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### Project Goals:

- Establish high school teacher professional learning communities (PLCs) to share ideas & identify best ways to include climate change education in their courses.
- Identify best strategies for distance-meetings.
- Connect teachers with climate scientists and climate educators.

*Figure 1. Original plan called for 3 tiers: LHS organizers, PLC Leaders, PLC Members*

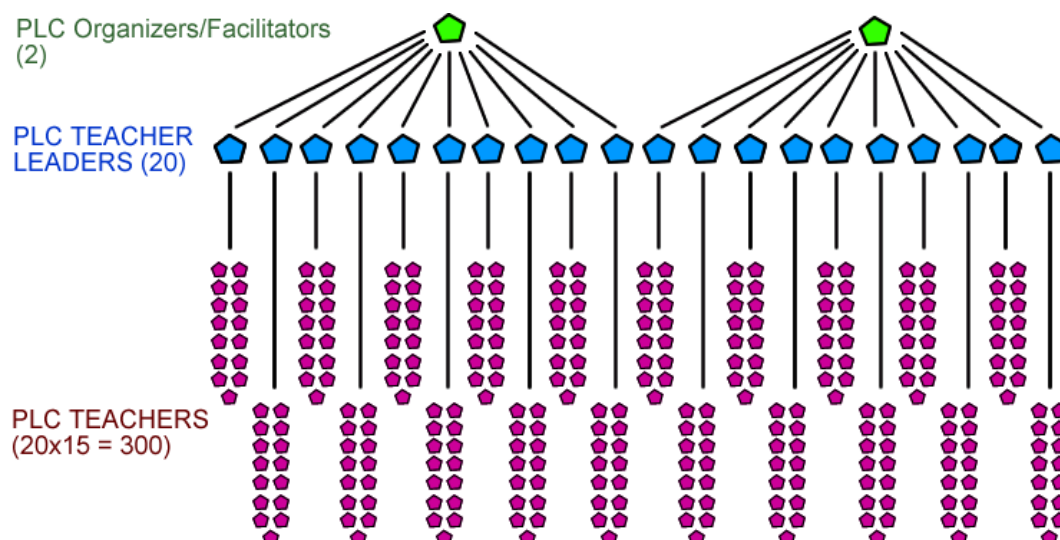


Figure 1 shows that our goal was to involve 320 people in PLCs (20 of them PLC Leaders). A recruitment flier circulated at conferences and was posted on the Global Systems Science (GSS) website -- <http://www.globalsystemsscience.org/lifelines>. That plus announcements about the project on the GSS e-mail list and various other e-mail lists was quite successful. The online application for teachers to apply to be in the PLCs was connected with a Google Doc spreadsheet as a "Form." This free resource from Google was very handy and useful. It also became our key reference for keeping track of participants. Both Google Docs and Google Sites which became important early in the project are very simple, easy to use, and free.

We got much farther toward to our goal of 300 teachers recruited than we expected in the first year. This seemed to put us ahead of schedule in that aspect. However there was a high percentage of "no shows" -- teachers who applied and were accepted, but did not ultimately participate. Likewise, there were a few leaders for whom a PLC did not materialize.

By the end of the project we had accepted 211 "participants" and 24 Leaders, but the success of the Leaders ranged from highly successful to "not able to get a PLC together." Likewise the participants ranged from fairly active to not-so-active (or lurker) to "no-show."

The \$100 stipend for participants (and \$500 for leaders) was definitely a factor in promoting participation, but other factors acting contrary to participation were present throughout the project. This will become apparent as a theme in the rest of this report.

Milestone-correlated details of Lifelines accomplishments may be found in the Table of Accomplishments starting on the next page. Keep in mind that the very last milestone, "Complete Final Evaluation," was designated for June 2012. In retrospect, this was unrealistic given the actual project end date of Feb 28, 2013 and the Final Report due May 28, 2013, almost a year after the stated milestone date. As a result, it's not surprising to see progressive slippage in timeline with respect to milestones.

