachers' instructional needs and concerns. While much of this feedback is collected informally through conversations with teachers at the booth, IRIS also uses the meeting to conduct formal evaluations of EPO products and programs with this national teacher audience. This combination of formal and informal feedback informs the development and updating of IRIS products and services.

The 2018 NSTA conference was held in Atlanta, GA. IRIS EPO sent four staff to the meeting to deliver three hour-long PD workshops, present four products as part of four share-a-thon sessions, and setup, staff, and dismantle a 10'x10' booth on the convention floor. Performance targets for the 2018 meeting, developed based on reach at the previous year's NSTA performance, were to reach at least 800 attendees at the booth and sessions, collect 200 new badge scans for the Teachable Moments/IRISEd listserv, and optimize programming and costs to keep costs per interaction below \$19/teacher. The impact objectives the following;

- 90% of attendees of hour-long sessions will indicate the intention to use the featured IRIS resources in their classroom.
- 80% of booth visitors spending at least 30 seconds with staff would be able to recognize the IRIS logo and name or identify at least one IRIS resource they intend to explore/use.

These two impact objectives are aligned to longer-term outcomes identified in the Logic Model (Figure 1) for attending NSTA. These outcomes have the following imbedded assumptions.

1. Reaching more teachers while at NSTA will increase the quantity and enhance the quality of seismology education if the teachers reached use IRIS resources
2. Reaching more teachers while at NSTA will increase the visibility and recognition of IRIS if the IRIS logo is featured and IRIS is explained.

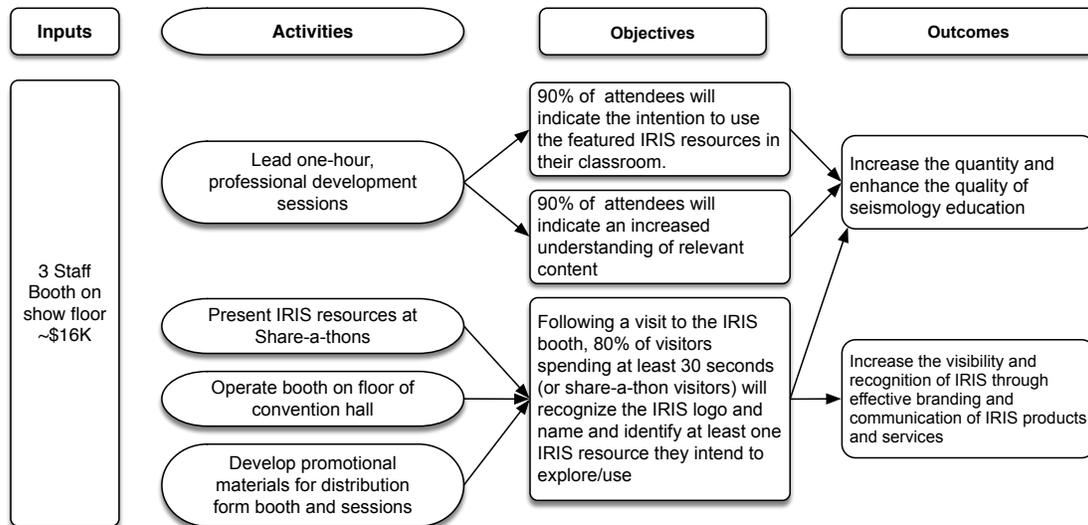


Figure 1: Logic model for IRIS's work at the national NSTA conference.

New for 2018, IRIS staff collaborated with our external evaluation consultants to plan and conduct an evaluation the impact of the IRIS booth. This evaluation consisted of semi-structured interviews with 30 attendees as they exited the IRIS booth.

### Pre-Show Promotion

Prior to NSTA, IRIS promoted its sessions and booth with targeted messaging sent directly to attendees that taught Earth, Physical, and/or General Science at the middle or high school levels. The eblast (Appendix A) was sent on a Monday, 10 days days prior to the start of NSTA. A second, duplicate eblast was sent on a Sunday, 5 days prior to the start of NSTA. This is a paid service provided by NSTA, but the content of the eblast was designed by IRIS EPO staff.

IRIS also used Twitter and Facebook to promote IRIS's presence at NSTA. Posts on both platforms appeared a few days prior to NSTA announcing that IRIS would be at NSTA. Then, daily posts were made during the show to promote the booth's location at NSTA, as well as as the daily schedule of IRIS sessions (Appendix B). Because social media accounts are free, the cost of such adversiting is only the effort required to create the content and push the information. In this case, all content was already created so the time investment was negligible.

### Hour-Long Sessions

Hour-long sessions provide an opportunity for IRIS EPO to contribute to the content knowledge and pedagogical content knowledge of participants. Sessions are designed such that participants can learn new content while gaining direct experience using the featured IRIS resources. This allows, teachers to confidently implement the activity when they return to their classrooms. In the session, participants not only receive relevant handouts for the lesson, but they also receive the IRIS Earthquake Resource handout (Appendix C). This handout provides an overview of the spectrum of resources IRIS offers beyond what is covered specifically in the workshop.

In 2018, IRIS submitted three proposals to run one-hour workshops within the agenda of the National NSTA meeting. All three session proposals were accepted for presentation (below).

**After an Earthquake: Real-Time Earthquake Data as a Hook to Encourage Answer-Seeking about the Geologic and Societal Context of the Event**

Help students explore earthquakes and Earth science in context after major earthquakes using a suite of free classroom products, data, animations, and visualizations from IRIS.

*Presenter(s): Michael Hubenthal (IRIS: Washington, DC), John Taber (IRIS: Washington, DC)*

**Yes, Humans Really Do Cause Earthquakes: Hydraulic Fracturing, Wastewater Injection, and Earthquakes**

Explore the “hot topic” of induced earthquakes with your student through an activity built on the Argument Driven Inquiry framework that supports three-dimensional learning.

*Presenter(s): Michael Hubenthal (IRIS: Washington, DC), Mike Gallagher (Oakland Schools: Waterford, MI)*

**Earthquakes, Earth’s Structure, and Plate Tectonics Animations: Powerful Learning Tools for Earth Science Educators and Their Students**

Use IRIS’s more than 100 free animations of Earth processes to explore how students process visual/auditory information, and learn strategies to effectively employ animations to enable learning.

*Presenter(s): Michael Hubenthal (IRIS: Washington, DC), Jenda Johnson (Earth Sciences Animated: Portland, OR)*

## Share-a-thons

Share-a-thons are opportunities to informally introduce a large number of teachers to a single resource in a short amount of time. To accomplish this, presenters distribute themselves at tables around the perimeter of a large meeting space. Attendees then circulate around the room and visit as many tables as possible in any order they wish. Once a small group of teachers has gathered, presenters introduce a single resource in 3 - 5 minutes. At the conclusion of each presentation, presenters distribute a handout that allows the audience to get more information on the resource at a later time. These mini-presentation are repeated continuously until the conclusion of the session or until all session attendees have visited all the presenter tables. The fast-paced format of share-a-thons does not allow for much impact beyond piquing the interest of participants and providing them with a handout to learn more.

In 2018 IRIS participated in three share-a-thons. Table 1, below, illustrates the resources presented in each share-a-thon as well as the number of EPO staff that presented. To help attract the attendees’ attention, IRIS EPO staff brought a single pop-up banner stand to place behind the presenter table. This year, IRIS staff also distributed an additional handout, the IRIS Earthquake Resource handout (Appendix c), which provides an overview of the spectrum of resources IRIS offers beyond the resourced featured by the presenter.

*Table 1: IRIS participation in share-a-thons at the 2018 NSTA National Meeting*

<b>Share-a-thon</b>	<b>Staffing</b>	<b>Resources presented</b>
NESTA Integrated Earth Science	1	geoPhysics
Meet in the Middle	2	5-Slinky Model & Seismic Waves viewer
NSTA High School	2	Seismic Waves viewer, geophysics, & Teachable Moments

## Booth

A 10'x10' corner booth is the core component of the IRIS presence on the convention floor at NSTA. As illustrated in Figure 2, the booth consists of three pop-up banners, which span the back of the booth, plus a large monitor that loops a slideshow of IRIS's educational resources (e.g. 10 to 12 slides). On a side counter, a touch screen computer highlights digital resources, while a physical model (e.g. the earthquake machine) is ready for demonstrations. A main demo screen and laptop, along with handouts, are positioned on the front counter. This year, the monitor on the side counter featured the IRIS Earthquake Browser (<http://ds.iris.edu/ieb/>) and various animations each day. Screens on the front counter featured the Seismic Waves Viewer (<http://ds.iris.edu/seismon/swaves/>) on one and jAmaSeis (<http://www.iris.edu/hq/inclass/software-web-app/jamaseis>) with a real-time data stream, on the second. IRIS staff also hand out several items to teachers who stop by. These giveaways include the "Earthquakes... Like Ripples on Water?" poster ([https://www.iris.edu/hq/inclass/poster/earthquakes\\_like\\_ripples\\_on\\_water](https://www.iris.edu/hq/inclass/poster/earthquakes_like_ripples_on_water)), plastic Slinkys, IRIS stickers, "Shaking Up Earth Science" name badge ribbon, the IRIS Earthquake Resource handout outlining IRIS resources relevant for teachers (Appendix B), and a handout listing IRIS sessions throughout the show.



Figure 2: IRIS staff set up the booth at the 2018 NSTA convention in Atlanta, GA

Staff who work at the booth at NSTA have been trained to use the following dialogue when meeting teachers who approach the booth. The goal of the dialog is to identify a need the teacher has, introduce them to IRIS, and highlight one or two resources that are likely to meet their needs, and ensure the teacher understand how to access the resources.

Greet – "Hello"

Welcome – "Welcome to our Booth. My names is XXXXXX..."

Meet – "...and you are?"

Discover – "So what brings you here?" or "I saw you were looking at the screen, do you teach about earthquakes?" *It is not about what you tell... it is what you ask!*

Organization – Point out the logo. "IRIS is a facility for seismological research that is funded by the National Science Foundation. Through our education and public outreach program we produce a variety of free educational resources for teachers and their students."

Products - All of the above should occur before you start talking about products...

*Less is more as they are probably on information overload.*

- IEB/3DV or Earthquake Channel
- jAmaSeis
- Hands on activity to lessons and demos

Use one of three products as an example of what we offer...

Closing –

- 1 Scanning their badge for IRIS Teachable Moments list
- 2 Get them a copy of the IRIS Earthquake Resource handout (Appendix A) and note or mark the resources that you discussed with them.

### Implementing Recommendations from 2017

The post 2017 NSTA evaluation report made ten recommendations based on the results of the 2017 evaluation (Table 2). All recommendations were carefully considered and prioritized by EPO staff. Many responses were implemented at the 2018 NSTA as illustrated in Table 2.

*Table 2: Recommendations from the post NSTA 2017 evaluation report and the corresponding programmatic response for 2018.*

Recommendation	Response
Future performance metrics should be adjusted to reflect the success of this year’s effort	Two of three performance metrics were adjusted; reach was increased to 800 attendees, and the target cost per interaction was reduced to \$19.
Develop additional approaches to measure the effectiveness of eblasts	Delayed until 2019
Tailor social media content	Social media posts targeted the timely promotion of individual sessions and the booth presence while the exhibit hall was open during 2018.
Develop an evaluation to explore how teachers select the hour-long sessions they attend at NSTA	Incorporated in a new post-session evaluation
Develop an evaluation that can be quickly implemented at the end of each session to measure aspects of effects on participants’ behavior, attitude, skill, interest, and knowledge (BASIK).	Developed and implemented a new post-session evaluation for all hour-long sessions in 2018
Expand evaluation to estimate how many teachers reached during a share-a-thon followed up	Delayed until 2019
Develop a booth impact survey to measure changes in attendees’ BASIK.	Developed and implemented an post-visit interview protocol.
If badge scans for TM are an important metric, having more tools to scan participants may be worth the effort depending on costs.	To increase IRIS ‘s capacity to scan badges during NSTA, a second scanner was rented.
Review the budget to see further costs savings that may exist to trim costs even further	No immediate cost savings were evident.

## Evaluation Methods

### Pre-Show Promotion

The evaluation of the pre-show promotion was focused on gathering data on how much attention the various pre-show promotion platforms garnered for IRIS. The impact of the first platform, eblasts by NSTA, were measured in two ways. First, the system at NSTA which sends the blasts reports the number of recipients who received the email. the number who opened and viewed the eblast (open rate), and number of users who clicked on an embedded URL in the email to access the linked content. This number is reported as click-through rate. The impact of eblasts were also measured by an item on the booth exit

interview (Appendix H) which asked participants “Did you see or receive this email announcing the IRIS Booth” in reference to the eblast (Appendix A).

