Chasteen Educational Consulting

Get the Facts Out: 2021 Annual Evaluation

Stephanie Chasteen (Chasteen Educational Consulting), with assistance from Glen Davenport (Elegant Insights)

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Evaluation Questions

Get the Facts Out is at the end of its third year of activity, and this report summarizes the observed progress and open questions at this point in the grant. The evaluation focuses on whether the project is on track to achieve its intended impacts.

This annual review is guided by the following evaluation questions:

Are the project processes and products likely to lead to the successful achievement of the vision?

1. **Continuous improvement:** Is the project improving and evolving over time? What potential barriers has it successfully overcome, what challenges remain?

2. **Champion engagement:** Is Get the Facts Out engaging an adequate number of local champions and which materials are they using?

3. **Change Agent activities.** To what degree are Change Agents reaching faculty to spread the messages of GFO?

4. **Professional development.** How well are the project professional development approaches working to spread project messages and engage champions?

5. **National reach**: To what degree does Get the Facts Out as a project have the potential to reach its intended national scale based on awareness across professional societies?

Data reviewed for this report include the following:

1. Project responses to evaluation feedback.
2. 2021 Annual reports submitted by PIs and working groups.
3. Change Agent activity tracking forms
4. Website tracking statistics
5. GFO Workshop survey results
6. Previous evaluation reports:
    a. 2021 Society Survey report
    b. 2020 Annual Evaluation report
    c. 2021 PI and AMTE interview report
    d. 2021 Champion Pilot interview report
    e. 2020 Change Agent FSI report

Executive Summary

Get the Facts Out is an ambitious project, aiming to address a complex, systemic problem (the lack of qualified K-12 STEM teachers) through tested marketing campaign which addresses most levels of the educational system. In the first two years of the project, it focused on developing structures, materials, resources, and outreach to achieve its vision. This year the project focus has (appropriately) shifted to engaging, tracking, and supporting the local faculty ("champions") using the materials.

The most substantive successes of the project this year are:

[1] Significant engagement of champions across disciplines.

As a whole, the data in this report conveys the depth of effort and activity that has occurred within the project. For example:

- 345 people on the email list, and 206 on the Facebook group, with an open rate and click-through rate on the newsletter that demonstrates its value.
- 113 engaged champions from 89 institutions, of which at least 65 are active, and 15 are *very* active. Champions conduct mostly one-on-one conversations, student presentations, and use posters and fliers, as they reach student audiences.
- Many champions make positive comments when entering their activities. For example, "We love your work. It is an excellent resource," and "Thank you for the phenomenal work that you do!"

[2] Significant and expanded contact with intended audiences reaching over 5000 people (this year) and an estimated 1000 institutions (to date).

Across champions and change agents, many faculty and students were reached.

- Champions conducted 32 student presentations (reaching ~1055 students) and 22 faculty workshops (reaching ~560 faculty members).
- Change agents conducted 73 activities: 26 chemistry, 12 math and 35 physics.
- GFO/Mines staff are incredibly active conducting over half of registered activities and reaching many faculty and students.
- A total of 138 workshops were conducted by change agents and PIs/staff: 26 by chemistry, 11 by mathematics, 33 by physics, and 68 by GFO staff. 41% of these are regional or national.
- Across champions, change agents, and GFO staff, a total of 81 student presentations, and 105 faculty workshops were delivered in Year 3. These have reached approximately 5200 people (2700 students and 2500 faculty). This is an expansion of almost 4 times the number of audience members reached in the previous year.
- Across Years 2 and 3, as many as 1029 institutions have been reached by the project (~615 Physics, ~166 Chemistry, ~248 Mathematics).

Table: Student and faculty presentations conducted by GFO in Year 3				
	Student presentation		**Faculty workshop**	
	Number	Est. participants	Number	Est. participants
Champions	32	1055	22	560
Change agents	24	1090	36	977
PIs/staff	25	596	47	971
Total	**81**	**~2741**	**105**	**~2508**

[3] Highly effective professional development workshops.

Analysis across workshops with pre/post results show that these workshops and presentations are highly effective for multiple presenters:

- 42% gain / 54% normalized gain for student presentations (1.98 effect size)
- Shift in student perceptions towards seeing teaching as a good career, that it pays similarly to other careers, and less negativity towards becoming a teacher.
- 43% gain / 60% normalized gain for faculty workshops (2.07 effect size).
- Shift in faculty perceptions towards seeing that teaching pays similarly to other careers, and becoming more comfortable with a favorite student becoming a teacher.
- Adequate fidelity of implementation for the average workshop.

[4] Significant national reach in terms of awareness and website use

A study of national reach demonstrated impressive results:

- 20,186 unique website sessions and 31,680 pageviews, which have grown over time to over 3000 sessions per month.
- 1584 GFO materials downloaded, though these rates have levelled off.

[5] A surprising fraction of society members are aware of GFO, though typical society members do not necessarily see the value of GFO.

Across all respondents, 24% had heard of GFO, or thought they might have, though many of these positive responses are due to the high awareness among AAPT/PhysTEC members. The greatest awareness is among those who are members of both APS and AAPT (40%) or PhysTEC. Additionally, 9% spontaneously indicated that they would turn to GFO (even before it was revealed that the survey was about GFO). Awareness of

GFO was not as high among members of the more traditional scientific societies (APS and ACS); just 8% and 5% respectively. However, this is considered a surprisingly high fraction for those traditional societies. Most have heard of it through newsletters and conferences from the society, as well as from colleagues. In the society survey, those who were not aware of GFO did not typically plan to visit the website. They may need a more thorough intervention to see the value. Survey respondents had several good suggestions of how to spread the word about GFO.

[6] A wide variety of dissemination mechanisms and continuous iteration of project activities.

The project has engaged in extensive continuous improvement, flexibly and dynamically evolving over time to address issues of time, communication, messaging, and scaling. The data in this report shows an extensive array of activities as partners attack dissemination from every angle, from social media, to an effective newsletter, to engaging champions and supporting them in novel ways, to conducting workshops.

[7] A strong early showing by Mathematics/AMTE

Despite this being the first year of involvement in GFO, AMTE has garnered much success, including:

- 11 workshops by Mathematics change agents, a large percentage of which are national or regional (54%), and a large percentage of which are faculty-facing (82%).
- 32 champions
- 248 institutions reached, over 200 of which were in the last year of the project.

Last year I indicated that number of faculty reached by the change agents may be adequate to reach the desired national reach, *if* the following conditions were met:

1. The workshops are persuasive, using the critical features of Get the Facts Out (i.e. fidelity of implementation).
2. The number of national, faculty-facing workshops are increased, especially for chemistry.
3. The workshops include faculty from a variety of institutions of higher education.
4. The workshops include a bid for faculty to "get the facts out" as local champions.
5. The workshops are accompanied by strong national campaigns for repeated exposure to the messages of GFO.

To date, all of these criteria have been met. This is a significant accomplishment.

The primary challenges of the project at this point are:

[1] Many activities are local

Across the activities reported by change agents and PIs, only 47% of activities and 41% of workshops were national or regional. Given that the focus of GFO is on persuading many faculty to take up GFO locally, I feel the regional and national focus should grow significantly in order to reach these local actors.

[2] Less expansive outcomes from Chemistry, with less focus on faculty

Across many measures the outcomes from Chemistry are not at the same level as the other disciplines, such as:

- Chemistry change agents are conducting equal numbers of faculty and student-facing workshops, but a greater number of students are being reached through those workshops.
- A lower number of estimated institutions reached (166 compared to 248 in Mathematics and 615 in Physics).
- 8 Chemistry champions (compared to 47 Physics and 32 Math)
- Only one Chemistry champion conducted a student workshop (compared to 17 Physics and 7 Mathematics).
- Lower awareness of GFO among society members (5% compared to 8% in APS and 27% in AAPT). Out of 350 ACS respondents, 50 suggested emailing the membership about GFO.

The low count of national, faculty-facing workshops in Chemistry is likely contributing to the lower awareness, and lower activity of chemistry change agents. However, Chemistry is perhaps in the toughest spot of the 3 disciplines in that it is a society for research-focused professionals (compared to AMTE, which focuses on teacher education), and does not have an existing depth of community building around teacher education (as does APS/AAPT/PhysTEC).

[3] Study sites are a nexus of activity

GFO Study Sites account for half of champion institutions, and are more active in conducting activities (including student presentations): 70% of GFO study sites conducted at least one activity (compared to 50% at other institutions), and 64% have done a student presentation (versus 26% at other institutions) . This in itself is not a bad thing, but engaging champions beyond study sites is also important. Non-GFO site champions may not be aware that student presentations are a powerful intervention.

[4] The main places that society members seek career information are not a focus of GFO.

In the society survey, those who mentor undergraduates were asked where they find information about K-12 teaching careers. Most explained that they would reach out to

teachers, including former students who are teachers (31%), and to their local schools of education (47%). This was especially true of ACS members. Neither of these audiences are a focus of GFO. Respondents suggested these audiences, and others, as the target of additional dissemination from GFO.

Recommendations

1. **Continue the good work** of engaging across disciplines and tracking champions. Additionally, encourage more conversation across societies and change agents about what they are doing and what is working.