**Table: Summary of Accomplishments in Terms of Milestones**

Date	Milestone	Accomplishments
Jun 2010	Identify GEMS sites and Centers that serve high schools;  identify resources and guest speakers for PLC's.	<ul style="list-style-type: none"> <li>• Dozens of GEMS sites and centers that serve high schools were identified, however the efforts of Lifelines GEMS staff to recruit and high school teachers from the GEMS Centers proved fruitless.</li> <li>• We were in regular contact with Earth Science Information Partners (ESIP) core staff (Brian Rogan and Carol Meyer), EOS Webster staff (Annette Schloss), JPL Climate Education (Michael Greene, Randall Jackson). An excellent series of speakers were lined up throughout this project. The list of speakers as well as recordings of their presentations are on this web page: <a href="https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/presentations-mtgs">https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/presentations-mtgs</a></li> <li>• Resources for climate change education were gathered throughout the project and are compiled on these web pages: Activities - <a href="https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/teaching-resources/activities">https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/teaching-resources/activities</a> Information- <a href="https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/teaching-resources/information">https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/teaching-resources/information</a> Multimedia – <a href="https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/teaching-resources/multimedia">https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/teaching-resources/multimedia</a></li> <li>• Lifelines project web pages were also created in the Global Systems Science (GSS) website where a recruitment flier was posted (<a href="http://www.globalsystemsscience.org/lifelines">http://www.globalsystemsscience.org/lifelines</a>) There are also links there to the two Lifelines Google Sites that were subsequently created in the project.</li> <li>• We created an online application for teachers to apply to be in the PLCs. It was a Google Docs spreadsheet, employing the "Form" functionality to make the form that applicants can fill out and have the data go directly into our recruitment spreadsheet.</li> <li>• We experimented with having presentations archived with audio included on slide-by-slide basis. This turned out to be more cumbersome than simply recording the presentation as video (mp4) and so the audio-enhanced-slides concept was eventually abandoned.</li> </ul>

Date	Milestone	Accomplishments
Sep 2010	<p>Recruit 1st round of professional learning community (PLC) network leaders.</p> <p>1st round PLC leaders orientation event.</p>	<p>In summer of 2010 we created a project staff Google Site Work Area at <a href="https://sites.google.com/a/berkeley.edu/berkeley-lifelines-project/">https://sites.google.com/a/berkeley.edu/berkeley-lifelines-project/</a> On that site is record of an experiment in group website work done during the Hands-On Universe (HOU) 2010 Conference. Participants each created their own page on the site with items of interest to the group, including presentation. Things could go up on the site practically in real time. This experiment was successful in demonstrating a highly effective technique for group interaction and record-keeping---the site constitutes proceedings of most of the HOU 2010 conference.</p> <p>By Sep 2010, we had recruited 20 teacher leaders though the online Google Docs Spreadsheet application. This was way ahead of planned schedule, so we revised our plans to combine the "1<sup>st</sup> round" and "2<sup>nd</sup> round" of leaders. We created a Leaders website in Google Sites that was used in holding Orientation sessions for the leaders in Sep 2010. The orientations were by telecon. The Leaders Google Site at <a href="https://sites.google.com/a/berkeley.edu/lifelines/">https://sites.google.com/a/berkeley.edu/lifelines/</a> has</p> <ul style="list-style-type: none"> <li>• Photo Name Tags — an idea where participants put photos of themselves to refer to during the orientation meetings.</li> <li>• Meeting notes that were taken live during the meetings.</li> <li>• Each Leader has his or her own page.</li> <li>• "How To" area with tips on "How to make an online application form in Google Docs," "How to make a Google Site for a PLC," "Guidelines for successful Skype sessions."</li> </ul> <p>Leaders began recruiting teachers to be in their PLCs</p> <p>First attempt to conduct the orientation using Skype failed (with 20 leaders). We switched to using a relatively inexpensive commercial service, ReadyTalk, which worked very well for the orientation sessions, and indeed for the entire rest of the project.</p>
Dec 2010	<p>1st round leaders recruit 1st round of teacher participants.</p> <p>1st round PLC leader group fully functioning.</p>	<p>Recruitment progress is summarized on the Leaders Site recruitment page at <a href="https://sites.google.com/a/globalsystemsscience.org/lifelines-plc-leaders-site/recruiting/recruitment-history">https://sites.google.com/a/globalsystemsscience.org/lifelines-plc-leaders-site/recruiting/recruitment-history</a></p> <p>Records of monthly leaders meetings are at <a href="https://sites.google.com/a/globalsystemsscience.org/lifelines-plc-leaders-site/meeting-notes">https://sites.google.com/a/globalsystemsscience.org/lifelines-plc-leaders-site/meeting-notes</a></p> <p>Highlight from Evaluator's Report: Most PLCs had fewer than 10 participants, and only a subset of participants consistently took part in the meetings. Many teacher applicants expressed interest in learning about Climate Change Science, but did not actually show up for the telecon meetings.</p>