Similarly, the potential audience of social media was measured through metrics reported by the platforms used. From Facebook, we report “Reach” and from Twitter we report “Impressions.” While both provide a metric for the potential audience, they do differ and therefore cannot be directly compared. For example, Facebook reach is the number of *unique* people who saw your content, while Twitter impressions are not limited to unique people. Rather, Twitter impressions represent the number of times a Tweet is served in timeline or search results.

The impact of the social media promotion was also gauged by the impact it had on viewers. For Facebook, the interaction rate was determined by dividing the number of Interactions (e.g. times individuals interacted with the content by “liking” or “sharing” a Facebook post) by the Reach. For Twitter, the Engagement rate was determined by dividing the number of Engagements (e.g. time individuals retweeted, replied, followed, etc. a tweet) by the number of Impressions.

### Hour-Long Sessions

The evaluation of hour-long sessions sought to answer two key questions; How large was the reach of the workshop (e.g. how many people attended)? How did the workshop impact participants (e.g. how did their Behaviors, Attitudes, Skills, Interest, and/or Knowledge change as a result of participating)?

To define the reach of the session, IRIS staff took a head count shortly after the session began. Since there is some ebb and flow in participation (some teachers arrive late while others leave early), a second head count was taken later in the workshop. When possible, staff attempted to document headcounts with photographic evidence (Appendix D). Attendance is also tracked by the difference in the number of handouts brought to the session compared and the number left at the end of the session. Since each approach has its own shortcomings (e.g. coming and goings of participants, and people potentially taking extra handouts or not taking any at all) the evidence is triangulated to arrive at a reasonable estimate that the program can have confidence in.

To answer the question of impact, two post-session evaluations were employed. First, an externally conducted session evaluation was facilitated by NSTA for all sessions in the conference. This online evaluation is available to conference attendees up to a week following the conference. NSTA then compiles the results and provides aggregate results to presenters several weeks following the conference. IRIS’s 2017 NSTA evaluation report (Hubenthal, 2017) suggests that the findings from the NSTA evaluation was not particularly informative. Therefore, IRIS developed its own post-session evaluations for 2018 to explore impact (Appendices E, F, & G). Each was distributed, in hardcopy, to session participants 5 minutes before the conclusion of the session so participants had time to complete the evaluation before leaving for their next session.

### Share-A-Thons

Unlike workshops, share-a-thons are designed to quickly interest teachers in a resource and provide them with a way to follow up at a later time. Given this, we have determined that share-a-thons may be best measured by reach alone. In the past, the program has attempted to count the teachers who come up to the table, but doing so is difficult as teacher come and go continuously, especially once crowds begin to form. Thus, the program uses the number of handouts distributed at each share-a-thon as an estimate of reach. To achieve this count, EPO staff carefully count the number of handouts they bring with them.

During the share-a-thon they attempt to only disseminate the handouts to teachers who watched the introduction. Following the share-a-thon, staff count the number of handouts they have left and report the difference.

## Booth

To estimate the reach from the booth, staff uses pocket clickers to count conversations with attendees. Staff were instructed to record the time and date they started and ended counting on a clipboard in the booth. Then, they were to “click” once for each person that they engaged with during this time period. For the purpose of the evaluation, engagement at the booth was defined as conversation in which EPO staff provided an attendee with more information about IRIS, and/or resources attendees might use as part of their instruction. These engagement counts provide a snapshot of the traffic at the booth within a given time window. Using these snapshots from across the day, we calculated an average number of interactions/hour for the booth on each day. This daily interaction average can then be multiplied by the number of staff hours worked at the booth to generate an estimated daily reach. Daily reach can then be summed to generate a total estimated reach from the booth.

In addition to counting booth interactions, an external evaluation of the booth was conducted in 2018 to deepen IRIS understanding of the booth experience for visitors and to measure the impact of the booth on attendees. In addition, the evaluation also explored who visits the IRIS booth, what brought visitors to the booth, how their booth experience was. The evaluators selected a convenience sample of 30 attendees who spent at least 30 seconds or longer interacting with IRIS staff at the booth. Each was asked a series of questions from the post-visit semi-structured interview guide and responses were recorded as fieldnotes by the evaluators (Appendix G).

## Results

### Pre-show promotions

This year’s eblasts were sent to NSTA registrants who taught Earth, Physical, and/or General Science at the middle or high school levels. As illustrated in Table 3 below, there were fewer registered participants who met our inclusion criteria in 2018 than there were in 2017.

*Table 3: Impact of IRIS’s email marketing campaign promoting IRIS’s booth and sessions at the 2018 NSTA Conference.*

Year	Show Attendance	Recipients	Open Rate	Click-Through Rate
2018 (10 days prior)	7832	2,889	35.9%	0.9%
2018 (5 days prior)	7832	2,982	34.4%	0.6%
2017 (Several days prior)	9511	3,516	37.2%	0.4%

According to NSTA, who reported the statistics for the eblast via email correspondence, 35.9% and 34.4% of the 2018 eblasts were opened. This triangulates well with the 2018 post-both visit interview data where 38% of interviewees, when shown the eblast, reported having received the email. While slightly lower than the open rate in 2017, the 2018 rates are still higher than average for email marketing campaigns within the industry sector of education/training clients specifically (21.8%) and email marketing campaigns generally (21.6%) (mailchimp, 2018). These results suggest that the subject line used by IRIS in the eblast (e.g. “Earthquakes at the 2018 NSTA Conference”) is attractive to recipients and encourages many to open the email. Thus, this should be maintained.

The click-through rate of the eblasts in 2018 (0.9% and 0.6%) was up, compared to 2017 (0.4%). However, this rate is still significantly lower than the average click-through rate (2.5%) for the industry sector of education and training clients (mailchimp, 2018). The low click-through rate is likely explained by the structure of the eblast (Appendix A), which contains all relevant information in the email itself and does not require recipients to click-through for more details. Thus, low click-through rates should not be viewed negatively.

Coordinated posts on Facebook and Twitter (Appendix B) were also used to advertise and promote the IRIS booth and sessions at the 2018 NSTA Conference. One post to Facebook the day prior to the start of the meeting reached 702 people, had 920 impressions (non-unique views), and had 30 engaged users. Posting to twitter started three days ahead of NSTA and included 11 separate tweets. Tweets came in two flavors (a generic post about the booth) and specific tweets promoting individual IRIS sessions (Appendix G). As illustrated in Table 4 below, Tweets received varying number of impressions and engagement. Posts one day prior to NSTA were out performed by Tweets both several days before NSTA and Tweets during NSTA.

*Table 4: Impact of IRIS's Twitter campaign promoting IRIS's booth and sessions at the 2018 NSTA Conference.*

Proximity to NSTA Meeting	Impressions	Engagement	Engagement rate
3 Days Prior	1107	15	1.4
1 Day Prior	721	11	1.5
1 Day Prior	585	5	0.9
1 Day Prior	538	2	0.4
1 Day Prior	559	3	0.5
1 Day Prior	954	8	0.8
1 Day Prior	647	6	0.9
During	790	8	1
During	697	6	0.9
During	819	12	1.5
During	861	12	1.4

Overall, we estimate that pre-show promotional efforts reached an estimated 35% of our target audience, or ~1044 attendees (13% of show attendees). Given that social media costs are minimal as most content is already created and staff time to make the posts is negligible, eblast are the largest expense at \$1700. Given this cost and the estimated number of attendees reached, IRIS spends \$1.62 per person to reach these 1044 attendees. It is difficult to determine if this per person cost is high or low as little is understood about the impact of the eblasts. To better understand this, future session evaluations should include an item to better gauge what percentage of teachers attended the session as a result of seeing the eblast.

### Hour-Long Sessions

This year, the reach of each of IRIS's hour-long sessions was above the long-term session average (2013-2017). As illustrated in Figure 3, IRIS staff reached at total of 239 teachers via the three sessions. The first session After an Earthquake, had the largest attendance. Post-workshop evaluations of this session (Appendix D) indicated a perceived increase in interest, knowledge, confidence, and awareness of

resources to teach about large newsworthy earthquakes within 24-hours of the event. All participants indicated that it was highly likely (92%) or likely (8%) that they would use IRIS resources from this session in their classroom and agreed (17%) or strongly agreed (83%) that they would recommend IRIS resources to a colleague.

Post-workshop evaluations for the Induced Seismicity session (Appendix F) indicated a perceived increase in knowledge about induced seismicity from the production of natural gas. It also indicated increases in participants' perceived ability to complete key learning outcomes for the session such as describing the process of natural gas production via high-volume hydraulic fracturing and constructing an argument from evidence describing how high-volume hydraulic fracturing does or does not impact the seismicity in Oklahoma. Participants in the Induced Seismicity session indicated that it was highly likely (54%) or likely (46%) that they would use IRIS resources from this session in their classroom. Nearly all strongly agreed (77%) or agreed (14%) they would recommend IRIS resources to a colleague.

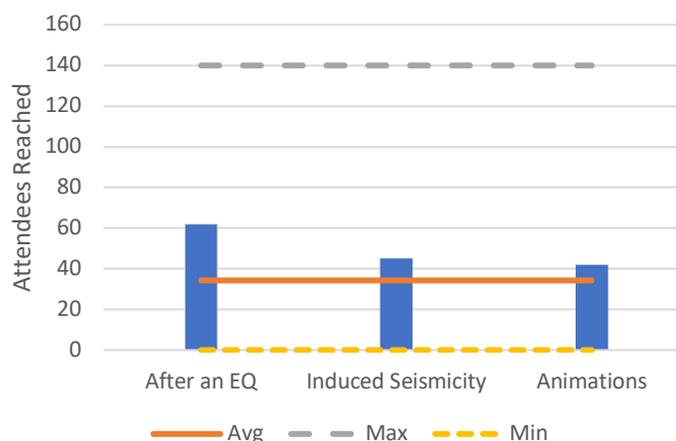


Figure 3: Reach achieved through IRIS's hour-long sessions as part of the 2018 NSTA National Convention. Blue bars illustrate reach for each 2018 session, while lines represent the maximum (grey dashed), minimum (yellow dotted) and average (orange solid) reach from previous sessions held at NSTAs from 2013-2017.

The Animation session was similarly well received. Post-workshop evaluations (Appendix E) indicated increases in participants' perceived ability to complete key learning outcomes for the session such as describing how students learn from animations, and describing at least two pedagogical approaches to effectively use IRIS animations in the classroom. Participants also indicated that it was highly likely (100%) that they would use IRIS resources from this session in their classroom and strongly-agreed (83%) or agreed (17%) they would recommend IRIS resources to a colleague.

A number of participants across the three sessions proposed possible topics for IRIS to present at future NSTA conferences (Table 5). While many of these are outside the scope of IRIS's content expertise, topics such as earthquake early warning, tsunamis, and plate tectonics are suggestions IRIS could develop sessions for.

Table 5: Topics participants, in all three one-hour sessions, would like to see IRIS offer at future NSTA conferences and the frequency they were proposed

Topic	Frequency
Tsunamis	7
Plate tectonics	6
Earth layers, using data how to analyze	4
Volcanoes	4

Design in buildings (and other structures) to prevent damage during EQ	4
Earthquakes and seismic waves	3
EQ Prediction and risk assessment	3
Natural hazards	2
Nuclear Blasts	2
Hurricanes	2
Wildfires	2
Faulting and folding	2
Uneven distribution of natural resources	1
How to incorporate engineering practices into any of these topics	1
Constructing isolines, examining geological relief maps (I don't know these)	1
Active wells and well sites not in use	1
Early warning systems	1
Magnetic reversals added to animation collection	1
Other aspects of IRIS and how to use it	1
I would like to see some kinesthetic based models that compliments the visual info online and the animations to get more leaning preferences addressed - more ways to connect to ideas	1
Structure and function	1

### Share-A-Thons

IRIS participated in three share-a-thon sessions and ran two presentations in two of them. Through the share-a-thons IRIS staff reached a total of 90 teachers. Since each resource was presented by a single staff member, 18 teachers were reached on average per staff hour invested. As Figure 4 illustrates, this reach was below the historic minimums for three of the five share-a-thon presentations and all five were below average.