2. **Continue to spread the word about GFO in societies through multiple mechanisms**. Awareness is growing but still modest, and is higher among audiences that have received multiple touches about GFO (i.e. APS/PhysTEC/AAPT audiences). Use newsletters, conferences, presentations, workshops, webinars, and more. Society survey respondents suggested emailing the entire society about GFO in a solo email, and including a little bit in every society newsletter. They also suggested paper flyers, social media, a "program in a box," and featuring GFO in society periodicals. Given that many respondents would start with internet searches, is the GFO site adequately SEO-optimized? Additionally, I suggest you review the data in the report on the tracked website links; who could be promoting the website more actively?

3. **Include dissemination to K-12 teachers and schools of education.** These are go-to places for many of the professionals we surveyed (and the first place that many would begin to seek out information). If these audiences know about GFO, they are likely to be able to spread the word to their disciplinary faculty colleagues. The successful efforts of STEP-UP to engage K-12 faculty might be leveraged. Survey respondents also suggested reaching out to state departments of education and Noyce sites.

4. **Include dissemination to chairs, deans, society chapter leaders, and student chapter leaders.** These were suggested audiences from the respondents to the society survey.

5. **Encourage non-GFO site champions to use student presentations and conduct activities.** Give them specific recommendations of what to do and ask them to log their activities each semester.

6. **Focus change agent activities on regional and national workshops.** I would like to see the percentage of activities and workshops that are at this scale grow.

7. **Engage in strategy for Chemistry/ACS national activities.** Chemistry's reach is lowest among the three disciplines. That said, Chemistry is perhaps in the toughest spot of the 3 disciplines in that it is a society for research-focused professionals (compared to AMTE, which focuses on teacher education), and does not have an existing depth of community building around teacher education (as does APS/AAPT/PhysTEC). In particular what could be improved is the number of faculty reached through change agent workshops, the number of institutions

reached, increased focus on recruiting Chemistry champions, and encouraging existing Chemistry champions to conduct student presentations. Consider whether you might need to expand the change agent group to include those with additional expertise or connections. National dissemination may need to be enhanced to increase general awareness as well: Particular recommendations from ACS members were emails to society membership (mentioned by 50 out of 350 respondents), inclusion in the ACS newsletter, banner ads in C&EN, local ACS chapters, and student ACS groups, and AACT.

In the body of this report I outline the evidence and findings leading to these recommendations.

Question 1: Continuous improvement

Is the project improving and evolving over time?

In the 2020 annual report I made the following recommendations, phrased as questions to address. In this section I identify how these recommendations have been addressed.

1. **TIME: How might we make time spent on the project most effective and manageable, for all involved?**

The project has addressed this concern in many ways: (1) Identifying a set of project priorities to hone their focus (2) Delegating leadership from PI Adams to other supportive staff, including David May (APS), Drew Isola (AAPT), and (3) PI Adams does not serve on all working groups on the project, which helps protect some of her time. Thus, while time is still a challenge for the project, the leadership have been actively experimenting to distribute the load and avoid scope creep.

2. **COMMUNICATION: How might project communications support information-sharing among the right people?**

The project has enacted a great many communication mechanisms to address last year's recommendations, including (1) Keeping track of local champions so that the project can communicate with them and find out what they are doing, (2) Honing the monthly newsletter to be an effective communication tool, (3) Tasking Drew Isola to attend all change agent meetings across disciplines to provide a "glue" across the project and ensure all have adequate information, (4) Publishing frequent blog articles and pushing GFO on Facebook and social media, and (5) Embarking on a website revamp. The engagement of both Drew Isola and David May in the Champion Engagement Strategy and associated working group has also greatly improved cross-project connections. However, a champion listserv has yet to materialize, and would be valuable.

3. **PROFESSIONAL DEVELOPMENT: How might the right people get the expertise they need about implementing GFO effectively?**

The project has also addressed this recommendation deeply, including posting Fidelity of Implementation checklists within workshop materials and the website, engaging with champions around their presentations, offering champions and change agents survey results from their workshops, running All Change Agent meetings, and planning an All Champion meetings and a Champion Mini Conference.

4. **SCALING: How might the project define and achieve the desired scale?**

The project has also explicitly addressed this recommendation by (1) Identifying top priority initiatives, tagging them as addressing "breadth" or "depth" in order to ensure that reach is both broad and deep, (2) Identifying national campaigns as a high priority initiative, and (3) Offering a variety of national webinars. These efforts have borne substantial fruit as shown by this report, in terms of numbers of faculty and students reached. However, awareness of GFO as a project remains low among societies and will need to be a continued focus.

Question 2: Champion Engagement

Is Get the Facts Out engaging an adequate number of local champions, and which materials are they using?

Significant effort was spent in 2020-2021 on identifying mechanisms to gather information on GFO Champions, and how they are using GFO. The data in this section is based on the Activity Registrations from GFO Champions, Champion Registrations, and identified people using GFO who have not registered as Champions ("little c" champions). Data up through 5/21/21 was included in this report; activities are continually being added by champions and an additional 17 were added in the two weeks since the data collection was closed.

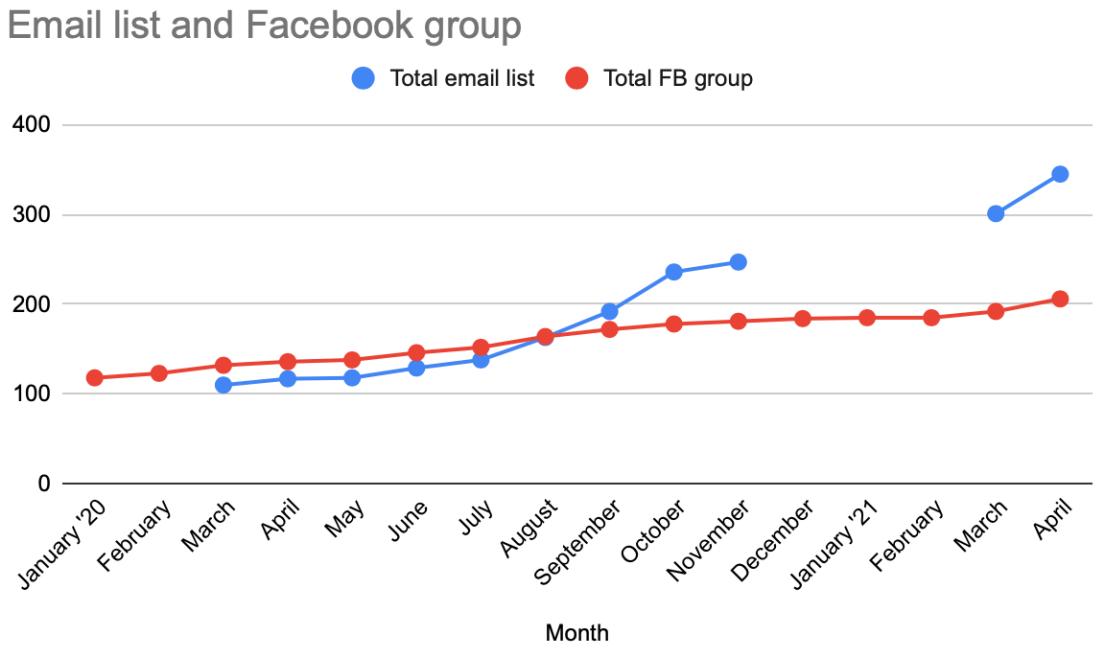
Email list engagement

Facebook and email list. One estimate of engagement is the number of people who engage with the email list and Facebook group.

345 people are on the email list, and

206 are on the Facebook group.

These numbers have grown steadily over time and represent significant engagement; see below.



Newsletters. The newsletters have an average of

36% **open rate** and

12% **click through rate.**

These are both higher than industry average (2-4%), and the click-through rate has increased from 5% on average in 2020 to 19% in 2021, demonstrating the project's iterative improvement of the newsletter to meet audience needs.

Number of champions

113 **unique individuals** are Champions representing 89 **unique institutions**

- **77 registered** as Champions; the others were added manually by the GFO team.
- **44 at GFO research sites** (32 at study sites, 12 at Comprehensive sites)
- **25 at PhysTEC sites**, all of which are are at GFO study sites
- **69** are not at a GFO or PhysTEC site.
- 47 are physics, 32 are Math, and 8 are chemistry. The remaining 26 are other disciplines.

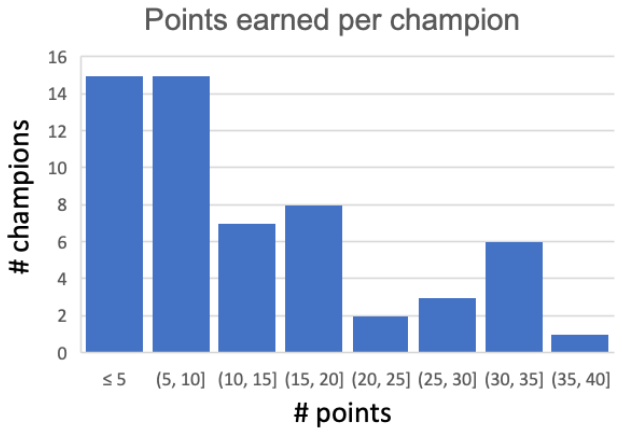
About **70%** of Champions in each of those disciplines are active Champions with at least one registered activity; see table below.

Discipline	1+ Activities Recorded	No Activities Recorded	Total
Physics	33	14	47
Math	21	11	32
STEM	5	9	14
Chemistry	4	4	8
Education	1	5	6
Biology	1	2	3
Administrator		2	2
Environmental		1	1
Grand Total	65	48	113

Of these 113 champions, 48 individuals have no recorded activities[1], so there are a total of

65 **active champions.** Of these, 58 have scored points on the website, and 7 have "other" activities listed that did not score points. The number of points scored are most commonly between 2-7 points (N=25), but several earned more than 7 points, showing a range of engagement.