Date	Milestone	Accomplishments
Dec 2010	Evaluation data collected on effectiveness of 1st round orientation and meetings.	<p>The complete evaluator's report, by Lifelines project evaluator Shirley Lee, is given at the end of this report (Appendix A). There were 3 orientation meetings held, including the first one which was a fiasco attempting to use Skype with 20 recruited leaders. The subsequent orientation sessions using ReadyTalk went smoothly. Notes from those meetings are posted at <a href="https://sites.google.com/a/globalsystemsscience.org/lifelines-plc-leaders-site/meeting-notes">https://sites.google.com/a/globalsystemsscience.org/lifelines-plc-leaders-site/meeting-notes</a></p>
Feb 2011	<p>Recruit 2nd round of PLC network leaders.</p> <p>1st round leaders conduct PLC meetings in local chapters.</p>	<p>The PLC leaders group (combined rounds) was fully functioning. Lifelines PLC Leaders website (<a href="https://sites.google.com/a/berkeley.edu/lifelines/">https://sites.google.com/a/berkeley.edu/lifelines/</a>) was actively used by PLC leaders and we had monthly meetings via ReadyTalk.</p> <p>Leaders recruited PLC teacher participants and they conducted PLC meetings in local chapters. On <a href="https://sites.google.com/a/berkeley.edu/lifelines/">https://sites.google.com/a/berkeley.edu/lifelines/</a> is summary of recruitment numbers (on Recruitment page) and local Lifelines chapter websites are linked on the PLC Websites page.</p> <p>Professional development presentations were made available to the entire Lifelines membership--all chapters. They were originally on the Presentations Page of the Leaders site, but were later moved to the Lifelines Courses site (<a href="https://sites.google.com/a/globalsystemsscience.org/courses-lifelines">https://sites.google.com/a/globalsystemsscience.org/courses-lifelines</a> )</p> <p>One lesson all the leaders were learning: teachers have very little free time, so getting participation in a PLC on a volunteer basis or even for a modest stipend is difficult. Teaching schedules do not accommodate time for teachers to communicate and share with one another.</p>
Mar 2011	<p>2nd round PLC leaders orientation event.</p> <p>Collect evaluation data on effectiveness of orientation session and 1st PLC meetings.</p>	<p>A few Leaders had to resign as Leaders, creating openings for new Leaders. The challenge of recruiting and orienting 2nd round PLC leaders did not fit neatly into a single orientation event. Hence, orientation was done with each new leader, not in a combined event. We experimented with online orientation tools in the Leaders website <a href="https://sites.google.com/a/berkeley.edu/lifelines/how-to/become-a-leader">https://sites.google.com/a/berkeley.edu/lifelines/how-to/become-a-leader</a>. We also tried to cope with applicants not geographically located in the area of any Leader. We began contemplating setting up a national PLC to accept "members-at-large."</p> <p>Participant surveys were done starting in January of 2011. These were analyzed by the evaluator and compared with a second set of surveys done in the fall of 2012. See Evaluator's Report in Appendix A.</p>

Date	Milestone	Accomplishments
May 2011	<p>2nd round leaders recruit 2nd round teacher participants.</p> <p>2nd round PLC leader group fully functioning.</p>	<p>By May 2011 there were 15 active Lifelines PLC leaders. Three first round leaders resigned as leaders but three new leaders added (one from Georgia and two from Colorado). A total of 212 participant/ members populated the PLCs in the Lifelines project, though there are widely disparate degrees of participation.</p> <p>Monthly meetings of PLC leaders continued, where issues were discussed, including: best communication techniques for use in PLCs, sharing of climate education resources, establishing a website for sharing course outlines indicating where climate education resources are in use. At one meeting, we decided not to try to duplicate the functionality of the CLEAN (Climate Literacy Environment Awareness Network), but to reference any of our Lifelines climate education resources to the collection of resources vetted and contained in the CLEAN set. The monthly meetings were recorded and archived at the Leaders' site  <a href="https://sites.google.com/a/globalsystemsscience.org/lifelines-plc-leaders-site/meeting-notes">https://sites.google.com/a/globalsystemsscience.org/lifelines-plc-leaders-site/meeting-notes</a></p> <p>Special presentations nearly each month on climate change education resources were recorded and archived – now residing at  <a href="https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/presentations-mtgs">https://sites.google.com/a/globalsystemsscience.org/course-s-lifelines/presentations-mtgs</a>.</p> <p>Many of the PLC leaders held monthly meetings. There were a total of 34 meetings involving a total of 161 participants in this 2nd quarter of the project year 2011. Information about those PLCs can be found on the individual PLC websites that are all linked from the PLC Websites page --  <a href="https://sites.google.com/a/berkeley.edu/lifelines/plcsites">https://sites.google.com/a/berkeley.edu/lifelines/plcsites</a>. Some of the leaders were so successful in setting up PLCs, they set up more than one. The Michigan PLC recruited enough members to form 3 PLCs. A Leader in New York started a PLC focused on use of iPads for climate change education and very quickly recruited over 40 members, split into 3 PLCs. However, as with all the PLCs, retention and maintaining participation was a challenge and the 3 iPad PLCs effectively became one.</p>
August 2011	Complete 1st round surveys/ interviews for evaluation.	<p>By August 2011 only about 42 teachers met participation requirements to receive stipends. That's about a 25% participation rate of total applicants. Collection of evaluation data was affected, since limited participation also meant less time to answer evaluation questions. Leaders who were also teachers had very limited time and were strained to keep their PLCs active.</p>