A similar downswing in reach at share-a-thons was detected in 2017. Previously, this was attributed to the inconvenient location of the NESTA share-a-thons in the farthest corner of the convention hall (Hubenthal, 2017). However, by looking at all share-a-thon reach

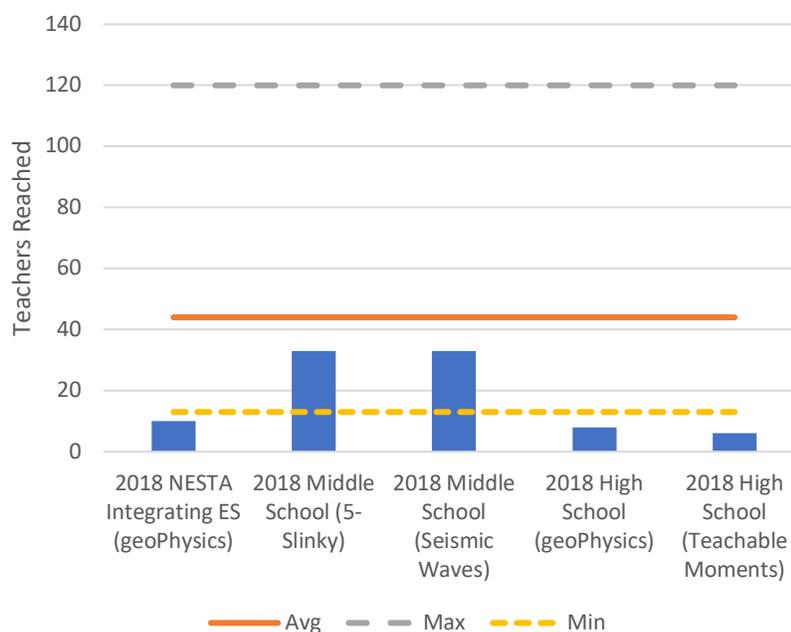


Figure 4: Reached through IRIS's participation in share-a-thons at the 2017 NSTA National Convention. Bars illustrate reach per activity presented with the share-a-thon session indicated in parenthesis. Lines represent the maximum (grey dashed), minimum (yellow dotted) and average (orange solid) reach from previous share-a-thons held at NSTAs from 2013-2017.

data, across multiple years, we see that the reach for all share-a-thons has been steadily declining over time (Figure 5). We also see that some of the share-a-thons consistently generate a greater reach than others. For example, the 2018 High School share-a-thons reached an average of 7 teachers per hour. This is a rate that is below the reach achievable at the booth, which has historically averaged ~14 people per hour. Thus, in some cases, doubling the booth staff instead of participating in a share-a-thon, may be more productive.

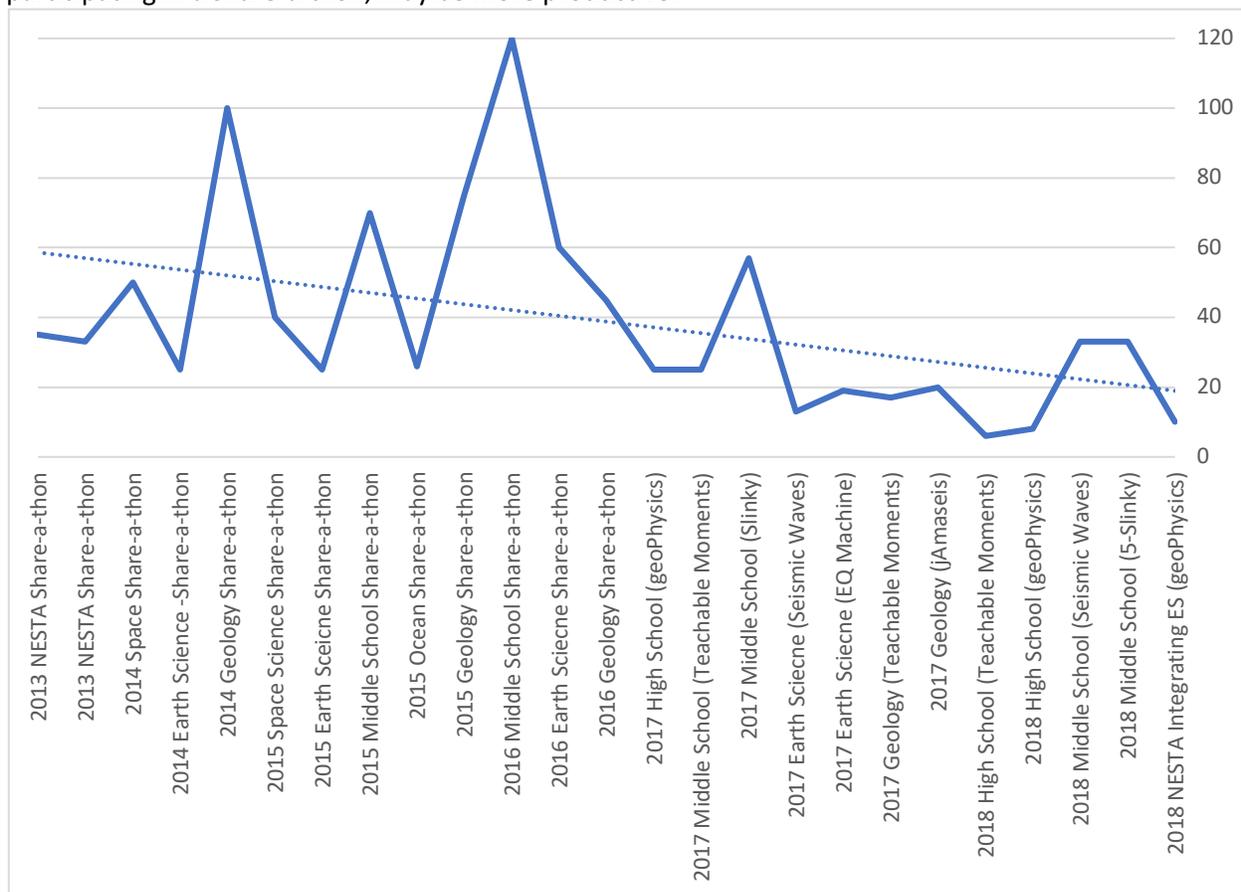


Figure 5: The number of teachers reached through IRIS's participation in share-a-thons (2013 to 2018) by session. The trend indicates an overall decline in teacher participation in share-a-thons, while the Middle School share-a-thon remains popular.

## Booth

As illustrated in Table 6 below, staff counts of interactions at the booth, or reach, suggest that approximately 343 attendees were engaged at the booth across the three days of the show. This was based on the number of staffing hours for each day and the average interaction rates tallied by staff working in the booth. The second day of the show continues to be the busiest of the three days of the show and staffing should be maximized on this day.

Table 6: Estimates of the number of attendees who interacted with EPO staff at the booth on the convention floor based on staff counts. \*A water leak in the convention hall that caused the hall to close for 2.75 hours on Friday, March 16<sup>th</sup>. As a result staff hours were shorter than planned and limited the reach on that day.

	Staff Hours	Avg. Interactions/Hour	Estimated Reach
March 15, 2018	14.0	9.9	138
March 16, 2018	13.5*	11.6	157

March 17, 2018	7	6.8	48
<b>Estimated show total</b>	34.5	10.0	343

Compared to past NSTAs, the total booth reach for 2018 appears to be the lowest since data was first collected in 2013. However, this was likely impacted by a water leak in the convention hall that caused the hall to close for 2.75 hours on Friday, March 16<sup>th</sup>. As noted previously this was the busiest day for the IRIS booth, so the closure may have reduced the reach by ~35 people for the day. Adjusting for this leaves the booth reach for NSTA low but no longer the lowest. Also, if the 2018 booth reach is normalized for the 7832 attendees (Sheldrake, 2018), which was the smallest show since data was first collected by IRIS in 2013, the percentage of conference attendees was only slightly below average (Figure 6).

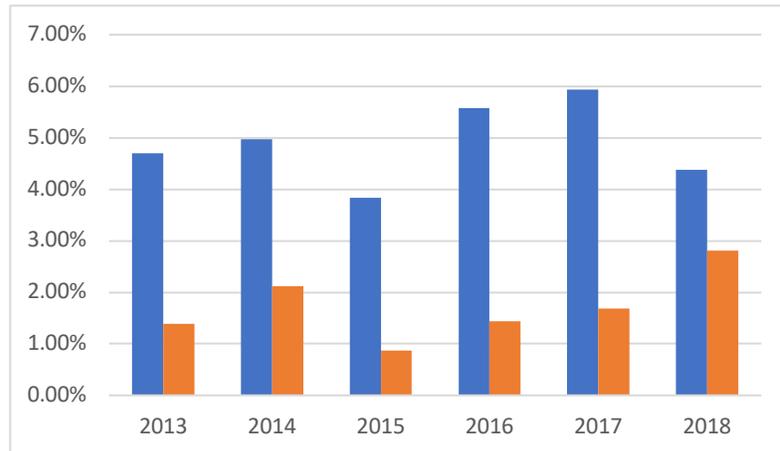


Figure 6: The annual percentage of NSTA conference attendees who interacted with EPO staff at the IRIS booth (blue), and the annual percentage of NSTA Conference attendees whose badges were scanned for IRIS Teachable Moments (orange).

An additional measure previously used for the booth has been the number of attendees who had their badges scanned to add them to the Teachable Moments listserv. In 2018 over 220 attendees had their badges scanned. As illustrated in Figure 5 this was the largest percentage of show attendees scanned since 2013. While this seems incongruent with the booth reach described above, it can be explained by changes in scanning technology and IRIS use of the scanners. In 2018 IRIS had both a booth scanning device and portable scanning capability via an ipad. This allowed two staff to scan attendees at a time from the booth. Additionally, it also allowed staff to take the ipad to all one-hour sessions and share-a-thons to scan participants while the other scanner remained active at the booth. Given the increased number of participants scanned, this portable functionality should be employed again at future shows.

As noted above, an external evaluation of the IRIS booth was conducted in 2018 to develop a deeper understanding of the IRIS booth at NSTA and to determine if the booth achieves its impact goals. The evaluation (Appendix H) consisted of semi-structured interviews with 30 attendees who spent at least 30 seconds at the booth talking with IRIS staff. Visitors had a wide range of teaching experience (1 to 31 years) but the average was 14 years of service. Participants taught primarily at the middle school (52%) and high school (40%) levels. Earth Science was the primary teaching responsibility for 72% of participants. Participants reported that a variety of factors attracted them to the booth, but visual elements such as words like “Earthquakes” and “Free”, and the animations on the screens were the mostly commonly identified. While not named as a reason for visiting, IRIS’s eblast was recognized by 38% of the participants. Most of the participants (62%) had not attended an IRIS session, yet many indicated an intention to do so and took the listing of sessions from the booth. Of the four participants who had attended a session the previous day, 3 remembered hearing about the IRIS booth while at that session.

The results of the semi-structured interviews also indicate that the booth was successful in achieving its impact objective. Eighty percent of participants reported recognizing the IRIS logo. While many knew it from previously visiting the IRIS website, others identified it from seeing it while at the booth. All of the participants (100%) reported learning about one or more resources they intend to use or explore. Participants described a variety of ways they intended to incorporate what they learned into their classroom lessons and projects depending on the resources identified. Many felt confident (40%) or very confident (53%) that they would be able to access the resources they identified later indicating the resource on the resource handout they had received (Appendix A). Importantly, most (90%) participants expressed the understanding that what IRIS offers is free and all participants (100%) would recommend IRIS educational resources to a colleague. When asked what they would say to a colleague about IRIS resources, they noted that it is a great website with resources that are free and that it can be used in support of what they are doing.

## Costs

As illustrated below, the costs for IRIS EPO’s participation at the 2018 National NSTA Convention totaled just under \$16,300, excluding staff time. As illustrated in Table 7, the largest single expense category for participation in NSTA continues to be staff travel, which makes up roughly 36% of the total. However, having a booth at the show takes up roughly half the budget as the booth space is 27% of the total and shipping, which is mostly the booth, is an additional 22%. The remainder of costs are relatively small and consist of advertising (11%) and printing (5%). The 2018 total cost is slightly higher than the 2017 show costs which were \$16,096. The 2018 cost per interaction can be calculated using the following formula. Total cost / Total reach = Cost per Interaction or  $\$16,278.82 / (343 \text{ [booth]} + 90 \text{ [share-a-thon]} + 149 \text{ [workshop]}) = \$27.97/\text{attendee}$  reached.