15 **super champions.** In investigating the point range (see histogram below), it is somewhat unusual for a Champion to earn more than 20 points. A total of 15 champion[2]s earned more 20 or more points. These represent the most engaged champions. These "super champions" were often in physics (N=9), and N=11 ran faculty workshops. Otherwise, they have no clearly defining characteristics.



Champion activities

One-on-one conversations and student presentations dominate the use of GFO, but posters, fliers, and faculty workshops are a significant part of the outreach efforts. All materials are used by at least some Champions. Brochures, Data handouts, and social media are rarely used.Below are the counts of activities conducted by those champions (note that team activities will be double counted).
Eliminating double-counted activities, champions have conducted

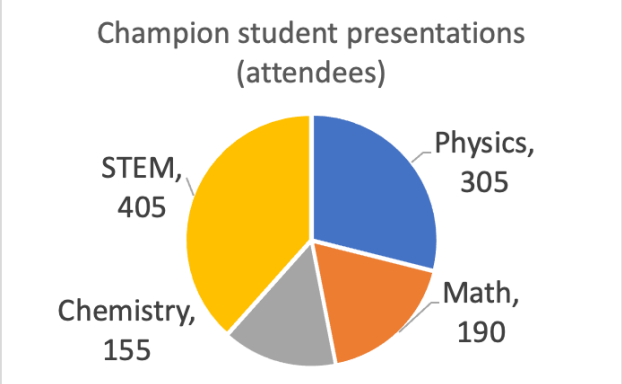
32 **student presentations** reaching 1055 **students**

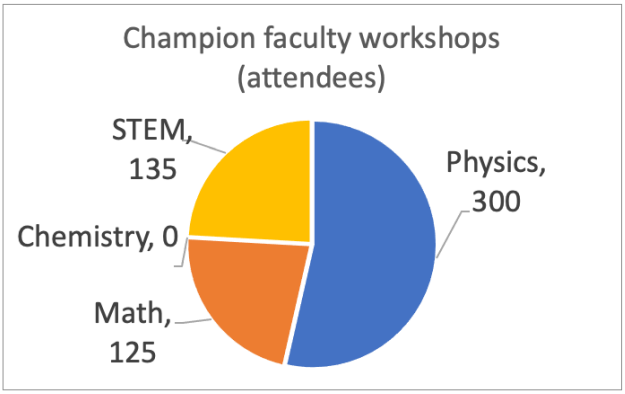
22 **faculty workshops** reaching 560 **faculty members.**

[1] Of these, 16 are marked as 'registered champions,' 17 signed up for the newsletter, 14 were sent the request for data, 42 were either assigned a change agent or had a program contact listed.
[2] Not included is one outlier champion earning more than 85 points; an engaged faculty member at Mines. Three earned exactly 20 points and are thus included in the 15-20 point bin.

GFO Activity	Number reported
One-on-one conversation	60
Student presentation	46
Posters	33
Fliers	29
Faculty workshop	26
Survey	21
Research local data	16
Brochure	12
Data handout	9
Social media	5
Other	10
Total activities (double counts team activities)	*267*

All disciplines are reached. When analyzed by discipline (below), these presentations are reaching a variety of disciplines, including mixed STEM audiences. However, **Physics** dominates the faculty workshops, and fewer **Chemistry** faculty and students are reached than other disciplines.





One-third of physics, math, and STEM Champions do student presentations -- but Chemistry Champions typically do not. In order to better understand which Champions are running student presentations (a critical intervention for the Champion population), we investigated the discipline of those who did at least one student presentation. Approximately 20-30% of Physics, Math, and STEM Champions did one student presentation (N=16 physics, 34%; N=7 Math, 21%; N=4 STEM, 28%). However, only 1 Chemistry Champion did a student presentation (N=1, 13%); other Chemistry-facing workshops were conducted by Champions in other disciplines. When investigating who is conducting faculty presentations (a sign of high engagement), these were conducted by 11 different Champions, but most by 1 Mathematics

faculty (N=4 email communications), 2 mixed STEM (N=5 presentations), and 3 physics faculty (N=8 presentations).

Champions at GFO sites are more active in conducting activities, including student presentations, than those at non-GFO sites. Among those at GFO sites (study sites and comprehensive sites) 70% recorded at least one activity, compared to only 50% of those at non-GFO institutions. Among those who have done at least one activity 64% of those at a GFO site conducted at least one student presentation, versus just 26% of those at non-GFO institutions. See tables below. This suggests that those at non-GFO institutions may need additional encouragement to use student presentations and to do activities in general.

For all Champions…	**1+ Activities Recorded**	**No Activities Recorded**	**Grand Total**
Champion's position is at a GFO site	31	13	44
Champion's position is *not* at a GFO site	34	35	69
Grand Total	**65**	**48**	**113**

For those conducting activities….	**1+ Student Presentations**	**No Student Presentations**	**Total**
Champion's position is at GFO site	20	11	31
Champion's position is *not* at a GFO Site	9	25	34
Total	29	36	65

Question 3: Change Agent Activities

To what degree are Change Agents reaching faculty to spread the messages of GFO?

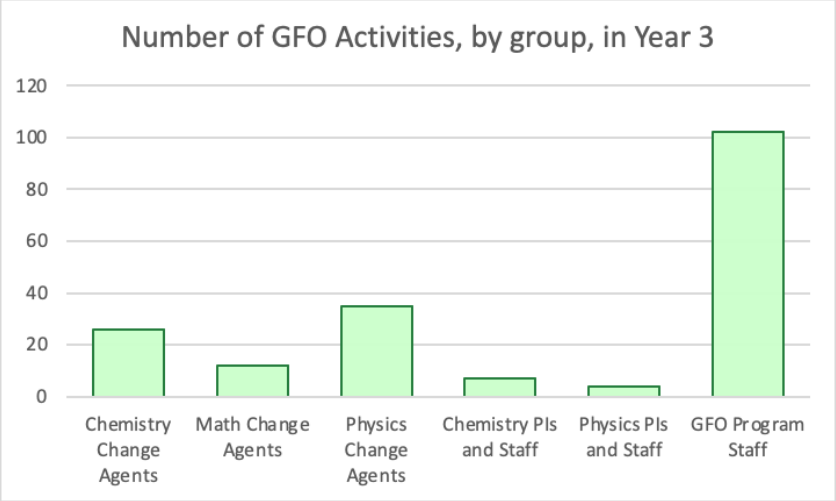
Number of Change Agent Activities

Based on activities entered in the change agent tracking sheet (up through 5/25/21):

186 **activities were conducted**, *(compared to 59 last year)* of which

73 **by change agent**s (the others mostly from GFO Program Staff [3]).

GFO Program staff **dominate the activities**, as can be seen in the graph and table below.

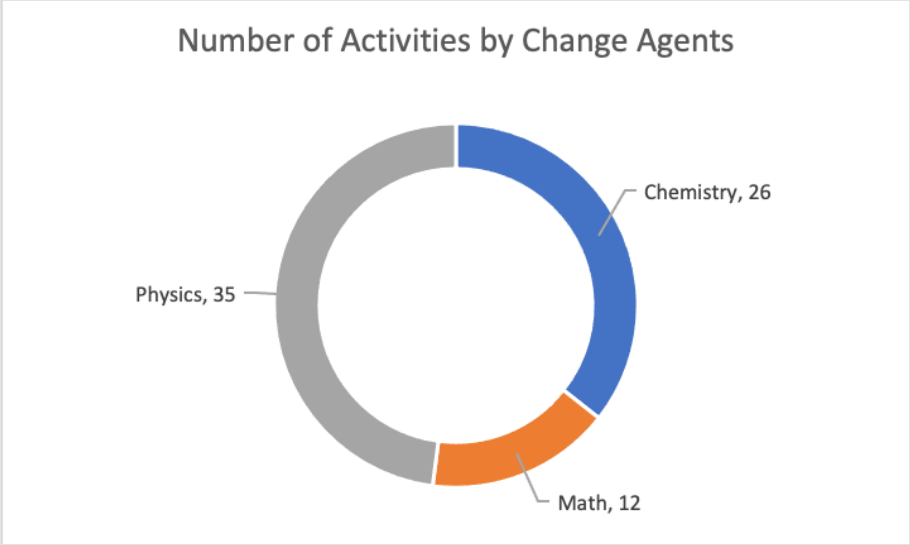


Category	# Of Activities
Chemistry Change Agents	26
Math Change Agents	12
Physics Change Agents	35
Chemistry PIs and Staff	7
Physics PIs and Staff	4
GFO Program Staff	102
Total	186

Note that 10 additional activities were logged by 4 of the former MAA change agents.

[3] "Program staff" include Adams, Isola, Logan and Breakall.

Physics and Chemistry **dominate the change agent** activities (see graph below), which is appropriate as Mathematics is just getting started.



Results per change agent are shown below: Note that some activities are double counted due to collaboration: This shows the number of activities that each change agent was involved with, and thus the total below adds up to more than the 186 total unique activities. Each change agent did conduct the required minimum of 2 workshops (and most many more).