Date	Milestone	Accomplishments
Dec 2011	1st round teachers implement curricula and resources in their classroom.	<p>The Course outlines website was established (<a href="https://sites.google.com/a/berkeley.edu/lifelinescourses/">https://sites.google.com/a/berkeley.edu/lifelinescourses/</a>) and 22 PLC members/teachers posted their course outlines there.</p> <p>In this time period, webinars were led by</p> <ul style="list-style-type: none"> <li>• Tamara Ledley on Earth Exploration Toolbook Nov 3,</li> <li>• Preston Lewis on My NASA Data Sep 27, and</li> <li>• John Pickle on Using Digital Earth Watch Software Jun 14.</li> </ul> <p>As usual, the webinars were recorded and archived.</p> <p>We secured separate telecon accounts for each leader so that would not be necessary to coordinate schedules using a single communication account and avoid overlapping meeting times.</p>
May 2012	2nd round teachers implement curricula and resources in classrooms.	<p>The 22 PLC members/teachers who posted their course outlines on the Lifelines Course outlines website presumably implemented their courses, however developing assessment tools for evaluation of impact of this project on actual student performance was not possible. In retrospect it was an unrealistic goal for this particular project.</p>
May 2012	<p>Complete all surveys/ interviews for evaluation.</p> <p>Collect student survey data.</p> <p>Evaluation team assesses program effectiveness.</p>	<p>From the aforementioned schedule shift, these milestones were premature. Program effective is summarized in the Project evaluator's report (Appendix A). Shirley Lee, conducted 30-60 min telephone interviews with 13 Leaders in January, February, and March of 2012. Some of her findings from that were:</p> <ul style="list-style-type: none"> <li>• Although many teachers were truly interested, many did not really have time to devote to a PLC, and most PLCs had fewer than 10 members, one PLC started from a pre-existing grant in need of a communication platform, which Lifelines provided. That leader said: <i>"If we didn't have a PLC, we'd be really weak as a project because we would've lost communication. We send out emails, but voice is far better. I don't know what we would have done with out the Lifelines PLC...."</i></li> <li>• Teachers could attend meetings due to scheduling difficulties—finding time to meet.</li> <li>• <i>"Meeting first in person and then meeting online would work better. If I know the people first, then I'll be more willing or able to talk with them online once we've met in person."</i></li> <li>• <i>"Seems like teachers have teaching materials--they have what they need. But they're so busy and trying to teach it and do it well... Climate change is only 1 topic, ... once a year for 2 weeks."</i></li> <li>• <i>"I really liked the online platform &amp; thought it had great potential, but it's still scary for other folks. It's an idea whose time has come, but...the tech level of teachers is not there. They say having teleconferences is a nice idea, but they're thinking, "Another meeting with technology that I'm not comfy with? With strangers? ...Sharing stuff? No, I've got better things to do."</i></li> </ul>

Date	Milestone	Accomplishments
May 2012	Prepare material for dissemination of project results at teacher organization conferences, journals, and websites.	<p>We tried using Google Groups for e-mail list functions. It has archiving of messages sent and is a good alternative to the UC Berkeley listservs we mostly used.</p> <p>PI Gould presented major revisions that were made in the Global Systems Science web-based book <i>Climate Change</i> available for free at <a href="http://www.globalsystemsscience.org/studentbooks/cc">http://www.globalsystemsscience.org/studentbooks/cc</a></p> <p>A presentation by Kevin Hussey about the NASA resource "Eyes On The Earth" was very well received.</p> <p>Starting in 2012, the leaders decided to move to bi-monthly meetings (every other month). As of spring 2012 there were 42 active teachers in Lifelines.</p> <p>The Leaders of the Detroit MI PLC, summarized nicely some tips for success of a PLC:</p> <ul style="list-style-type: none"> <li>• Have regular meeting times</li> <li>• Have assignments/projects for participants to work on</li> <li>• Have round robins; each person say things at meetings</li> <li>• Have partner to help lead</li> </ul> <p>The Leader for the Connecticut PLC suggested having PLC-wide topics, or theme-of the month for all PLCs.</p>
Jun 2012	Implement plan for continuation of PLC network activities	<p>We implemented a new class of PLC leader: for discipline-focussed PLCs (e.g. a leader for teachers of Physics courses, one for Environmental Science courses, etc.) One goal of this effort was to create model course outlines with Units that include climate change topics highlighted, as well as links to the actual climate change resources used in the courses.</p> <p>We also began a program of having monthly nation-wide PLC member telecons. The first ones were held 2012 May 4 and 2012 June 26. The purpose was pool PLC members from areas where participation was low, into a larger nation-wide group that will promote inter-regional communication and allow new avenues for participation and communication. These meetings were recorded also.</p>
Jun 2012	Complete final evaluation	<p>By the end of the project, 14 more Lifelines participants posted their high school course outlines on the Lifelines Courses site (<a href="https://sites.google.com/a/globalsystemsscience.org/courses-lifelines">https://sites.google.com/a/globalsystemsscience.org/courses-lifelines</a>) resulting in an increase from 33 course outlines in September 2012 to 47 course outlines as of 2012 Dec 26: 9 Biology, 4 Chemistry, 7 Earth Science, 11 AP Environmental Science, 10 (regular) Environmental Science, 2 Marine/Ocean Science, 2 Mathematics, 1 Physics and 1 middle school.</p>