*Table 7: IRIS EPO’s participation costs for the 2018 NSTA Convention*

Category	Cost	Percentage
Booth	\$ 4,319.27	27%
Shipping	\$ 3,519.45	22%
Printing	\$ 813.40	5%
Advertising	\$ 1,709.70	11%
Staffing	\$ 5,917.00	36%
Total	\$ 16,278.82	100%

## Summary and Recommendations

The four IRIS staff that attended the 2018 National NSTA convention had a busy week with a booth presence in the exhibit hall, facilitation of three hour-long sessions, and presenting five share-a-thons. IRIS’s approach towards evaluation has proven capable of measuring the reach of sessions, share-a-thons, and booths. Importantly, the newly implemented session and booth evaluations have provided critical insights into the impact of these efforts, which in turn, will help IRIS further optimize these efforts. As illustrated above, the many teachers were reached through the staff’s work and the work was impactful and well-received. However, these results must be compared to the performance targets set by IRIS staff ahead of the meeting. Here we see that IRIS was only successful in reaching one-third of the performance metrics, but successful in reach both impact targets.

**Performance Metric #1** - IRIS sought to reach at least 800 attendees through a booth, share-a-thons, and sessions. The combined reach for the 2018 show was only 582 attendees or 73% of the goal of reaching 800 attendees. Three factors contributed to this short-coming. First, the exhibit hall was closed for 2.75 hours unexpectedly which reduced reach from the booth (Table 4). Second, the reach for 2018 share-a-thons was below average for all five presentations (Figure 3). Finally, the show attendance was only 82.3% of the 2017 show attendance (n=9511) making it difficult to achieve the performance metric as set.

**Performance Metric #2** – IRIS sought to collect 200 new badge scans for the Teachable Moments/IRISed listserv. Staff at NSTA scanned 220 badges or 10% more than the goal. Thus, IRIS did exceed this second performance metric. This success can be attributed to the use of a second scanner, which allowed staff to take a scanner to all sessions and share-a-thons while still keeping a scanner at the booth.

**Performance Metric #3** - IRIS sought to optimize programing and costs to keep the cost per interaction at or below \$19. IRIS did not meet this performance target. The cost per interaction was \$29.97/interaction or 57% over the target. Two factors influenced this. First, as illustrated above, the reach for IRIS at the 2018 NSTA was lower than IRIS anticipated. Second, IRIS's costs were flat from 2017, though some decisions impacting costs were made for other reasons (e.g. the inclusion of a 4<sup>th</sup> staff at the 2018 show).

**Impact Objective #1** – IRIS designed its hour-long sessions with the objective of having 90% of attendees or more indicate the intention to use the featured IRIS resources in their classroom. As described above, 100% of respondents to the surveys in the 2018 one-hour workshops indicated that it was highly likely or likely that they would use IRIS resources from this session in their classroom. Thus, IRIS met or exceeded this impact objective.

**Impact Objective #2** – IRIS set the objective of having 80% of visitors spending at least 30 second at the booth with staff would be able to recognize the IRIS logo and name or identify at least one IRIS resource the intend to explore/use. Exit interviews from the booth indicate that 80% of booth visitors reported recognizing the IRIS logo and 100% reported learning about one or more resources they intend to use or explore. Thus, IRIS met or exceeded this impact metric.

While not aligned with a performance or impact metric, it is worth noting that 97% of participants of one-hour sessions were likely or highly like to recommend IRIS products to their colleagues. This mirrors results from the booth exit-interviews where 100% of interviewees would recommend IRIS educational resources to a colleague. This suggests that not only are the sessions and booth impactful at NSTA, but the resources featured are perceived to be of high-quality by the attendees.

While IRIS did not achieve all of its performance metrics, the evaluation demonstrates that what IRIS offers at NSTA is important and well-received. Below are a series of recommendations to further enhance IRIS's impact at future NSTA Conferences.

**Recommendation #1 - Reflect on and re-set performance metrics to better account for variability in NSTA attendance**

Currently, all three performance metrics are based on numbers of attendees reached. While this has served as an easily understanding starting point for monitoring the performance of IRIS's participation in NSTA, such numbers are problematic in that they don't account for variability in the size of each NSTA. For example, reaching a total of 800 attendees would be easier in 2014 when attendance was 11,500 than in 2018 when the attendance was 32% lower at only 7832 attendees. Since show attendance is a variable beyond the control of IRIS, the performance metrics should be reformatted to better account for this. For

example, IRIS successfully met the target of reaching 800 attendees in 2017 when the attendance was 9511, or 8.4% of show attendees. If the ~8% of attendees had been the performance metric employed in 2018 (n=626), IRIS's total reach of 582 (+35 for the exhibit hall closing for ~3 hours) would have been just below the target and would probably have aligned more closely with how successful the conference was perceived to be by staff.

### **Recommendation #2 - Experiment to measure the effectiveness of eblasts**

This is a repeated recommendation from 2017. Metrics provided by NSTA for eblasts do not provide any insight into "if" and "to what degree" the emails influence attendees interest and behaviors. Therefore, future evaluation efforts should be developed to attempt to measure this. The booth survey in 2018 was a good initial start and indicates that of the 30 attendees interviewed 11 reported having seen the emails. While this data aligns well with eblast open rates reported by NSTA, the interview did not probe to see what influence, if any, seeing the eblast had on the attendees and their actions while at the show. For example, future emails might include a coupon that can be redeemed at the booth or sessions for a "special" slinky and could then be counted. By better understanding the impact of the eblasts on show attendees, IRIS will be better positioned to make critical decisions about eblasts versus other forms of pre-show promotion such as direct mailings of post-cards to attendees, etc.

### **Recommendation #3 - Continue impact evaluations and explore follow-up surveys**

The results from both the booth (Appendix H) and session impact evaluations (Appendices E, F & G) provided IRIS with a rich data set to better understand who attends the IRIS booth and sessions at NSTA, how the attendees are impacted, and what attendees are looking for from the sessions and the booth. While minor revisions or additions may be desirable, both tools have proven useful for documenting impact and providing richer data to facilitate planning. In the future, IRIS should consider expanding these evaluations with follow-up surveys sent to booth visitors and attendees of hour-long sessions. If delayed by six months or more, it would allow IRIS to learn if attendees actually used IRIS resources and what they thought after using them. Or, if applicable, reasons why they didn't use the resources could also be explored.

### **Recommendation #4 - Find alternatives to the traditional share-a-thon**

As illustrated in Figure 5, the reach achieved by participating in share-a-thons is steadily declining. Therefore, IRIS must find new ways to reach more NSTA attendees. A full spectrum of options should be explored ranging from working with NESTA to devise ways to reinvigorate existing share-a-thons, exploring alternative sessions formats (e.g. advertiser sessions, longer-format sessions), and advertising options to garner more attention for existing offerings.

### **Recommendation #5 - Offering sessions informed by teacher feedback**

The 2018 session surveys indicate that the top two reasons teachers attended were that the "Topic sounded interesting" and they "Wanted to get resources for (their) classroom". Thus, future sessions titles and descriptions should appeal to teacher interest and emphasize resources. Additionally, the survey collected topics participants would like to see IRIS offer at future NSTA conferences. While many are not within the content expertise of IRIS, the list could serve as a starting point to develop potential sessions

for the following year. Such a list could be further refined by experimenting additional teacher feedback via quick polls offered to listservs such as ESPRIT and NSTA's Earth Science, and/or IRIS Facebook and Twitter followers.

**Recommendation #6 - Reduce costs and limit staffing to 3 out of town participants**

The cost per interaction, at ~\$28, was high this year and \$9 per interaction above the performance target. Thus, finding ways to reduce costs in future years will be important. For example, sending a fourth staff to NSTA adds significantly to the budget but does not proportionally increase the reach. Alternatives such as using local seismologists, undergraduate geoscience students, or even teachers may be a strategy to reduce costs. Staff should also look for additional ways to reduce costs in the NSTA budget by printing fewer resources, shipping less material, or planning ahead to save on slower turn-around printing charges.

## References

Hubenthal, M. (2017). Evaluating the Impact of the IRIS EPO Presence at the 2017 NSTA National Convention. Retrieved from:  
[https://www.iris.edu/hq/files/programs/education\\_and\\_outreach/Evaluation/2017\\_Post\\_NSTA\\_Report\\_FINAL.pdf](https://www.iris.edu/hq/files/programs/education_and_outreach/Evaluation/2017_Post_NSTA_Report_FINAL.pdf)

mailchip (2018) Average Email Campaign Stats of MailChimp Customers by Industry. Retrieved from <https://mailchimp.com/resources/research/email-marketing-benchmarks/>

Sheldrake, J. (2018) Post Event Report: NSTA National Conference on Science Education. (Sheldrake, J., personal communication, April 11, 2018).

## Appendix A: Pre-show Eblast

### ATTENDING NSTA?

### Join us in Atlanta!

Join us at the Atlanta NSTA to expand your knowledge of earthquakes while learning to use our FREE classroom resources! Find us at our **BOOTH #1043** or attend one of our **exciting learning sessions!**

Our FREE resources include animations, seismic data, classroom activities and demos, videos, earthquake recording software, posters, and much more!

### Friday

#### **Ideas for Teaching About Earthquakes and Earth Structure in an NGSS Classroom**

Friday, March 16 9:30 AM - 10:30 AM  
*Georgia World Congress Center, B216*

#### **After an Earthquake: Real-Time Earthquake Data as a Hook to Encourage Answer-Seeking about the Geologic and Societal Context of the Event**

Friday, March 16 11:00 PM - 11:30 PM  
*Georgia World Congress Center, A412a*

#### **Meet Me in the Middle Session: Middle Level Share-a-Thon**

Friday, March 16 2:30 PM - 4:30 PM  
*Georgia World Congress Center, A411/412b*

### Saturday

#### **Yes, Humans Really Do Cause Earthquakes: Hydraulic Fracturing, Wastewater Injection, and Earthquakes**

Saturday, March 17 11:00 AM - 12:00 AM  
*Georgia World Congress Center, A305*

#### **High School Share-a-Thon: Set Your Sights Higher!**

Saturday, March 17 11:00 AM - 12:30 PM  
*Georgia World Congress Center, B101*

#### **NESTA Integrating Earth Science into Other Disciplines Share-a-Thon**

Saturday, March 17 12:30 PM - 1:30 PM  
*Georgia World Congress Center, B103*

#### **Earthquakes, Earth's Structure, and Plate Tectonics Animations: Powerful Learning Tools for Earth Science Educators and their Students**

Saturday, March 17 12:30 PM - 1:30 PM  
*Georgia World Congress Center, A305*



### CONNECT



### CONTACT

Have questions? Contact us at:  
**epo@iris.edu**



# Appendix B: Earthquake Resources Handout

FREE EDUCATIONAL RESOURCES

## IRIS EARTHQUAKE Resources

**Education & Public Outreach Product Overview**  
<http://www.iris.edu/earthquake>

**Lessons & Demos**

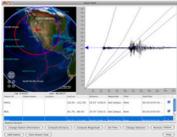
Access both individual learning resources (lessons, animations, data sets, etc) and instructional sequences that link learning resources to strengthen students' conceptual understanding of seismological concepts!  
<http://www.iris.edu/hq/inclass/search?type=3&level=1&2>

**IRIS Earthquake Browser/3D Viewer**

An interactive map that allows both recent and historical global seismicity, and tectonic plate boundaries to be explored. Up to 20,000 earthquakes can be displayed on the map, from a database of 4.5 million. Rotate and zoom through hypocenters using the 3D Viewer.  
<http://www.iris.edu/ieb>

**Videos**

Concise video lectures give background information on the Earth and plate tectonics for teaching how earthquakes happen and how they are studied. In these videos, geologic concepts are explained in understandable terms using common materials.  
<http://www.iris.edu/hq/inclass/search?type=8>



**JmaSeis**

Monitor the Earth from your classroom! JmaSeis allows you to watch a local or distant seismic station in real time. Students can use this software to interrogate an earthquake to determine its location and magnitude.  
<http://www.iris.edu/hq/jmaSeis>

**Teachable Moments**

Capture that unplanned opportunity to bring knowledge, insight, and critical thinking to the classroom following a newsworthy earthquake using our editable PowerPoint presentations!  
<http://www.iris.edu/hq/retm>

Front

## IRIS Education & Public Outreach Product Overview

**Seismic Waves**

See how earthquakes allow us to infer Earth's interior structure! Seismic Waves is a browser-based tool to visualize the propagation of seismic waves through Earth's interior and around its surface.  
<http://ds.iris.edu/seismon/swaves>

**Animations**

IRIS has over 100 animations to help teach Earth science fundamentals from plate tectonics to seismic-wave propagation. These range from concepts for non-scientists to those with college-level understanding of geology.  
<http://www.iris.edu/hq/inclass/search?type=1>

**Seismographs in Schools**

Serving teachers across the country and around the world using seismic instruments or real-time seismic data in the classroom. We offer classroom activities, technical support, and tools to share seismic data.  
<http://www.iris.edu/hq/SIS>



**Posters**

More than just wallpaper, these eye-catching, educative posters invite students to become mind-on with Earth's internal structure, earthquakes, seismic waves and more!  
<http://www.iris.edu/hq/inclass/search?type=6>

**Professional Development**

Explore the interface between cutting-edge seismology and pedagogy in our standards-driven workshops led by seismologists and science educators! Our sessions are offered at regional or national conferences, or through custom designed short courses at your district.  
[http://www.iris.edu/hq/programs/education\\_and\\_outreach/professional\\_development](http://www.iris.edu/hq/programs/education_and_outreach/professional_development)

<http://www.iris.edu/earthquake>  
 IRIS Education and Public Outreach  
 @IRIS\_EPO

wv.3.8.17

Back

## Appendix C: Workshop Attendance Photos

Photo of attendance at IRIS's session "After the Earthquake" from the back of the room, midway through the session. The photo was taken on March 16, 2018.