Chemistry: Willy Hunter (8), Jenn Nielson (13), Etta Gravely (8), Ellen Yezierski (9)

Math: Timothy Hendrix (5), Jean Lee (9), Glenn Waddell (5), Gary Martin (4), Amy Roth-McDuffie (6)

Physics: Vince Kuo (7), Karen Magee-Sauer (7), Gay Stewart (9), Duane Merrell (10), Sarah Formica (3)

Type of Change Agent Activities

Workshops **dominate** the activities conducted, as is appropriate (see below). This is true for all types of people conducting activities.

The table below shows the type of activities, by group. These are unique activities. "Publications" include PERC proceedings and articles in Chemistry education journals. "Other" includes a variety of activities such as presentations about GFO (but not spreading the facts), and GFO research talks and activities.

Category	Sum of Workshop	Sum of Poster	Sum of Publication	Sum of Other
Chemistry Change Agent	23	0	3	0
Math Change Agent	11	0	0	1
Physics Change Agent	30	2	0	3
Chemistry PIs and Staff	3	0	4	0
Physics PIs and Staff	3	0	0	1
GFO Program Staff	68	9	6	19
Total	138	11	13	24

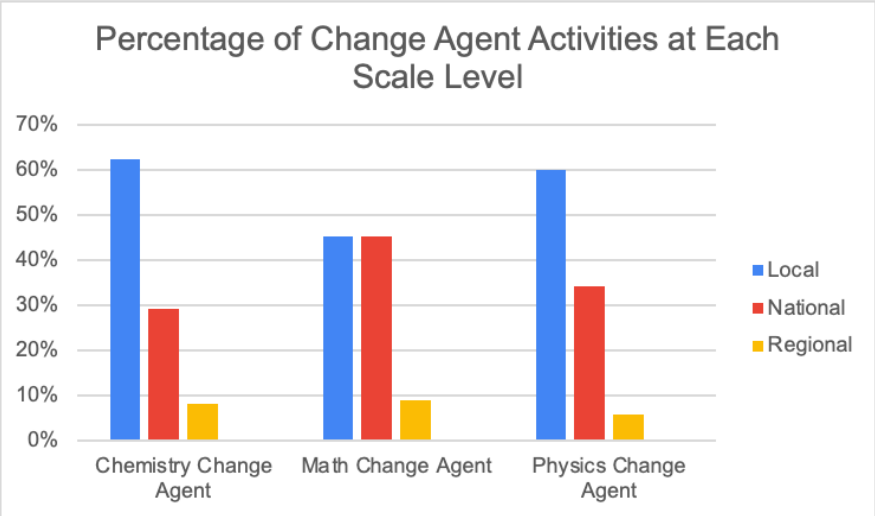
47% **of activities are national or regional.** This is intended to be the main target of GFO change agent work.

The table below shows the location of the activity, by group. Thus, 53% of the total number of activities are local, 42% are national, and 5% are regional. Chemistry and Physics have similar proportions of national and local activities, which is an improvement from last year. However, Mathematics has a proportionally greater number of national activities than do other disciplines. This result demonstrates Mathematics strong early engagement, comfort conducting professional development activities, and focus on co-leading webinars to build expertise within AMTE.

Group	Local	National	Regional	Total
Chemistry Change Agent	15 (63%)	7 (29%)	2 (8%)	24
Math Change Agent	5 (45%)	5 (45%)	1 (9%)	11
Physics Change Agent	21 (60%)	12 (34%)	2 (6%)	35
Chemistry PIs and Staff	0	4 (100%)	0	4
Physics PIs and Staff	1 (33%)	1 (33%)	1 (33%)	3
GFO Program Staff	42 (54%)	33 (43%)	2 (3%)	77
Total	**82 (53%)**	**64 (42%)**	**8 (5%)**	**154**

The number adds up to fewer than the total number of activities (N=186) due to the field being left blank. Percents are given as a percent of that group.

Below is the percentage of activities at each level, just for change agents.

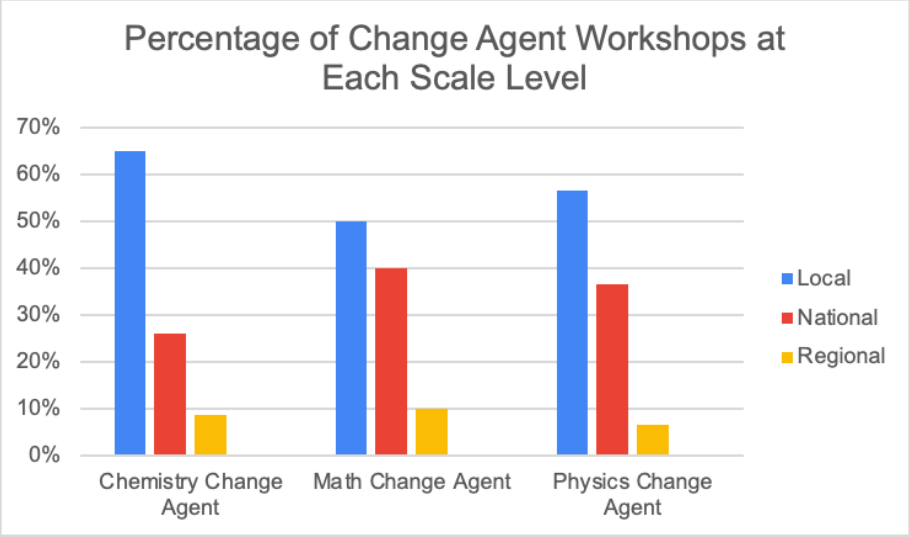


Workshops

Physics and Chemistry **offer similar numbers of workshops,** when we discount the substantial activities of the Mines staff. This is appropriate given that Mathematics is just getting started. Chemistry and Physics Change Agents are thus relatively equally sharing the load of workshops. Chemistry Change Agents continue to offer more local workshops than do Change Agents in the other two disciplines, but the additional offerings of large national webinars by the Chemistry PI helps balance the overall portfolio of workshops in Chemistry to an appropriate level.

41% **of workshops are national or regional.** This is a total of 52 workshops. This is similar to last year (N=53 workshops). I consider this a significant effort at broad dissemination. Below is a table summarizing the data for workshops only. Chemistry change agents are disproportionately focusing on local workshops and a reasonable goal would be to increase the number of national and regional workshops by ~5 next year.

Groups	Local	National	Regional	Total
Chemistry Change Agent	15 (65%)	6 (26%)	2 (9%)	23
Math Change Agent	5 (50%)	4 (40%)	1 (10%)	10
Physics Change Agent	17 (57%)	11 (37%)	2 (7%)	30
Chemistry PIs and Staff	0 (0%)	3 (100%)	0 (0%)	3
Physics PIs and Staff	1 (33%)	1 (33%)	1 (33%)	3
GFO Program Staff	36 (60%)	19 (32%)	2 (3%)	60
Total Workshops	**74 (59%)**	**44 (35%)**	**8 (6%)**	**126**



83 faculty workshops

were conducted, and faculty workshops appear to dominate the efforts. The table below shows the number of workshops with at least 25% faculty or student audience. This does not add up to the total number of workshops since not all responded to the question and some workshops have both audiences. Ultimately, there are a total of 83 unique workshops with a faculty audience.

Group	Workshops with 25%+ Faculty Audience	Workshops with 25%+ Student Audience	Number of Workshops Reported
Chemistry Change Agent	11	8	23
Chemistry PIs and Staff	3	0	3
GFO Program Staff	41	23	68
Math Change Agent	9	2	11
Physics Change Agent	15	14	30
Physics PIs and Staff	3	2	3
Grand Total	83	49	138

Group	Estimated Sum of Audience Members	Estimated Average Audience Size	Estimated Number Faculty Attending	Estimated Number Students Attending
Chemistry Change Agent	683	29.7	171	475
Math Change Agent	355	32.3	301	44
Physics Change Agent	1145	38.2	505	571
Chemistry PIs and Staff	70	23.3	70	0
Physics PIs and Staff	68	22.7	48	18
GFO Program Staff	1518	24.1	853	578
Grand Total	3839	28.9	~1948	~1686

At least 1500 **students** and 2000 **faculty** are estimated to have been reached[4] through GFO-run workshops this project year, for a project total of **3637 attendees** *(compared to 1378 last year; 700 faculty and 678 students)*. See counts above. This is a very rough estimate based on reported proportions of attendees at workshops. Note that about 8 workshops focused on advisors, reaching about 140 people, and these are not included in the faculty counts. (*See the section on Evaluation Question 5 (national reach) to see this combined with Champion workshops.)*

Physics **is reaching faculty and students equally.** The number of student and faculty workshops, and students and faculty reached, is roughly equivalent for change agents; GFO program staff are reaching many more faculty than students.

Chemistry **is disproportionately reaching student audiences.**

Compared to other disciplines the proportion of students reached by Chemistry is much greater (63%) than in Physics (42%) and Math (12%). While the number of faculty-facing workshops is similar to student-facing workshops, many of the largest presentations given by Chemistry were to students.

Mathematics **is disproportionately reaching faculty audiences.**

Mathematics has conducted more faculty-facing workshops, and reached a larger number of faculty audiences than student audiences**.** Mathematics Change Agents have a strong background in faculty development and have identified that they are able to engage quickly in working with their faculty colleagues, and that this is an appropriate (and intentional) strategy. Mathematics has chosen this focus in order to generate a large number of Champions who will conduct student-focused activities locally.

[4] *Note that estimates in this table are very approximate, and are likely under-reporting reach because (1) not all Change Agents provided counts of audience, and (2) Attendees are not reported broken down by audience, and so if both faculty and students were present we assumed the attendance was 50/50. Thus, we don't have exact numbers for audience size but can estimate a lower bound.*

Question 4: Professional Development

How well are the project professional development approaches working to spread project messages and engage champions?