## **Conclusions—Summary of Best Tools and Practices**

In this project, we experienced both successful and unsuccessful professional learning communities. So we should be in a good position to identify essential enabling elements for a successful PLC. They can be enumerated in two broad categories: communication tools/platforms and good practices.

### **Communication Tools & Platforms for PLCs**

Live Remote Meeting Platforms (synchronous)  
Adobe Connect (commercial)  
Bluejean (free videoconference system allowing various inputs)  
Elluminate (commercial)  
Google Hangout (free)  
JoinMe (free service for desktop/screen sharing via Internet)  
ReadyTalk (commercial)  
Skype (free)  
Webex (commercial)  
Wiggio (free)

Notes:

We were traumatized by our first attempt to use Skype which did not work for our 20 or so participants in part because one of the participants attempted to convene the meeting moments before I did, leading to mass confusion. We regrouped on a normal telephone telecon line using the commercial service ReadyTalk and had a successful orientation that way. Later we held two more orientation sessions using Skype with fewer people without significant problems. We also created a set of tips for using Skype, posted on the Leaders' website.

Late in the project Google Hangout became available and it seems to be quite promising as a platform for Live remote PLC meetings. Audio and video quality is generally good. Getting participant organized in such as to make a Google Hangout start up is not trivial, but once everyone becomes familiar, it may be viable.

But overall distance meetings and presentations can go much more smoothly and reliably with paid-for service. ReadyTalk was our workhorse for this project.

### ***Asynchronous Communication Tools***

Google Docs (free text documents and spreadsheets)  
Google Sites (free websites)  
E-mail lists  
    University/district e-mail services/listservs  
    Google Groups  
    Yahoo! Groups

We found that Google Docs and Google Sites are very simple and easy to use. Since they are free they are great tools for cash-strapped schools. In this project we created quick tips for PLC leaders on using the Google tools to serve the PLCs. Those tips are on the Leaders' site (<https://sites.google.com/a/berkeley.edu/lifelines/communication-tools/google-site-tips>). The Google Sites are great collaborative workspaces for Leaders and for their PLCs. Meeting notes can be taken live during meetings.

## Good Practices for PLCs

### *Set Goals*

It's helpful to have some kind of clearly defined goal(s).

### *Leaders*

A Leader to guide the PLC is essential.

Teachers, swamped with teaching duties, cannot often devote adequate time for this. Our most successful PLCs were not led by active teachers:

- a retired teacher who had time and interest in this effort ended up leading a few of our PLCs, not just one.
- a district coordinator was one of our most successful Leaders and organized 3 PLCs.

For some PLC members, especially just starting up in a PLC, their technology savvy is not up to speed. The Leader needs technological expertise and willingness to do some "hand-holding" for getting tech-newbies going with whatever platform and programs are being used.

### *Asynchronous Participation*

Here are some ideas for asynchronous participation generated at one of our Leaders meetings:

- brief report on a climate activity they tried out in their classroom
- analysis of a climate activity, even if they have not tried it out.
- posting a syllabus of their course, indicating precisely where climate activities or climate resources are used
- book review on a climate-related book they read
- posting link to an interesting article on climate-related subject
- e-mail discussion/thread on particular subjects

For a PLC not focussed on climate change, substitute the actual PLC subject for "climate" in the above points.

### *Initiating a Live Remote Meeting*

E-mail communication is vital, but voice has distinct communication advantages and voice plus visual information (via desktop sharing) is even better, as evidenced by an especially successful meeting we held in September 2012 in which every participant was made a "presenter" able to share their desktops.