## Appendix D: Results from Animation Session Post-Evaluation

Table 1: Reasons participants attended this session and the frequency they were selected. Participants could select more than one statement or select "Other" and describe (n=10)

Statement	Frequency
Topic Sounded Interesting	7
Wanted to get resources for my classroom	8
I am familiar with IRIS and its products/resources	1
I have heard the presenters in the past	1
Wanted to improve my science content knowledge	6
Wanted to improve my pedagogical content knowledge (how best to teach these science topics)	6
Other (Please describe)	3
<ul style="list-style-type: none"> <li>• Heard others speak about IRIS, wanted to learn more</li> <li>• Heard of IRIS - wanted more</li> <li>• stopped at the booth yesterday and learned about these sessions</li> </ul>	

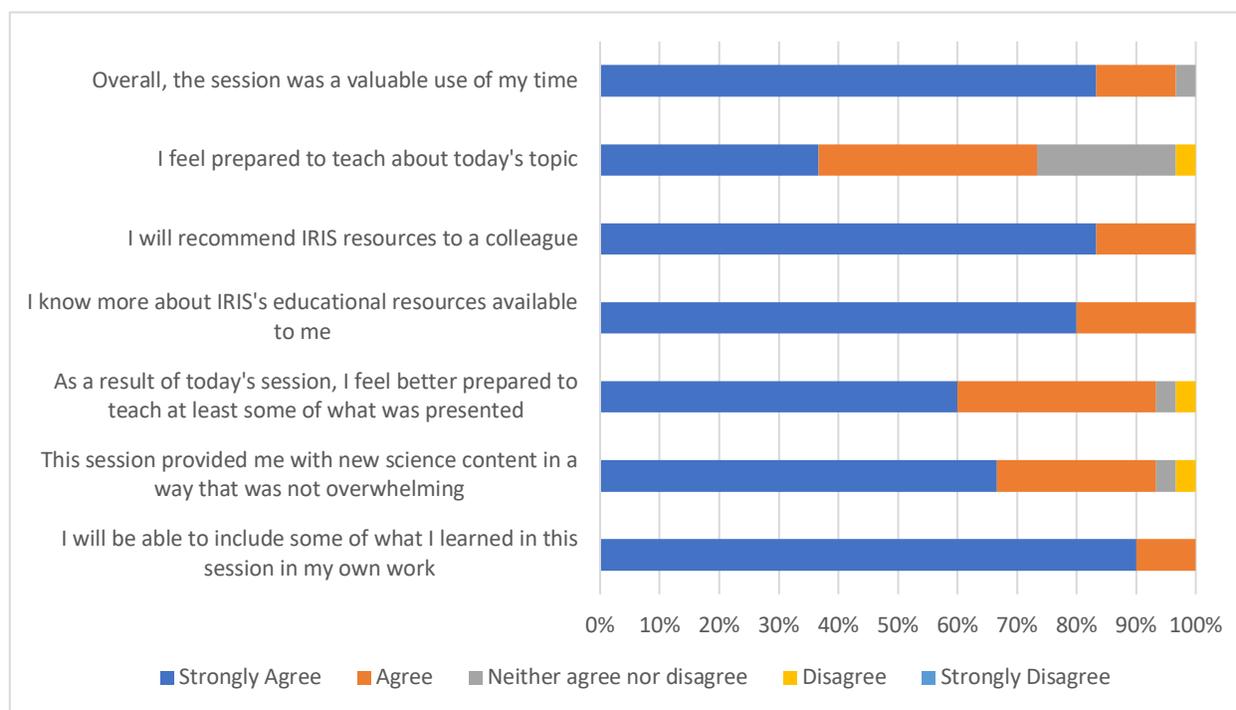


Figure 1: Participants' perceptions of IRIS's Animations session at the 2018 NSTA national conference (n=10).

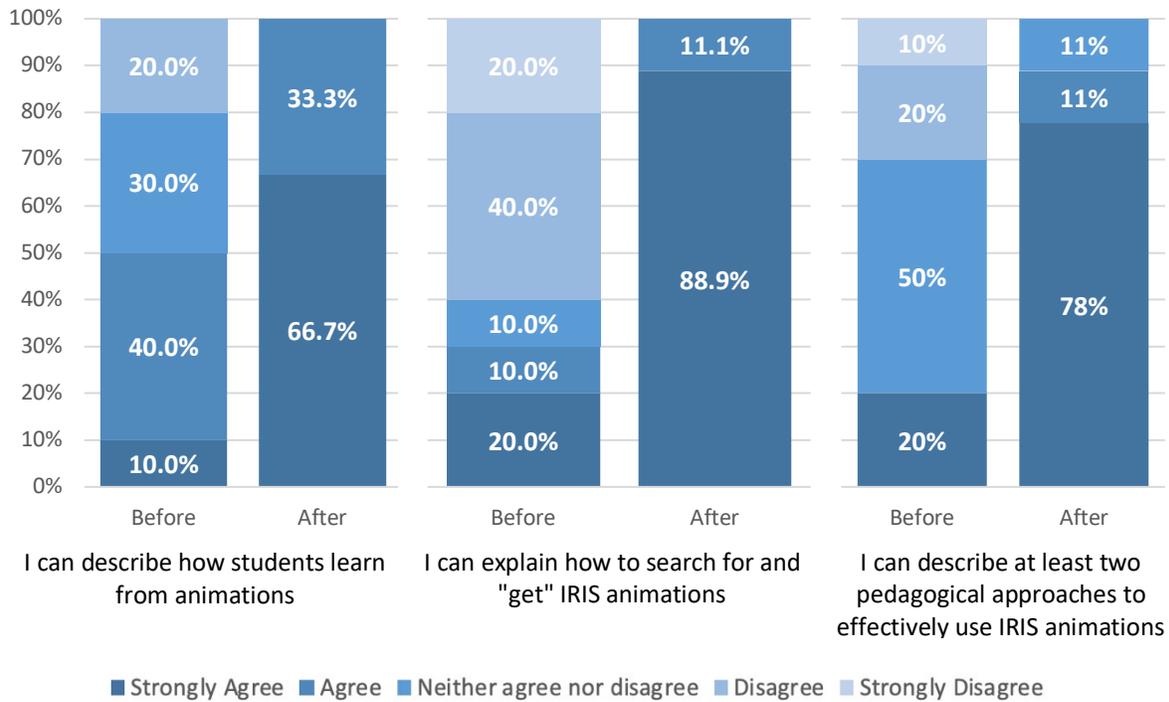


Figure 2: Participants' degree of agreement about their ability to describe how students learn from animations, get IRIS animations, and describe two approaches to use animations with students. (n=10)

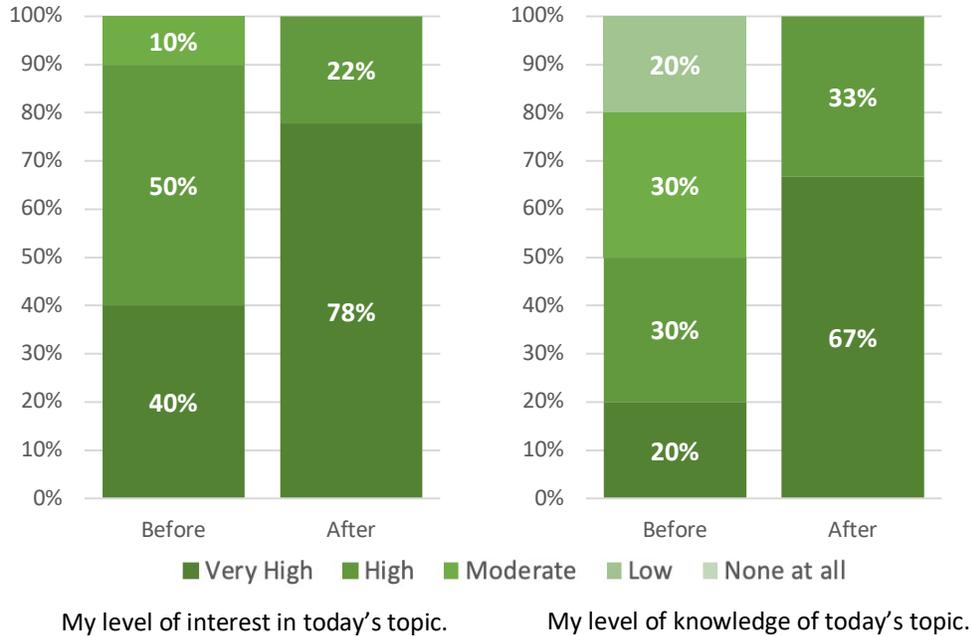


Figure 3: Participants' degree of interest in and knowledge of the topics included in the Animation session as measured both before (measured retrospectively) and after the session. (n=10)

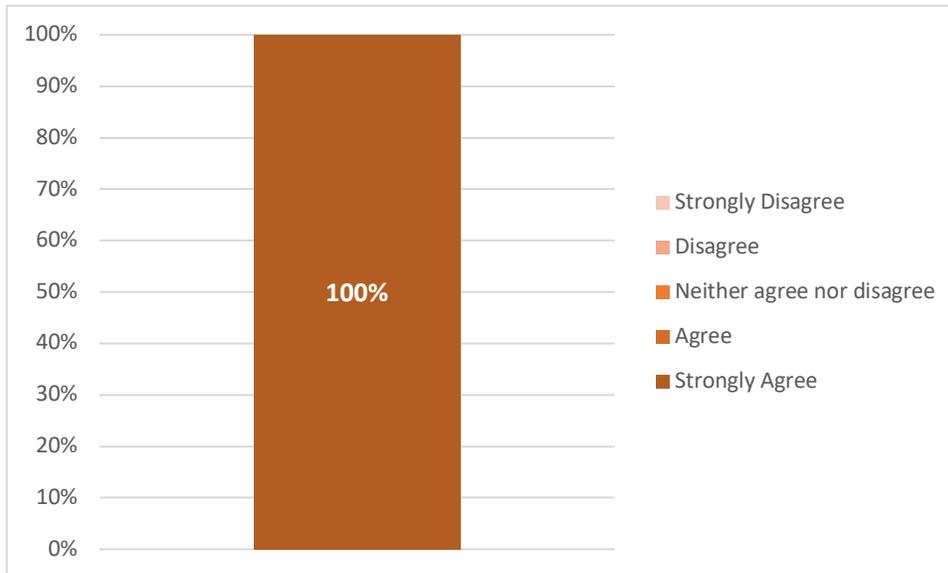


Figure 3: Perceived likelihood that participants will use the IRIS resources from today's session in their classroom (n=10)

Table 1: Topics participants would like to see IRIS offer at future NSTA conferences and the frequency they were proposed

Topic	Frequency
Magnetic reversals added to animation collection	1
Other aspects of IRIS and how to use it	1
I would like to see some kinesthetic based models that compliments the visual info online and the animations to get more leaning preferences addressed - more ways to connect to ideas	1
Structure and function	1
Sessions related to volcanism	1

Table 2: Suggestions for improving the Induced Seismicity session and their frequency

Improvement(s)	Frequency
Not presentation, but more engaging voice over (the current voice is very monotone)	5
Add magnetic reversals to Plate Tectonic overview	3
Not so much... good pacing and presentation	1

Table 3: Participant's responses to an item asking if there is anything else they wanted to share.

I really enjoyed the presentation
very well-prepared session
enjoyed - thanks
I appreciate the resources and the thoughtful way the session was designated and presented
Glad I came
Great job. Really enjoyed this session. Resource will be used FOR SURE!