Workshops are a key aspect of the Get the Facts Out -- these include presentations to students (to spread the GFO messages directly to those who may choose teaching professions) and workshops for faculty (to establish a more supportive culture for students to choose teaching careers). In this section

Workshops conducted and audiences reached

Workshops are conducted primarily by Change Agents, PIs, Mines staff, and Champions. Below are the counts across these different entities, compiled across different elements of this report.[5] At least **81 student presentations, and 105 faculty workshops** have been conducted across the project, **reaching a total of approximately 5200 people** (2700 students and 2500 faculty). For comparison, last year we estimated that about 1400 people were reached (500 students, 700 faculty), and in year one we estimated that 500 people were reached. **Thus, the Get the Fact Out project has reached almost 4 times the number of people as it did last year.**

	Student presentation		**Faculty workshop**	
	Number	Est. participants	Number	Est. participants
Champions	32	1055	22	560
Change agents	24	1090	36	977
PIs/staff	25	596	47	971
Total	**81**	**~2741**	**105**	**~2508**

[5] There are several sources of data for this information (Pre/post survey sheets, registered activities by Change Agents and Champions, sign-in logs from workshops), but the data on most of these items is redundant. Having checked that all items are included in the registration forms when they appear in the sign-in or pre/post survey forms, I use the results from the Change Agent and Champion registrations to estimate these.

Faculty and institutions reached

How many faculty are being reached to spread the message of GFO? How many institutions does this represent? The original intention of the project was to reach 400 institutions over the 5 year project, or 80 per project year. Below I update a table created in Year 2 to estimate the number of departments reached to date.

	Physics	Chemistry	Mathematics
Target institutions per year	*80*	*80*	*80*
Year 2: Institutions reached[6]	86	20	25
Year 3: Institutions reached (change agents/champions)	529 (400, 129)	146 (136, 10)	223 (180, 43)
Total institutions reached (fraction of 400)	**615 (150%)**	**166 (41%)**	**248 (62%)**

This is most definitely an overestimate in physics due to the fact that many institutions are likely double counted due to the nature of the activities. However, this gives a good sense of the progress towards the goal. A total of 1029 institutions are estimated to have been reached.

--

Given that a great many faculty and students are reached by the project, how effective are the workshops at changing perceptions of teaching as a profession?

[6] Estimates are generated by looking at the audience of the activity (e.g. local or national, discipline). A local workshop is expected to reach 1 institution, a regional workshop is expected to reach a number of institutions equal to a quarter of the number of faculty attendees, whereas a national workshop is expected to reach a number of institutions equal to half the number of faculty attendees. Broad STEM events are distributed across disciplines. Each champion institution is included. This is thus a very rough estimate.

Workshop effectiveness

In this section I report results across all workshops with pre/post results. Note that these results only represent the fraction of attendees with usable, complete pre/post results. It was not unusual for these to be available for only 50% of attendees. Thus, there are significant self-selection effects.

Each workshop includes a pre/post survey which includes "quiz" questions testing factual knowledge and perceptions. An overall pre/post quiz score is assigned to each respondent based on the factual correctness or desirability of the answers. The data below represents these quiz questions and scores, averaged across workshops. The workshops included are also tallied.

	N of events	Conducted by:	N of attendees	Average N of attendees	Average gain (effect size)	Average normalized gain
Student	13	Change agents: 4 Mines: 3 Champions: 5	199	15	42% (1.98) SD: 11%	54% SD: 13%
Faculty	22	Change agents: 10 Mines: 9 Champions: 3	393	18	43% (2.09) SD: 11%	60% SD: 21%

I compared results *across workshops* to those *across individual attendees* and found that the trends were very similar. Thus, results reported are across workshops.

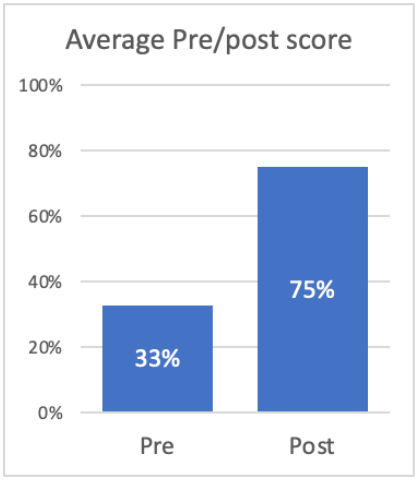
Student presentations

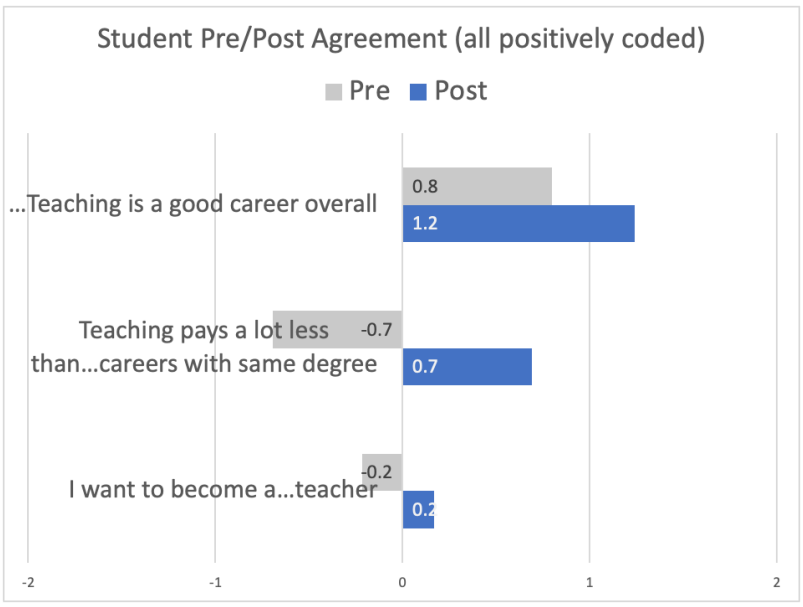
Students presentations are highly effective, as demonstrated by

42% **gain**, on average quiz score and 54% **normalized gain** and a

1.98 **effect size** (on the gain); considered a large effect size.

Below are shown the average pre/post score (out of 100%), and agreement on 3 Likert scale questions about the profession (the second is reverse-coded so that a positive score is the desired response for all questions.) Gains are impressive. The shift towards wanting to become a teacher is minimal on average but the standard deviation is large (0.78 pre, 0.81 post), showing that many do shift their perceptions -- which is the desired outcome.





A variety of presenters are effective. I compared these results for Mines personnel compared to all others and did not find non-Mines presentations to be noticeably less effective: While Mines had generally higher gains, these results were well within 1 standard deviation.

Fidelity of Implementation is adequate, and may be connected to perception change. A series of 3 questions probed Fidelity of Implementation of the workshops: Whether the key message of GFO was emphasized, time was provided for peer discussion, and time was provided for active processing of data. The average across all workshops was "agree", with somewhat lower responses as to whether time was provided for peer discussion. Additionally, the aggregate "fidelity score" of all 3 questions combined was correlated (r=0.5) with the increase in the rating of "I want to become a….teacher" for that workshop. However, fidelity was *anti-correlated* (r=-0.39) with normalized gain. This result is worth further investigation, across attendees. Note that Fidelity of Implementation results across attendees was not the same as across workshops.

Below are the results of all 10 questions, pre,- and post-, aggregated across all *attendees.*[7]
As you can see, many questions have very low responses pre-presentation, and high responses post, with the exception of desire to become a teacher (which remains low) and endorsement that Grade 7-12 teaching is a good career choice (which was not very low pre-presentation).

[7] N=382; this is fewer than those reported across workshops as a few workshops were not included in the analysis.Note that Q10 is reverse coded so that a high score is favorable.

Pre/post questions		Pre	Post	*Gain*
Q1	How do you think teachers rate their lives…	44%	94%	*50%*
Q3	Do grade 7-12 teachers have student loan forgiveness programs…	28%	87%	*59%*
Q5	What is the average age of K-12 teacher retirement in the U.S.?	24%	60%	*37%*
Q6	What is the typical mid-career (15 years) salary for grade 7-12 teachers?	28%	82%	*55%*
Q8	Teaching pays a lot less than most other careers a student can get with the same degree.	13%	66%	*53%*
Q9	I want to become a grade 7-12 teacher.	33%	40%	*7%*
Q10	Grade 7-12 teaching is a good career choice in general.	66%	91%	*25%*