In preparation for a live remote meeting, it's good to have at least two announcements for a meeting: one week(s) in advance and another a day before. Maybe even one an hour before the meeting.

For Skype, was important for participants to follow a simple rule stipulating that the leader/facilitator be the only person to initiate and call people into the meeting. This may not be quite as important as it was at the outset of the Lifelines project (when we had our disastrous orientation attempt), because there have been improvements to Skype over the years.

#### *Audio Etiquette*

A really basic rule for all remote meetings: participants should mute their microphones unless they intend to speak. However, this also means they must remember to unmute when they want to say something.

Sometimes it's hard to "get a word in edgewise" because no one can see visual cues about intending or wanting to speak. So it's best to be especially on guard for avoiding cutting someone off or jumping in talking before someone has finished what they want to say. This is tricky because some people just speak faster than others and will dive right into a very short pause in a slower person's speech.

#### *Sharing the Microphone*

Several Leaders noticed that their best responses came when everyone was given a turn to speak during the PLC. This meant having one or two times in a meeting for a set of "round robin" responses. A round-robin early in the meeting sets the tone for everyone to realize that they can contribute to the conversation.

#### *Recordings*

In recording meetings and presentations, at least with the ReadyTalk system, if there is a lot of action going on in the screen (other than just changing of slides), and/or if the presenter is using a large monitor, the recording can generate a very large file very fast. This can be a problem in terms of posting in an archive. Fast onscreen action should be minimized. Show only short movies if any.

For the sake of archiving, it can be advantageous to break recordings into time segments of 10-20 minutes or less, 30 minutes max. Of course it's easiest just to let the recorder run throughout the whole meeting. If the Leader or a participant has time, they can snip the recording up before posting. The advantage is that PLC members who did not make the meeting can listen to part or all of the meeting in bite-size portions, or only to parts that interest them, if the clips are labelled by subject.

#### *Desktop Sharing*

Often a presenter or participant will want to point something using a cursor. It's important to remember that in remote systems there is a delay, so do not move the mouse too fast. Clicking around and jumping from page to page quickly may get lost in the Internet delays.

#### *Meeting Time*

Having up front a really clear date and time to meet makes a big difference; Have a regular meeting time, so that members can plan their time.

It's especially difficult to find a time for everyone to meet when participants are in 4 different timezones. Multiple meetings may be needed for that. This is not so much a problem for local or regional PLCs

#### *Ideal PLC Size*

The ideal number of meeting participants may fall in the range of 3 to 15. Skype may serve adequately up to 10 or possibly more, but audio quality could be iffy—no group video, except if one person pays. Google Hangout handles up to 10, with video, fairly good quality usually. Commercial platforms generally handle more participants with higher quality audio.

#### *Meet In-Person if Possible*

Meeting first in person and then meeting online is ideal, though not always possible, depending on geographical separations.

#### *Host Institution*

A PLC that has set structure sanctioned by the school district and requiring participation has a better chance of participation and success. Even then, participation will likely be less than 100%.

## Challenges

Two key challenges of the project were:

- ***Recruiting participants who would actually participate and “show up” for meetings.*** Even knowing their stipends could increase based on participation, some teachers, with real interest, simply did not have time to make in their busy schedules.
- ***Sustaining the PLCs after grant funding ends.*** This is actually the subject of one of the questions in our final survey for participants. See Appendix A Evaluator's Final Report for details of the survey findings. One of our most successful PLCs had separate funding from another (non-NICE) grant, but that funding ended and sustainability is now a challenge for them.

On the PLC Challenges page of the Lifelines PLC Leaders website, there is a summary of challenges identified from our in-person Leaders meeting at NSTA 2011 in San Francisco:

- Getting busy people to do "one more thing."
- Recruitment
- Retention
- Participation
- Sustainability
- Getting the "right" people---those who will participate and contribute.
- Getting more than just the PD enthusiasts who are very active in PD efforts.
- Determining reasonable, doable requirements
- Setting reasonable expectations.

- Members can't always make it to live (real time) meetings.
- Getting teachers to put up their "stuff" (lesson plans, techniques...)

Although we are disappointed in low PLC member participation rates and a noticeable Leader dropout rate, we are encouraged by the promising nature of telecon meetings and free online communication tools (Google sites, wikis, Skype, Google Hangouts, etc.). The dropout factor and low participation are true of any project that relies on teachers to make time in their extremely busy schedules without it being integrated into their normal teaching duties. If anything, the convenience of telecon meetings and online tools has made it easier for participation to happen.