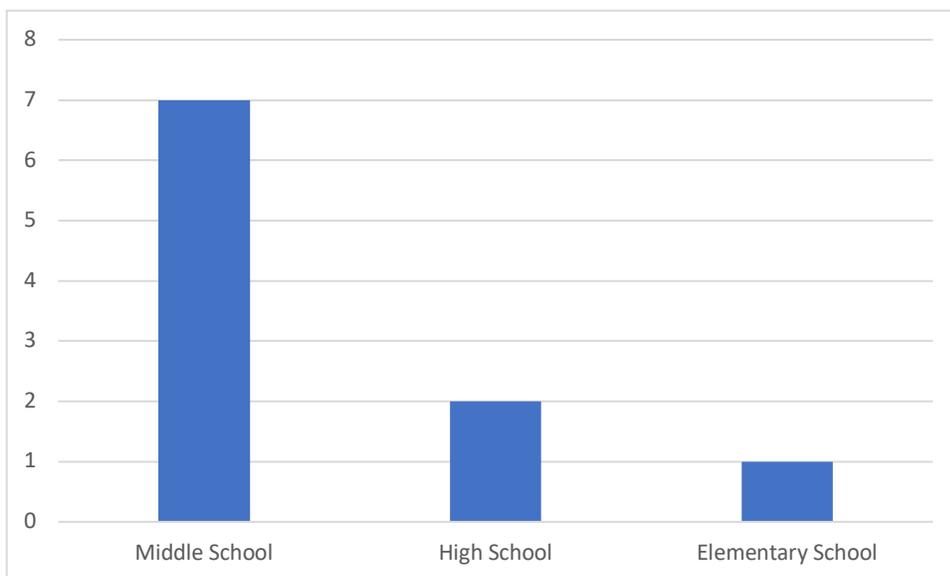


Figure 4: Distribution of participants' teaching situation (n=10)

Table 5: Participants' average teaching experience (n=10)

Max	32
Min	2
Average	19.6

Table 6: Results from external NSTA evaluation

Please indicate the degree to which you agree with the followings statements.	Average score (scale = 1 to 5, where 1=strongly agree)	(n)
I selected this session for immediate classroom use.	2.1	8
I selected this session based on the reputation of the speaker.	2.7	7
I selected this session to improve my personal pedagogical knowledge/skill.	2.2	8
I selected this session to improve my science content knowledge.	2.1	9
The session met my needs.	2.1	9
The information presented was clear and well-organized.	2.1	9
Safe practices were employed.	2.3	9
The session avoided commercial solicitation.	2.3	9
The session should be repeated at another NSTA conference.	2.2	9

## Appendix E: Results from Induced Seismicity Session Post-Evaluation

Table 1: Reasons participants attended this session and the frequency they were selected. Participants could select more than one statement or select "Other" and describe (n=30)

Statement	Frequency
Topic Sounded Interesting	20
Wanted to get resources for my classroom	18
I am familiar with IRIS and its products/resources	2
I have heard the presenters in the past	1
Wanted to improve my science content knowledge	14
Wanted to improve my pedagogical content knowledge (how best to teach these science topics)	16
Other (Please describe)	3
<ul style="list-style-type: none"> <li>• I have been trained in ADI so was interested in the topic</li> <li>• More data on fracking</li> <li>• Looking at cross-discipline ideas that would interest my kids</li> </ul>	

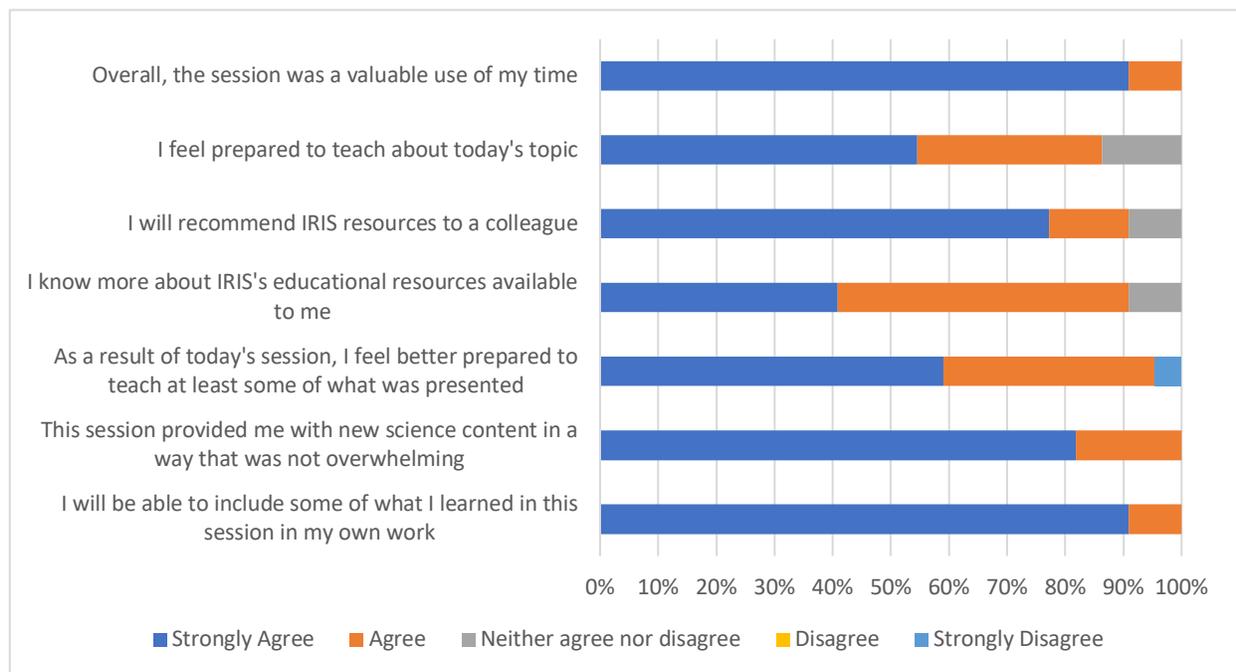


Figure 1: Participants' perceptions of IRIS's Induced Seismicity session at the 2018 NSTA national conference (n=22).

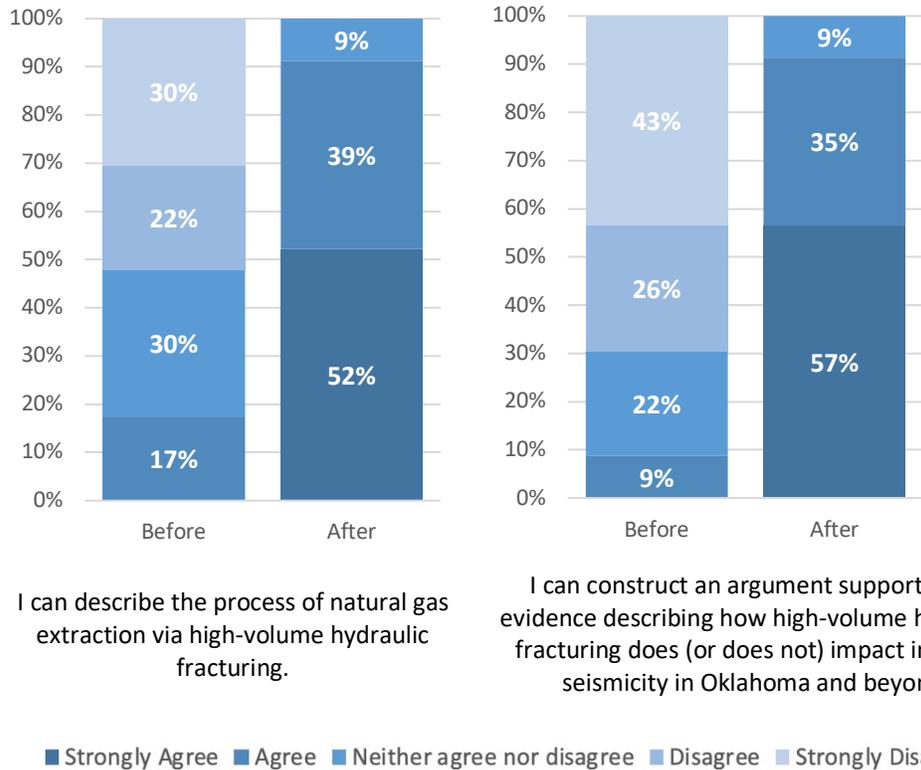


Figure 2: Participants' degree of agreement about their ability to describe the process of "fracking" and construct argument supported by evidence describing how high-volume hydraulic fracturing does (or does not) impact induced seismicity in OK and beyond. (n=23)

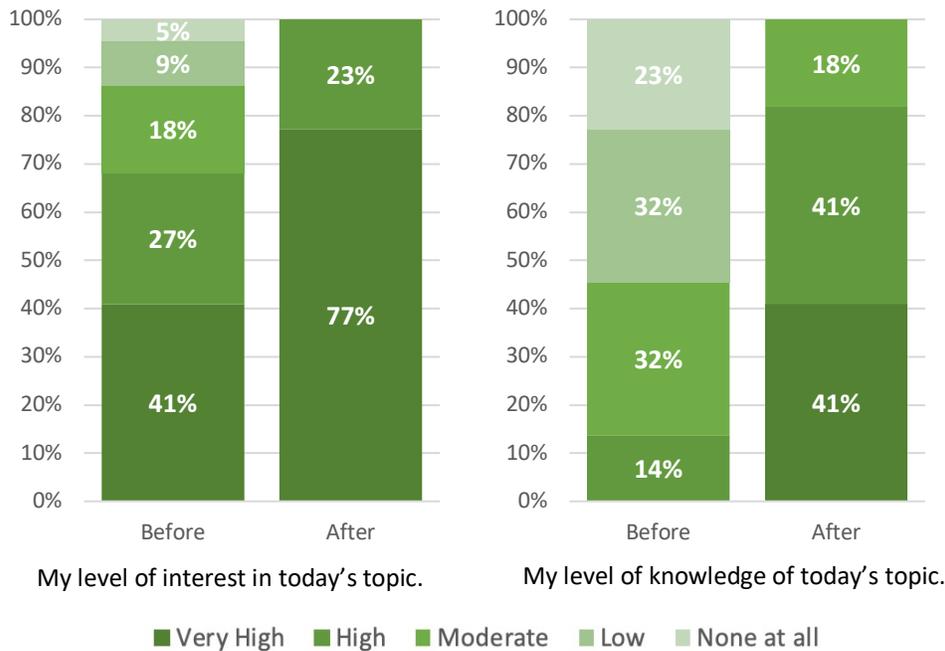


Figure 3: Participants' degree of interest in and knowledge of the topics included in the Induced Seismicity session as measured both before (measured retrospectively) and after the session. (n=22)

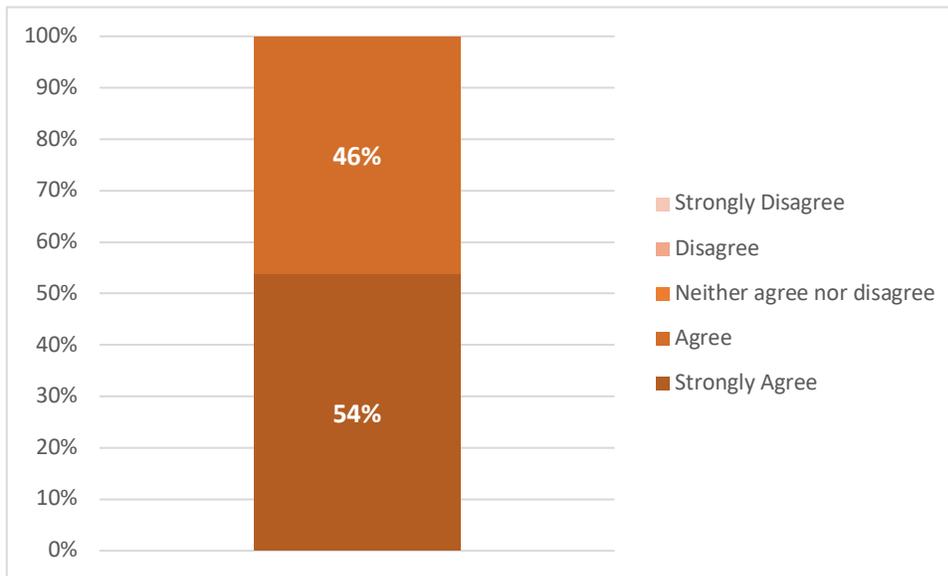


Figure 3: Perceived likelihood that participants will use the IRIS resources from today's session in their classroom (n=13)

Table 1: Topics participants would like to see IRIS offer at future NSTA conferences and the frequency they were proposed

Topic	Frequency
Plate tectonics	4
Design in buildings (and other structures) to prevent damage during EQ	4
Natural hazards	2
Earthquakes and seismic waves	2
Faulting and folding	2
Constructing isolines, examining geological relief maps (I don't know these)	1
EQ Prediction	1
Faulting and folding	1
Uneven distribution of natural resources	1
Any	1
How to incorporate engineering practices into any of these topics	1
Earth layers, using data how to analyze	1
Volcanoes	1
Tsunamis	1
Active wells and well sites not in use	1

Table 2: Suggestions for improving the Induced Seismicity session and their frequency

Improvement(s)	Frequency
No	5
More materials	3
Post slides in advance so we can follow along	1
Hearing impaired/ microphone	1
See examples of students work and specific strategies to teach ADI	1
Longer session	1
Explain IRIS resources and show us site	1
Wish I could have seen the last 2 components	1
Good job!	1
Smaller room, great job adapting though	1

Table 3: Participant's responses to an item asking if there is anything else they wanted to share.