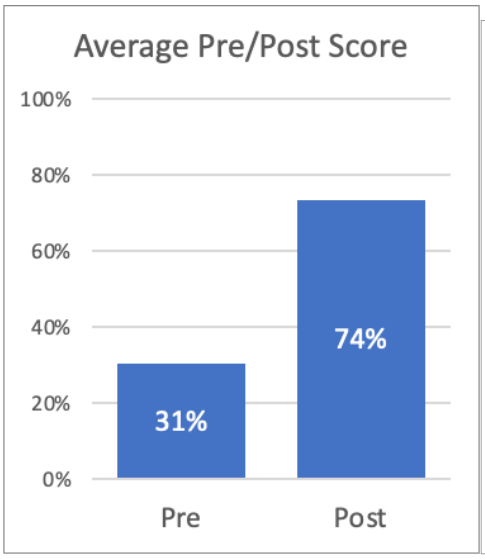
Faculty workshops

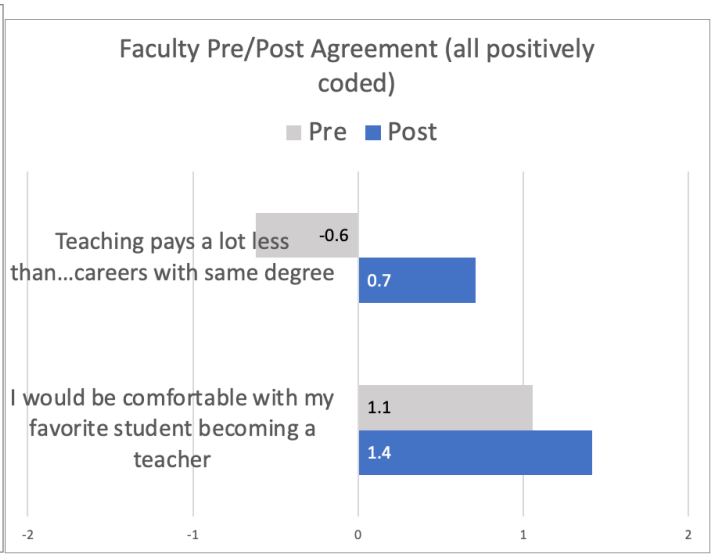
Faculty workshops are also highly effective, as demonstrated by

43% **gain**, on average quiz score and 60% **normalized gain** and a

2.09 **effect size** (on the gain); considered a large effect size.

Below are shown the average pre/post score (out of 100%), and agreement on 3 Likert scale questions about the profession (the first is reverse-coded so that a positive score is the desired response for all questions.) Gains are again impressive. The shift towards being comfortable with one's favorite student becoming a teacher is (as with the student responses), minimal but the standard deviation is large (0.50 pre, 0.37 post), showing that many do shift their perceptions -- which is the desired outcome. Again, there was no clear difference between Mines and non-Mines personnel.





Fidelity of Implementation is partially adequate, and may be connected to learning. A series of 4 questions probed Fidelity of Implementation of the workshops: Whether the key message of GFO was emphasized, time was provided for peer discussion, time was provided for active processing of data, and time was provided to identify or review local data. While the key message of GFO was emphasized and participants were given time to actively process data (average was "agree" or higher) the average was less than "agree" (0.7-0.8) for time for peer discussion or identifying local data. This may reflect the virtual environments in which events took place this year. Additionally, the aggregate "fidelity score" of all 4 questions combined was correlated (r=0.35) with the normalized gain, but not correlated (r=0.06) for the increase in the rating of "I would be comfortable with my favorite student becoming a teacher" for that workshop. It would be worthwhile to explore these results in more detail across attendees at a later time. Note that Fidelity of Implementation results across attendees was not the same as across workshops.

Below are the results of all 10 questions, pre,- and post-, aggregated across all *attendees.*[8] Unlike the student results, pre-workshop results are not uniformly low, including whether they would be comfortable with their favorite student being a teacher. However, post-workshop results are uniformly high.

Pre/post questions		***Pre***	***Post***	***Gain***
Q1	*How do you think teachers rate their lives…*	*36%*	*95%*	*59%*
Q2	*What percentage of STEM students expressed some level of interest…*	*9%*	*71%*	*62%*
Q3	*Do grade 7-12 teachers have student loan forgiveness programs…*	*45%*	*92%*	*47%*
Q4	*What fraction of grade 7-12 teachers remain in the profession at year 5?*	*12%*	*65%*	*54%*
Q5	*What is the average age of K-12 teacher retirement in the U.S.?*	*24%*	*61%*	*37%*
Q6	*What is the typical mid-career (15 years) salary for grade 7-12 teachers?*	*47%*	*82%*	*35%*
Q7	*What fraction of teachers report having control over what and how they teach?*	*5%*	*56%*	*51%*
Q8	*… "I am treated with respect by students and parents"?*	*27%*	*83%*	*56%*
Q9	*I would be comfortable with my favorite student becoming a grade 7-12 teacher.*	*77%*	*87%*	*10%*
Q10	*Teaching pays a lot less than most other careers a student can get …**	*21%*	*65%*	*44%*

[8] N=382; this is fewer than those reported across workshops as a few workshops were not included in the analysis.Note that Q10 is reverse coded so that a high score is favorable.

Question 5: National Reach

To what degree does Get the Facts Out as a project have the potential to reach its intended national scale based on awareness across professional societies?

Website engagement

Based on website analytics, we can see the degree to which the GFO website and materials are being used by its constituents. Since January 2020 the project has logged a total of

20,186 **unique website sessions** and

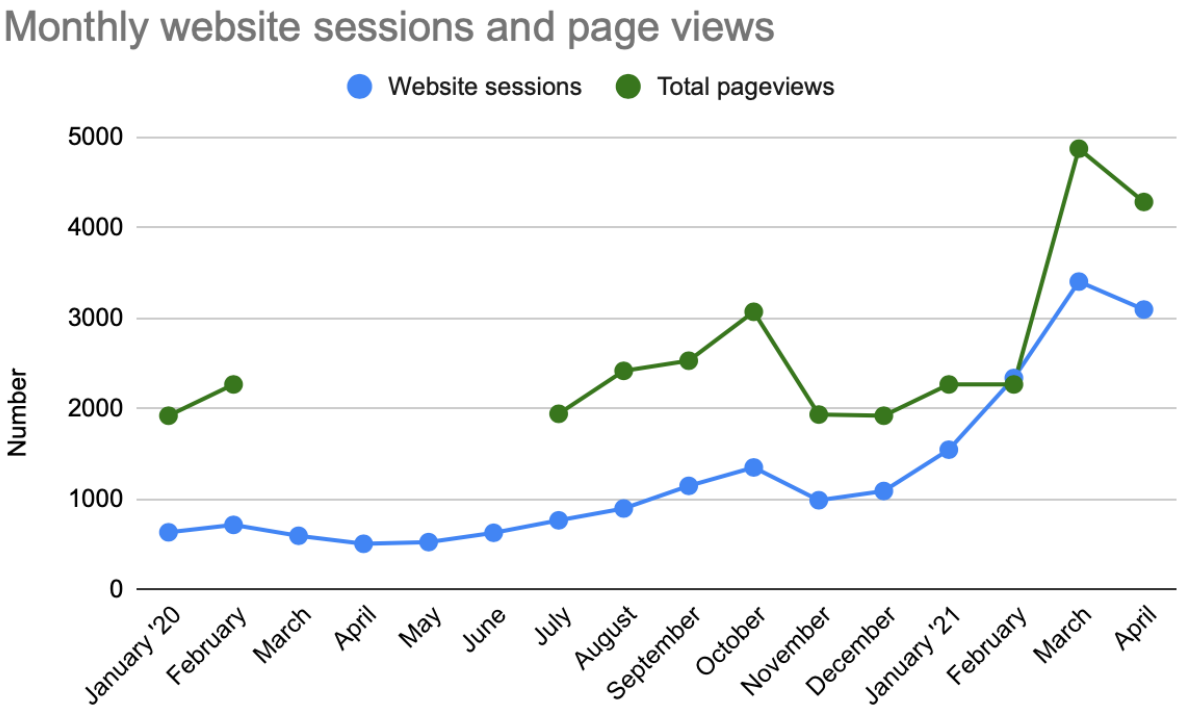
31,680 **pageviews.**

These numbers have increased over time to a peak of about 3000 website sessions per month. This represents good reach and use of the project. Only a small fraction of these (N=1270) originate with the tracked links from GFO Change Agents and PIs. The majority of website sessions since January originate through organic searches (73%) rather than from the tracked links used by project personnel. This indicates that the site is search engine optimized and is attracting its target audience organically. An additional 19% of users visited the URL directly. However, the bounce rate for organic searches is somewhat high (87%), suggesting that visitors may not be finding what they are looking for.

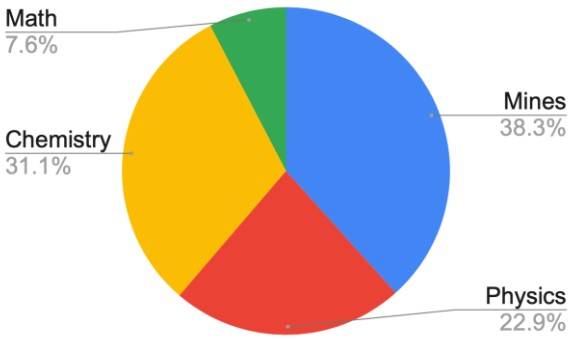
The most popular pages (since January 2021) are the **blog, homepage, and recruiting resources,** including a blog article that went viral and accounts for approximately 50% of GFO website traffic:

1. Blog article: "How do teacher retirement plans work": 11,721 pageviews
2. Homepage: 4050 pageviews
3. Recruiting resources: 1021 pageviews
4. Facts and data: 711 pageviews
5. GFO community: 664 pageviews
6. Prospective teachers: 634 pageviews (*This one is aimed at students)
7. Blog article: "Top 3 reasons…": 574 pageviews.

Several blog articles have garnered several hundred hits, and so aggregated together are among the more popular pages.



Investigating traffic originating in the tracked links given to project personnel, we see that the majority of these sessions originated through Mines (N=487) and Chemistry (N=395), with Physics close behind (N=291). Math has many fewer web sessions (N=97) but this is in their inaugural year with the project.