I enjoyed seeing the ADI model showed in a real teachable lesson
great depth or knowledge by speakers
The session was very helpful - efficient and informative
Very easy to understand and create discussions
It was great!
N/A
I think I will implement this into my upcoming unit
Google drive share nice

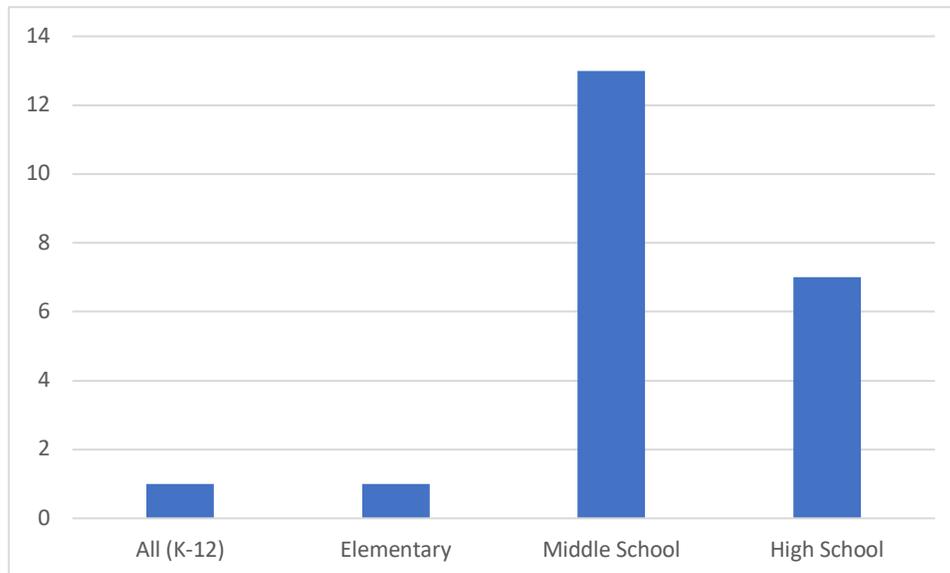


Figure 4: Distribution of participants' teaching situation (n=23)

Table 5: Participants' average teaching experience (n=23)

Max	30
Min	1
Average	9

Table 6: Results from NSTA's external evaluation of the session conducted separate from IRIS's session evaluation

Please indicate the degree to which you agree with the following statements.	Average score (scale = 1 to 5, where 1=strongly agree)	(n)
I selected this session for immediate classroom use.	1.6	8
I selected this session based on the reputation of the speaker.	2.8	8
I selected this session to improve my personal pedagogical knowledge/skill.	1.2	9
I selected this session to improve my science content knowledge.	1.2	9
The session met my needs.	1.1	9
The information presented was clear and well-organized.	1.1	9
Safe practices were employed.	1	9
The session avoided commercial solicitation.	1.3	9
The session should be repeated at another NSTA conference.	1	9

## Appendix F: Results from After an Earthquake Session Post-Evaluation

Table 1: Reasons participants attended this session and the frequency they were selected. Participants could select more than one statement or select "Other" and describe (n=30)

Statement	Frequency
Topic Sounded Interesting	22
Wanted to get resources for my classroom	26
I am familiar with IRIS and its products/resources	6
I have heard the presenters in the past	0
Wanted to improve my science content knowledge	15
Wanted to improve my pedagogical content knowledge (how best to teach these science topics)	17
Other (Please describe)	3
<ul style="list-style-type: none"> <li>• Teach it more</li> <li>• Wanted to learn to use the resources on the website</li> <li>• Wanted real time data and lessons to add to my 8<sup>th</sup> grade unit on waves</li> </ul>	

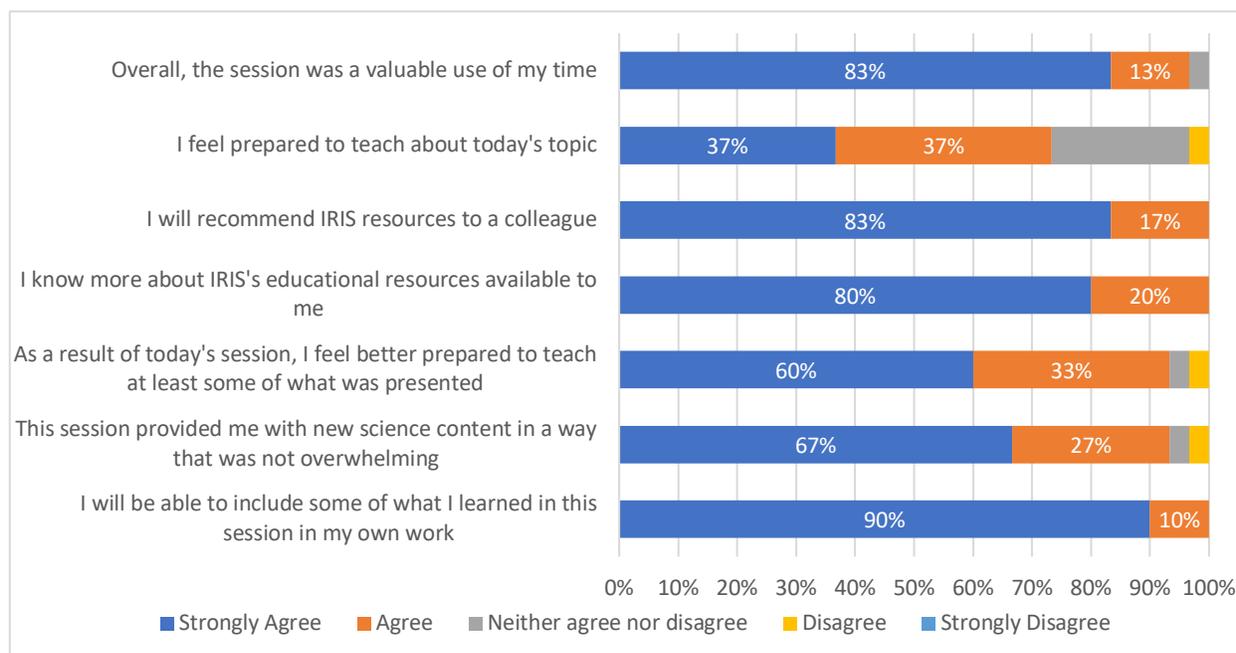


Figure 1: Participants' perceptions of IRIS's After an Earthquake session at the 2018 NSTA national conference (n=30).

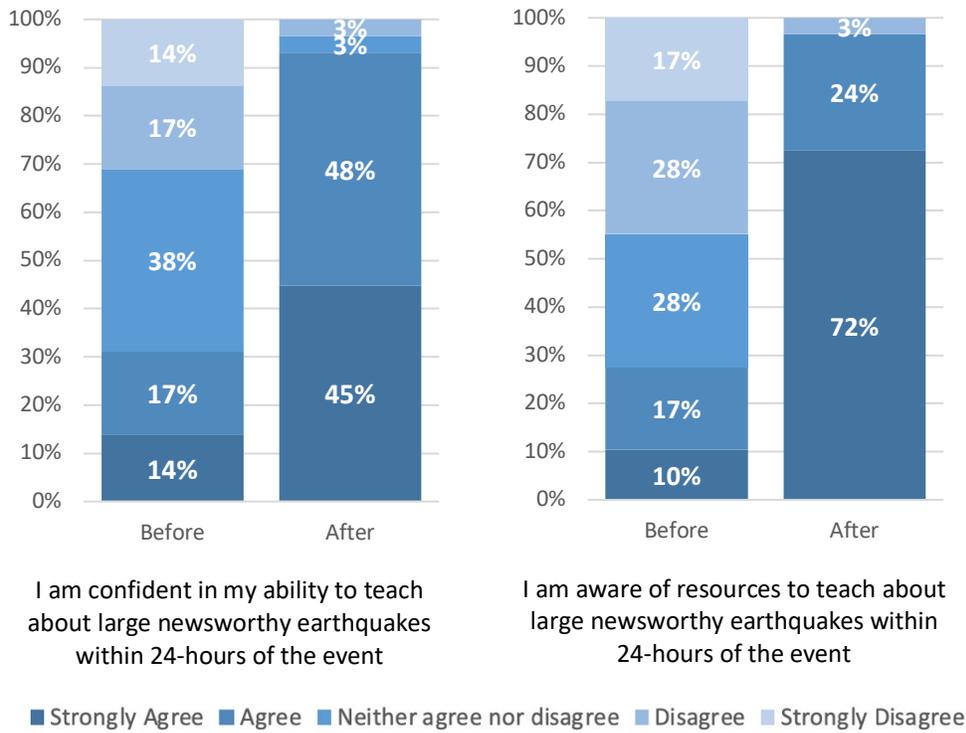


Figure 2: Participants' degree of agreement about their confidence in their ability to teach about large newsworthy earthquakes within 24 hours of the event, and their awareness of resources to support such instruction (n=29)

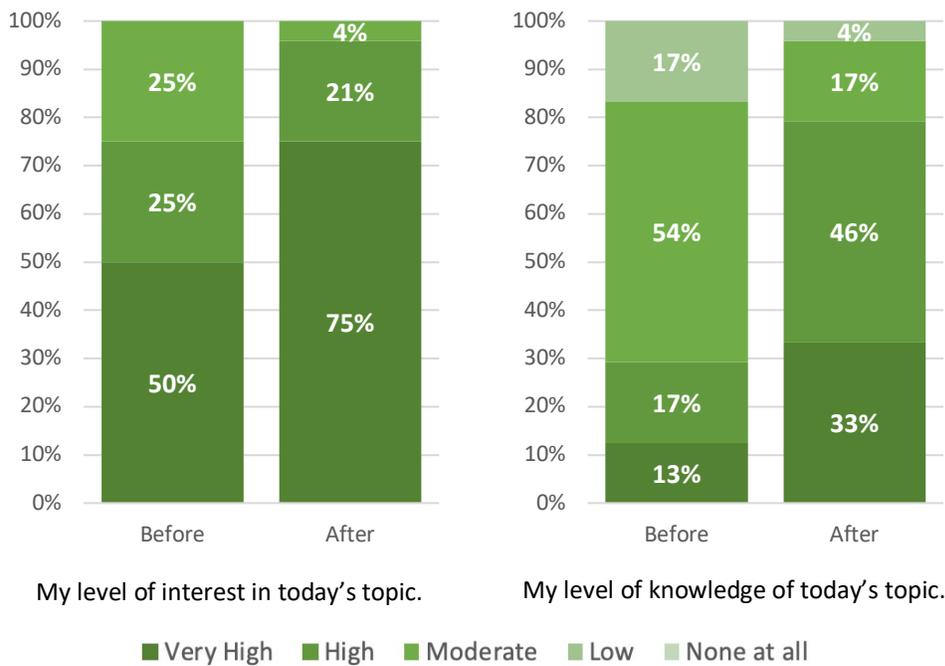


Figure 3: Participants' degree of interest in and knowledge of the topics included in the After an Earthquake session as measured both before (measured retrospectively) and after the session (n=24)