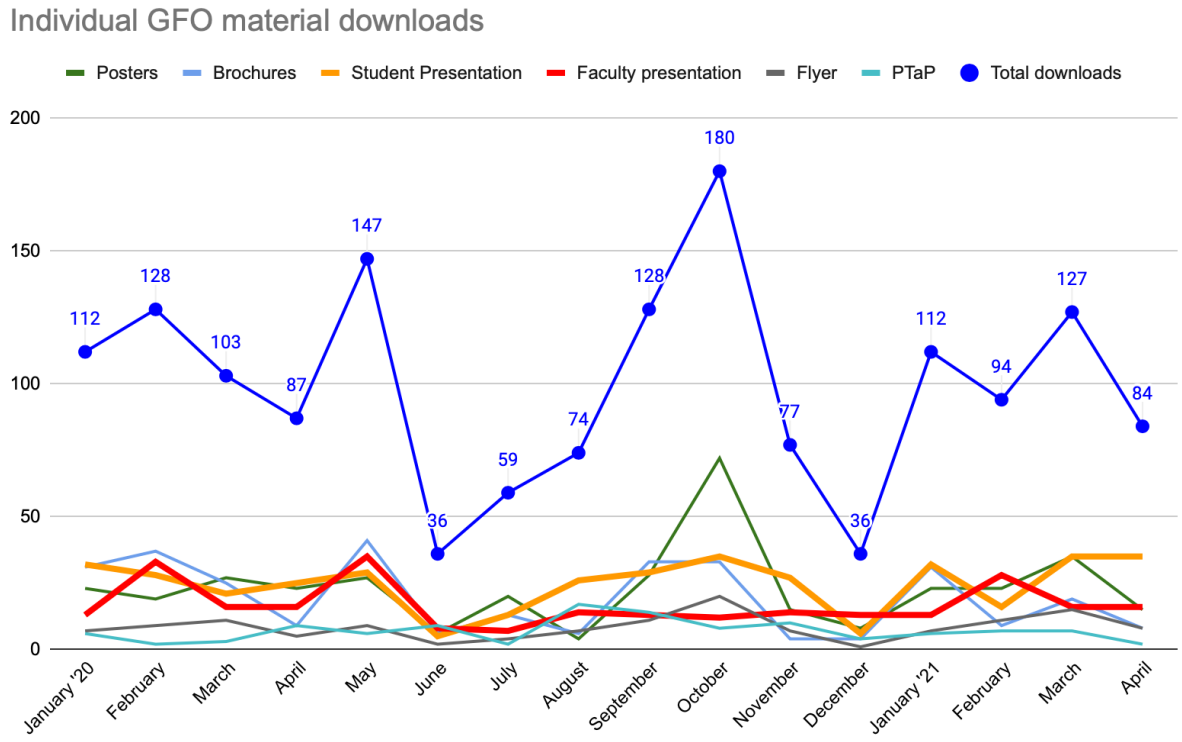
Below is a list of all tracked link website hits. Those with fewer results should consider how they can better disseminate the GFO website.

Name	Sessions	Name	Sessions
Wendy	269	Shari	5
Terri	219	Glenn	4
Jared or Savannah	218	Karen	4
Drew	126	Duane	4
AAPT	94	Amy	4
Ellen	87	Willy	2
Jean	74	Gary	2
Jennifer	59	Vince	1
Gay	53	AMTE	0
ACS	28	Sarah	0
PhysTEC	9	Etta	0
Timothy	8	Monica	0
		Grand total	**1270**

That website engagement is associated with a download of

1,584 **GFO materials downloaded**, including 394 student presentation materials, 267 faculty workshops, 368 posters, 309 brochures, 134 flyers, and 112 PTaP. The graph below shows steady downloads of materials over time. It would be preferable if these downloads were increasing over time since the website engagement has increased over time. While in theory people only need the materials downloaded once, they do continually change and improve and one would hope that many new and repeat

customers would download materials. That said, not every person visiting the GFO site would be expected to download materials as not all are directly involved in recruiting.



Awareness of GFO

A survey was conducted of members of the 3 societies (ACS, APS, AAPT) to gauge awareness of Get the Facts Out, and gather information on how GFO might better reach audiences engaged in career mentoring for undergraduates. A total of 776 complete responses were received; the table below shows responses by society.

Items on the APS and AAPT versions asked participants to report if they were members of both organizations, and if they were members of PhysTEC. These responses were used to categorize physics respondents by society (rather than the survey which they responded to).

The surveying efforts received 324 complete responses from ACS members, 152 responses from individuals only in APS, 88 responses from individuals only in AAPT, and 193 responses from individuals in both APS and AAPT. The majority of respondents were at 4-year public or private institutions (77%) and a majority were tenure-track faculty (66%)

Sample	Sampled*	Respondents (response %)	Did Not Finish	Completed Surveys
ACS	4,000	347 (8.7%)	22	325
APS-Only	4,609	180 (6.2%**)	24	156
AAPT-Only	2,308	101 (8.9%)	13	88
BOTH		207	0	207
Total	10,017	835 (8.3%)	59	776

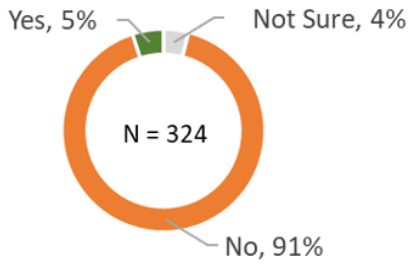
*Sample included 4,000 randomly selected members of APS and ACS, 858 members of PhysTEC, and 2308 members of AAPT (representing all AAPT members who had opted into email communications; 362 two year college and 1946 four year college). Duplicates were removed from PhysTEC and AAPT lists. Thus the "APS-Only" sample size includes the APS random sample plus the 609 PhysTEC members who were not on the APS or AAPT provided samples. Respondents were asked to self-identify their membership on the survey so respondents in each category were not necessarily in the original sample population.

** In order to estimate response rate, the 207 responses which were members of AAPT and APS were split between the APS-only and AAPT-Only samples.

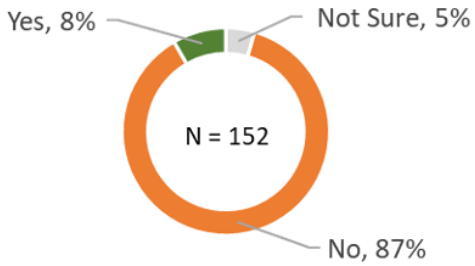
Overall, awareness of Get the Facts Out is not bad. Across all respondents, 24% had heard of GFO, or thought they might have, though many of these positive responses are due to the high awareness among AAPT/PhysTEC members. Additionally, 9% spontaneously indicated that they would turn to GFO (even before it was revealed that the survey was about GFO). However, awareness is particularly low, at just 5%, among respondents from the American Chemical Society and those who are members of American Physical Society (8%) only (i.e. they are not also members of AAPT). One thing to consider is that those who respond to this kind of survey are those that are particularly aware, those that read emails from the professional society and will respond to requests. Awareness is likely to be lower in the larger population of the professional societies than what is presented here.

Have you heard of Get the Facts Out?

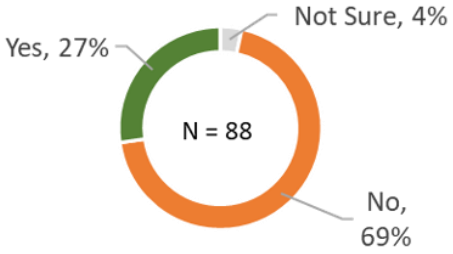
American Chemical Society



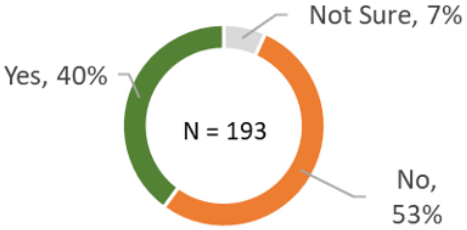
Members of American Physical Society Only



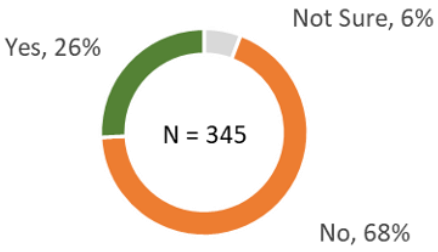
Members of American Association of Physics Teachers Only



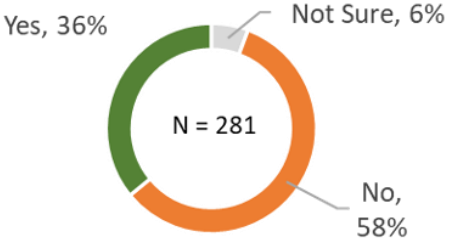
Members of Both APS and AAPT



All APS Members



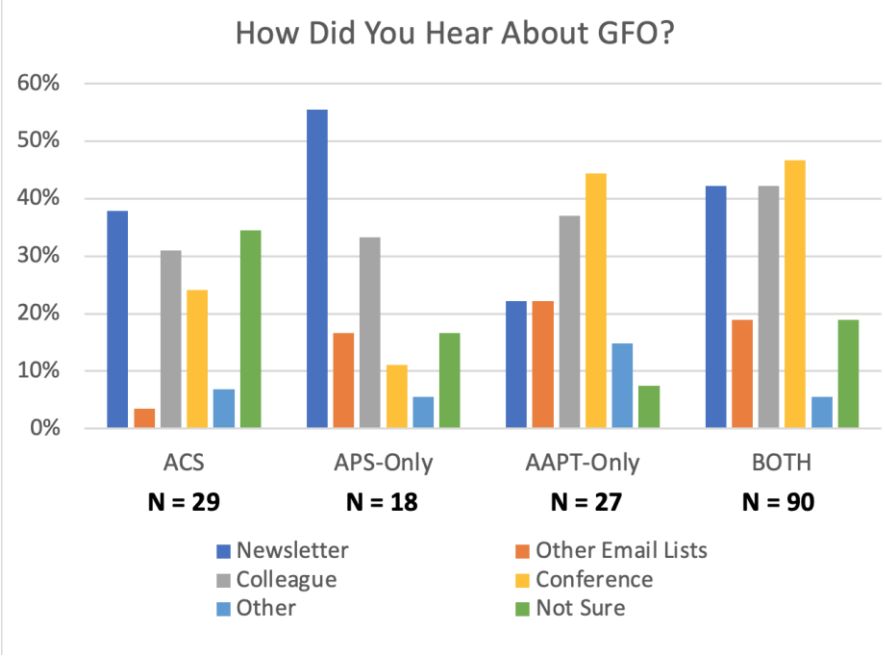
All AAPT Members



Tables of awareness are below.

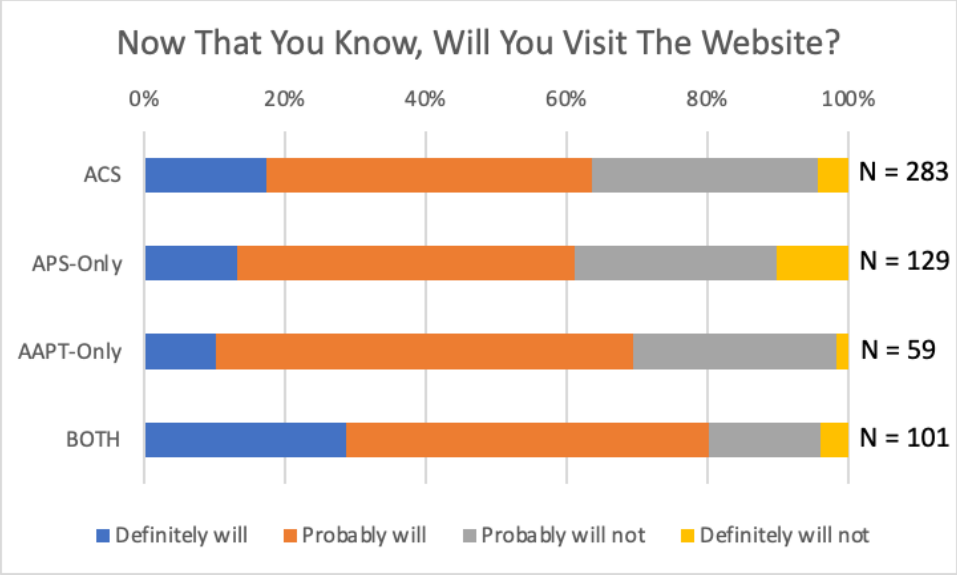
	N (Percent of sample)				
	ACS	APS-Only	AAPT-Only	AAPT + APS	Total
Not sure	13 (4%)	7 (5%)	3 (3%)	13 (7%)	36 (5%)
No	295 (91%)	136 (87%)	61 (69%)	103 (53%)	595 (76%)
Yes	**16 (5%)**	**13 (8%)**	**24 (24%)**	**77 (40%)**	**148 (19%)**
Total	324	156	88	193	779

Society emails, conferences, and colleagues were common modes of awareness. Of the people who were aware of Get the Facts Out, APS members were more likely to report hearing about it from society newsletter emails and AAPT members were more likely to report hearing about it at a conference.



A substantial fraction of people who were not aware of GFO do *not* plan to visit the website. Those who were not aware of GFO were given a little information about the project and

asked if they might now visit the website. Those who are members of both AAPT and APS report feeling more likely to visit the website.



Career information is mostly sought through teachers, schools of education, AAPT, and PhysTEC. For those respondents who said they knew where to find information about K-12 teaching careers, 9% cited Get the Facts Out before it was revealed that the survey was about GFO. Many explained that they would reach out to teachers (31%), to their local schools of education (47%), and some to STEM education experts on campus (12%). Additionally, those who said they did not know where to find information on K12 careers were relatively likely to seek it out through their local schools of education, as well as internet searches. AAPT members were more likely to say they would turn to AAPT (37%) and PhysTEC (27%) for information. Of those who said they would reach out to K-12 teachers, many said they would contact alumni who had graduated from the STEM program and become teachers. This may represent an opportunity to reach faculty by connecting with high school instructors and working 'backwards' through chains of influence. Awareness of GFO did not seem to vary meaningfully across institution or position types.

Below are the codes that were used for this analysis (inclusion criteria in parentheses):

Connect with k-12 teachers (self, alumni, teachers in the community, friends and family)
Education Programs at Institution (school of ed, academic advising, teacher prep program)
We do this here (Noyce grants, Uteach site, PhysTEC site, DBER faculty, dual-major programs, I am the coordinator for science ed)
Other organizations (state, federal, professional, union) (STEP UP, NSTA, AIP, Uteach website, state departments of education)
ACS, APS, AAPT (Including The Physics Teacher)
GFO (or cites a change agent or PI by name)
PhysTEC
Other (Google searches, literature review, employment websites, job listings, recruiters)

For those who said that they know where they would look for information on K12 careers, the table below shows the percent of responses, by society, by percent of each subsample.

	Percent of respondents (in that subsample)						
Code	APS-Only	AAPT Only	Both	ACS	All APS	All AAPT	**Total**
Connect w/ K-12 Teachers	3	32	21	**39**	**25**	**23**	**31**
Education Program/SoE	52	44	31	**66**	**36**	**33**	**47**
"We Do This Here"	17	17	10	10	12	11	12
Other Organizations	19	20	24	**37**	22	23	27
ACS, APS, AAPT	16	37	26	15	24	28	22
GFO	3	12	16	1	13	15	9
PhysTEC	13	27	21	2	19	22	14
Other	11	5	4	15	6	4	9

One surprising result is the number of people who said "I have former students who are teachers now, I could ask them." This was coded under Connect with K-12 Teachers. This suggests that GFO outreach to K12 teachers might be a way to reach out to faculty.

The respondents who were members of both APS and AAPT appear to be a meaningfully different population with more awareness of GFO. They were more aware of Get the Facts Out (40%) than people who were members of one or other society (5%, 8%, and 27%). Those that were not aware said, more frequently than other respondents, that they would visit the GFO site for more information. They were also likely to list fewer resources in the question above, which may be because they had a ready-set of resources available at their fingertips: Namely PhysTEC, AAPT, and GFO. These dual membership respondents were more likely to also be members of PhysTEC: Out of the 75 members of PhysTEC 13 were in APS, 9 in AAPT, and 53 in both APS and AAPT. These 53 members of all three organizations were highly likely to be aware of GFO (69%). This pattern extended to the few APS-Only and AAPT-Only individuals who were members of PhysTEC, 8/13 and 7/9 were aware of GFO, respectively. We can conclude that either PhysTEC has been a successful mode of dissemination for Get the Fact Out, or that there is an active and motivated subgroup of physicists who engage readily with science education programming, or both.

Respondents suggest emailing society membership to increase awareness.
The final question of the survey asked participants to suggest modes of outreach that would make faculty more aware of GFO. The top line result is that many of the participants suggested emailing the entire membership of the society about GFO, or including GFO in the regular newsletters. This has been done multiple times annually by ACS and likely in at least one APS newsletter, but it has not been effective in reaching the faculty who responded in this survey. Some respondents suggested that GFO make regular appearances in the newsletters, to compensate for the high volume of email content, much of which is ignored. Respondents had a number of suggestions for how to get a higher open rate, from sending the email six weeks into the semester to keeping the email very short to writing a subject line that is exciting but does not sound like spam.

Respondents suggest targeting chairs, deans, society chapter leaders, K-12 instructors, Education faculty, and student chapter leaders. The respondents had many suggestions for who to reach out to instead of in-discipline faculty. Respondents most commonly suggested that GFO target department chairs, deans, and local chapter leaders of the society. Respondents suggested reaching out to students directly by email, connecting with student chapters of the organization or 'major clubs.' Lastly, many respondents suggested reaching out to K-12 instructors, schools of education, education faculty, and counseling services at institutions, as they can push local faculty to encourage teaching.

Respondents suggest non-email modes of communication. Respondents also had many suggestions for modes of contact other than email. Many suggested paper flyers or paper mailers that would not be as easy to ignore as email. Many respondents suggested social media, though could not offer more detail than that. Several responses said that surveys, like the one they were responding to, were effective dissemination, though a few were annoyed with the survey and felt like it was a bait-and-switch advertising tactic. Other less common suggestions included creating a program-in-a-box to send to departments, hosting webinars, reaching out to state departments of education, reaching out to Noyce sites, and starting a YouTube channel. Lastly, a frequent suggestion was to use the society periodicals (Chemistry & Engineering News, The Physics Teacher, etc), either by featuring GFO in articles or advertising regularly in the issues. It is true that GFO has already been featured in articles. It's worth noting that many respondent suggestions were strategies already employed by GFO.

A full report of the survey will be provided to the project in Summer 2021.