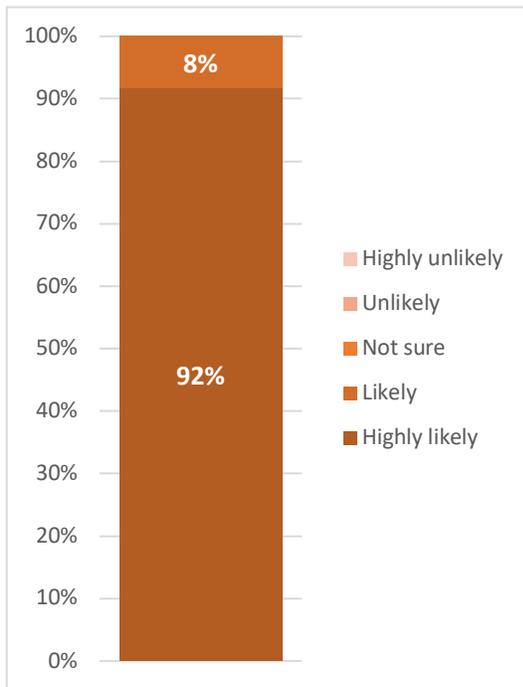


Figure 3: Perceived likelihood that participants will use the IRIS resources from today's session in their classroom (n=12)

Table 1: Topics participants would like to see IRIS offer at future NSTA conferences and the frequency they were proposed

Topic	Frequency
Tsunami	4
Nuclear Blasts	2
Volcanoes	2
Recent changes in plate movements & Tectonics	2
Earthquake risk assessment	2
Earth's Interior (For MS w/simplified data for evidence)	2
Hurricanes,	2
Tornadoes,	2
Wildfires	2
More about waves hitting outer core, making foam models of boundaries	1
Real time map or (of?) quakes	1
Early warning systems	1

Table 2: Suggestions for improving the After An Earthquake session and their frequency

Improvement(s)	Frequency
Longer session/more time	5
Improve navigation of IRIS site	2
Copy of ppt to look at with links	1
Actual lesson plans that integrate the resources	1
With the implantation of phenomena in our lessons it would be nice to have pictures or video clips to use	1
I think using a current phenomena and your materials would make things more tangible	1
No, this was great!	1
Storylines - N. Korea	1
Show navigation through website	1

Table 3: Participant's responses to an item asking if there is anything else they wanted to share.

I love this
great resources
just need time to show more details
Amazing!!
no - it was great
longer
Thank you!
Love it. Thank you so much
N/A
No

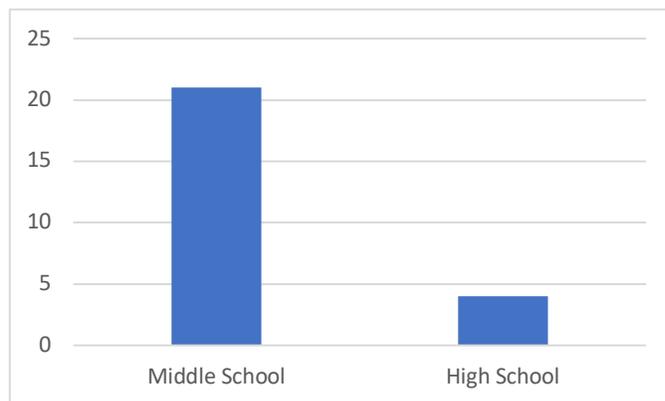


Figure 4: Distribution of participants' teaching situation (n=25)

Table 5: Participants' average teaching experience (n=25)

Max	31
Min	2
Average	11

Table 6: Results from NSTA's external session evaluation

Please indicate the degree to which you agree with the followings statements.	Average score (scale = 1 to 5, where 1=strongly agree)	(n)
I selected this session for immediate classroom use.	1	6
I selected this session based on the reputation of the speaker.	2	5
I selected this session to improve my personal pedagogical knowledge/skill.	1.5	6
I selected this session to improve my science content knowledge.	1.5	6
The session met my needs.	1.7	6
The information presented was clear and well-organized.	1.2	6
Safe practices were employed.	1.5	6
The session avoided commercial solicitation.	1.8	6
The session should be repeated at another NSTA conference.	1.3	6

## Appendix G: Example Social Media Promotions



**IRIS Earthquake Science**

Published by Wendy Clarey [?] · March 14, 2018 ·

Are you going to NSTA? Come and visit us at Booth #1043 for seismology and geology lessons, information, posters and fun!

You can also find us at these great sessions that highlight IRIS lessons, products and resources!

\* Ideas for Teaching About Earthquakes and Earth Structure in an NGSS Classroom Friday, March 16 9:30 AM - 10:30 AM

\*After an Earthquake: Real-Time Earthquake Data as a Hook to Encourage Answer-Seeking about the Geologic and Societal Context of the Event Friday, March 16 11:00 AM - 11:30 AM

\*Meet Me in the Middle Session: Middle Level Share-a-Thon Friday, March 16 2:30 PM - 4:30 PM

\*Yes, Humans Really Do Cause Earthquakes: Hydraulic Fracturing, Wastewater Injection, and Earthquakes Saturday, March 17 11:00 AM - 12:00 PM

\*Earthquakes, Earth's Structure, and Plate Tectonics Animations: Powerful Learning Tools for Earth Science Educators and Their Students Saturday, March 17 12:30 PM - 1:30 PM

<http://www.nsta.org/conferences/schedule2.aspx?id=2018atl>



**IRIS Earthquake Sci @IRIS\_EPO**

IRIS activities at **@NSTA** - Ideas for Teaching About Earthquakes and Earth Structure in an NGSS Classroom Friday, March 16 9:30 AM - 10:30 AM | **@NESTA\_US**

<http://www.nsta.org/conferences/schedule2.aspx?id=2018atl> ...



**IRIS Earthquake Sci @IRIS\_EPO**

Are you going to NSTA? Come and visit us at Booth #1043 for seismology and geology lessons, information, posters and fun!

<http://www.nsta.org/conferences/schedule2.aspx?id=2018atl> ...  
[pic.twitter.com/dTJ76zbMek](http://pic.twitter.com/dTJ76zbMek)

## Appendix H: 2018 NSTA Booth Exit Interview Guide and Results

During the 2018 NSTA national conference 30 attendees who visited the IRIS booth were asked to complete a short semi-structured interview about their experience, what brought them there, and what they might use and share. Interviews were all conducted on the second day of the show.

### Summary

- Nearly all said they recognized the NASA logo (97%) and the USGS logo (93%) with a high percentage recognizing the IRIS logo (80%). For those that recognized the IRIS logo, most knew it primarily from other visiting the IRIS website, or from seeing it while at the booth.
- All of the 30 educators (100%) reported learning about one or more resources while at the IRIS booth and intend to incorporate what they learned into their classroom lessons and projects, download and use the data, visit the website more, and engage their students. Nearly all felt confident (40%) or very confident (53%) that they would be able to access the resources they identified later.
- Most (90%) of the educators knew that what IRIS offers is free.
- All of the educators (100%) would recommend IRIS educational resources to a colleague. When asked what they would say to a colleague, they noted they would say things emphasizing that it is a great website with resources that are free and that it can be used in support of what they are doing.
- A variety of factors attracted attendees to the booth. However, visuals elements such as words like “Earthquakes” and “Free”, and the animations on the screens were the mostly commonly identified.
- More than half of the educators (62%) reported not seeing the IRIS eblast.
- Most of the visitors to the booth (62%) had not attended an IRIS session, yet many intended to do so and took the listing of sessions from the booth.
- Of the four educators who had attended a session the previous day, 3 remembered hearing about the IRIS booth while at that session.
- Interviewees reported having taught for an average of 14 years. Most were teaching at the middle school (52%) or high school (40%) levels. Earth Science was the primary teaching responsibly for 72% of interviewees.

## Survey Results

1a) Which of the following organizations have you heard of or seen before?

	N	%
	0	0
	28	93%
	24	80%
	0	0
	29	97%
	9	30%

1b) (If IRIS identified) How do you know the IRIS logo?

- *Have been to the website (6)*
- *Saw it today (5)*
- *NSTA – previous conference (3), email (3)*
- *Took classes with Larry*
- *New York Teachers Association and through Lamont presentations*
- *From the worksheet*
- *In an article*
- *Took a picture of the logo yesterday*

2) While at the IRIS booth, did you learn about one or more resources that you intend to use or explore?

- 100% = yes

3) How do you intend to use that/those items?

- *Excellent resources (7) Website - locate earthquakes on the website with students. Website for personal use. Engineering vide with gifted students. Good source of seismographic examples and how they are applied*
- *Access to real data (6) E.g. Plate tectonics from the real live data*
- *Website access for student explorations (2)*
- *Animations within lessons in the classroom (2) Animations of waves through the earth*
- *Teachable moments (2)*

- *With my classroom and to develop lessons*
- *Inquiry lab about earthquakes and what causes earthquakes*
- *Going to use the lesson that we talked about – block and sandpaper*
- *Students in class lesson*
- *Do an earthquake unit so will look at lessons and videos*
- *Cut version with 6th graders*
- *Devotedly because first semester is earth structures*
- *Edge and student interactions*
- *Classroom and down.*
- *Working with my large ethnic population and that helps*
- *High school students need to learn about waves and will use the models.*
- *Will share with my colleagues that will teach Earth Science next year*
- *Still have a hard time with fully understanding why earthquakes are happening*
- *I'm a curriculum coach so I will incorporate into our NGSS and add it back in*
- *Incorporating Ng into unit t on earthquakes and with home school and trying to build open courses for the kids and free is best*

4) How confident are you that you will be able to access that/those item(s) later?

	N	%
Very confident	16	53%
Confident	12	40%
Somewhat confident	2	7%
Not yet confident	0	0

### Overall perception of IRIS resources

5) Does IRIS charge to access and use any of the resources that you explored?

	N	%
Yes	1	3%
No	27	90%
Unsure	2	7%

6a) Based on what you saw at the booth, would you recommend IRIS's educational resources to your colleagues?

- 100% = yes

6b) If so, how would you describe them?

- *Great/interesting and free (7)*
- *Have the other teachers/colleagues use it (6)*
- *Seems like it has a lot of good resources (3)*
- *Organization that tracks seismic activity and makes resources available*
- *Website (3)*
- *I help develop curriculum and aligning NGSS (2)*
- *Earth science at conference*
- *For a few that will teach the same things*
- *Send the teachable moments and at department meeting and the format is always the same is good too*
- *Owe my good this is so cool and you have to see this*

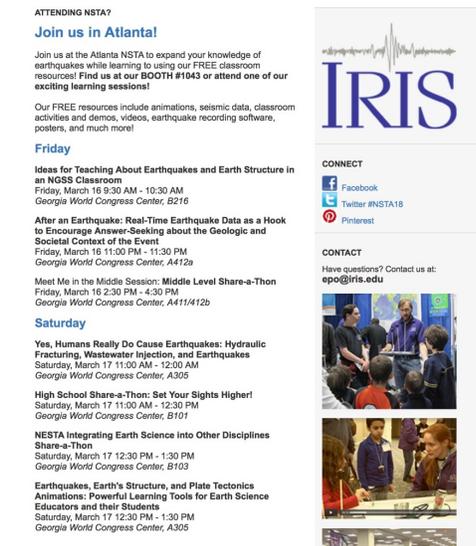
- With the engineering department
- Share the paper resource and the lessons and the animation
- Will try to. Show the depth part and the kids can go look at the data
- Great to incorporate the different topics and social justice
- Will share with other home me schoolers and with school colleagues

**Attraction of visitors to the booth**

7) Describe what attracted you to stop at the IRIS booth?

- Earthquakes (3)
- Been to the website (2)
- Listserve (2)
- Free poster (3) and slinky
- NSTA before come back for anything new
- Animation/Simulation on the screen (3)
- Ice core and seismic readings
- Been here before. Simulators are great and would like to see some on the website
- So much more info and interesting than PowerPoint
- Went to a session earlier
- Interested in the topic
- Being about earth science

8) Did you see or receive this email announcing the IRIS Booth



	N	%
Yes	11	38%
No	18	62%

9) Did you attend an IRIS session (Friday and Saturday interviews only) (N=13)

	N	%
Yes	4	31%
No	9	69%

9a) If yes, did you learn about the IRIS booth from the session? (N=4)

	N	%
Yes	3	75%
No	1	25%

### Demographics

10) What level do you teach?

	N	%
Elementary	0	0
Middle	16	53%
High	12	40%
College	1	3%
Not a teacher or instructor	1	3%

11) Which of the following best describes your primary teaching responsibilities?

	N	%
Biology	0	0
Chemistry	1	3%
Earth Science	21	72%
Physics	3	10%
Elementary	0	0
Environmental Science	1	3%
Physical Science	0	0
Integrated/General Science	3	10%
Other	0	0

12) How many years have you been teaching?

- Range 1 – 31
- Mean – 14 years