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## Appendix A

# Evaluator's Report for Lifelines for High School Climate Change Education

NASA Innovations in Climate Education (NICE)—Grant NNX10AB60A

Evaluator: Shirley Lee

### Project Description

The goal of the Lifelines project was to build professional learning communities (PLCs) at two levels. First, at the PLC leader level and, second, at the PLC member or teacher level. This structure represented a highly leveraged system for delivering professional development because, by supporting the PLC leaders, this project was able to disseminate key information about climate change instruction to the smaller group of leaders who were then able to turn around and share this information with the members in their respective PLCs, thereby multiplying the number of teachers benefiting from the Lifelines project.

The PLC leaders met monthly through online meetings to try out and discuss online communication tools and exchanged climate change teaching resources that they could share with the teachers in their respective PLC groups. In this way, the PLC leaders formed a sort of “uber-PLC” that could review and share the finest resources identified for climate change education as well as sample and improve PLC communication techniques to ensure that all the local PLCs were informed of the best materials and strategies. By structuring the project this way, the Lifelines project was able to achieve the broadest dissemination of teaching materials and communication methods.

### PLC Leaders

The plan was to recruit 20 PLC leaders, some associated with current Great Explorations in Math and Science (GEMS) sites and centers, and others identified as leaders in other projects such as Global Systems Science (GSS) or other Earth Science Information Partners (ESIP) members. As intended, the project ramped up over 2 years, with most of the teacher leaders (about 15) recruited early in year 1, and a few more teachers (5) the latter part of year 1. Each of the 20 PLC leaders was expected to organize 15 science teachers into a local PLC. As a result, 300 teachers would be involved in PLCs and introduced to the Lifelines project.

The project succeeded in enrolling 24 PLC leaders to participate in the Lifelines projects. There were three tiers of engagement among the leaders: (1) Extremely engaged leaders (6 leaders); (2) Leaders who succeeded in setting up their own PLC groups (13 leaders) but were less engaged than the first group; and (3) Leaders who applied and were accepted, but never got their PLCs going (5 leaders).

Lifelines leaders met during monthly meetings, initially using Skype, but due to difficulties in convening a meeting over Skype with more than 10 people, the group discontinued using that online platform. Eventually, they settled with ReadyTalk, a webinar service that was able to accommodate larger group sizes by phone. ReadyTalk also provided web interface, which allowed members of a meeting to share their desktop, give presentations, and discuss written or visual

material. During the fall of 2010, the 1st round of leaders recruited their teacher participants and began conducting regular monthly PLC meetings.

### Local PLCs

There were 15 PLC active leaders who succeeded in establishing 22 PLCs with registered members. The number of members in each PLC ranged from 1 to 16. On average, each of the local PLCs had 10 members. One leader was able to run 8 separate PLCs containing distinct members and meeting times; four of these were done with the teacher-members using iPads.

One of the most successful PLCs was based in Michigan and was equivalent to 2 or 3 PLCs. They had many active members, held regular meetings, which were recorded and archived, a website, and Facebook page. This PLC had the benefit of a simultaneous NASA grant for a project called, “Investigating Climate Change and Remote Sensing” (ICCARS), which helped to create a community of teachers that eventually became part of the Lifelines project.

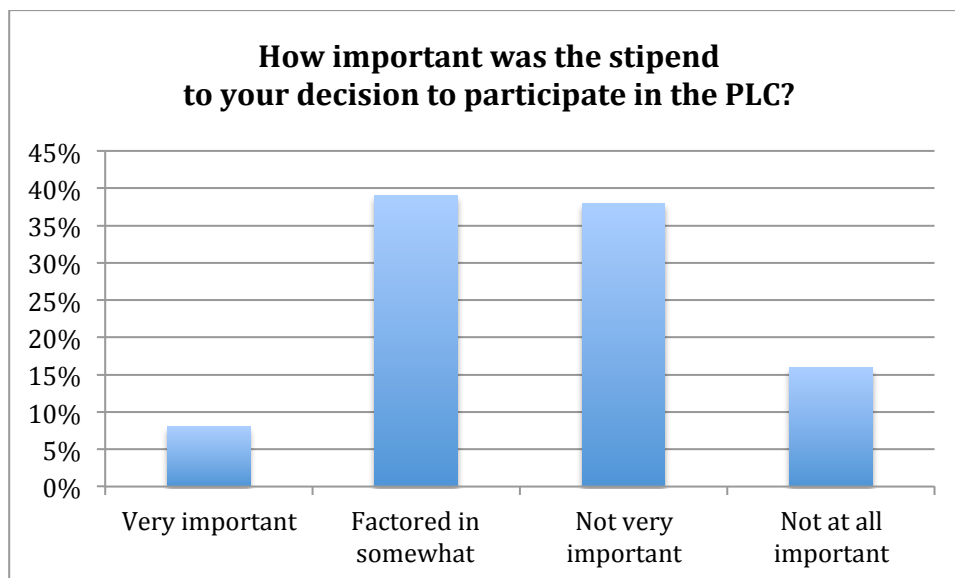
### Project Surveys

The graphs in this report are generated from two surveys conducted during the project:

2011: 80 respondents

2012: 63 respondents

### Participant Stipends



Teacher leaders received a stipend to partly offset their expenses in the project and the PLC teachers at the local level received small stipends as well to cover expenses for their efforts. The monetary compensation was not high, but we wished to attract participants who are genuinely interested in being part of a PLC for the long term,

and not just for a short-term advantage or reward. The following quote suggests we managed to recruit such interested parties and, hopefully, struck a balance between external incentive and intrinsic motivation:

“The monetary compensation is appreciated, but I would probably participate if members were not compensated.”

-PLC member

#### Lifelines project websites

Two websites were created to facilitate communication among project participants.

In the fall of 2010, the Lifelines PLC Leaders website (<https://sites.google.com/a/berkeley.edu/lifelines/>) was established and being actively used by PLC leaders. The Lifelines project formed online communities and required minimal or no travel for participants, staff, and leaders. This was consistent with the very issue lying at the heart of the focus of the project—limiting the release of greenhouse gases in our daily lives at work and at home.

Each Lifelines leader established a leader webpage on the Lifelines website. Here, they were expected to upload information about their local PLCs, meeting notes, links to webpages and resources, and photos. Participants expressed much appreciation for the Lifelines website, from which they were able to access activities, information, or multi-media resources for their classrooms.

On a separate website (<https://sites.google.com/a/globalsystemsscience.org/courses-lifelines/>), the Lifelines leaders and PLC members posted their course outlines in order to create a resource that other teachers could draw from.

#### Limited in-person meetings

In-person meetings of project leaders were held on a very limited basis—at the two NSTA conferences that occurred during the course of the project. In March 2011, 11 participants attending the in-person Lifelines meeting in San Francisco, and in March 2012, 12 participants convened (2 of them online) for the in-person Lifelines meeting in Indianapolis. Alan Gould, the PI of the Lifelines project, was at the 2011 meeting in person and attended the 2012 meeting remotely. Evaluator Shirley Lee was at the 2012 meeting in person.

During these in-person meetings, leaders discussed issues faced within their respective PLC groups and exchanged ideas for improving the communication tools and the PLCs, in general. Leaders were able to brainstorm ideas together and offer suggestions.

The leaders in attendance deeply appreciated being able to have at least *one* face-to-face interaction, which should be a factor to consider in future online communities. In general, PLC leaders felt that it would be most beneficial to start with a face-to-face meeting at the beginning of the project, or early on.

#### Participants learned how to successfully use online platforms

Alan Gould, the PI of the Lifelines project, already has significant experience in teleconferencing techniques. LHS staff organizers worked with the PLC leaders to plan meeting strategies and techniques for the most effective professional development teleconferencing (or videoconference) tools. Prior to the project, staff

anticipated that some of the most effective strategies are the simplest ones, which would be less susceptible to being foiled by technical difficulties, such as basic phone teleconference with participants accessing Worldwide web resources, powerpoints, movies and animations on their own computers while the meeting is in progress. In fact, project and PLC leaders were able to use these strategies in a combined, single platform—ReadyTalk (an inexpensive commercial service)—for meetings. ReadyTalk allowed for an ease of communication that included teleconferencing while viewing the computer screen of the PI, who usually led the meetings, or the occasional presenter, who could share visuals such as slides or website pages with the rest of the group.

In this project, the staff experimented with leading workshops via teleconference to overcome professional development budget constraints as well as to limit damaging effects of excessive or unnecessary use of our current fossil fuel-based transportation choices. Distance meetings are not very commonly used in the education world, but the PLC leaders and members gained much experience and a greater comfort level in using teleconferencing strategies through their participation in this project.

Throughout the project the PLC leaders also discussed other important aspects of conducting regular online meetings, such as social protocols, customs, and procedures that work best for getting involvement from all participants. Any group that meets together regularly needs to establish norms and expectations, and an online group is no different in this respect. Lifelines participants recommend the following tips for more successful online meetings:

- Meet consistently
- Focus the discussions (having an agenda helps)
- Everyone should participate (round robin sharing is particularly useful)
- Having a leader helps (or expert)
- Have sufficient time to meet
- Offer synchronous meetings allow for more flexibility

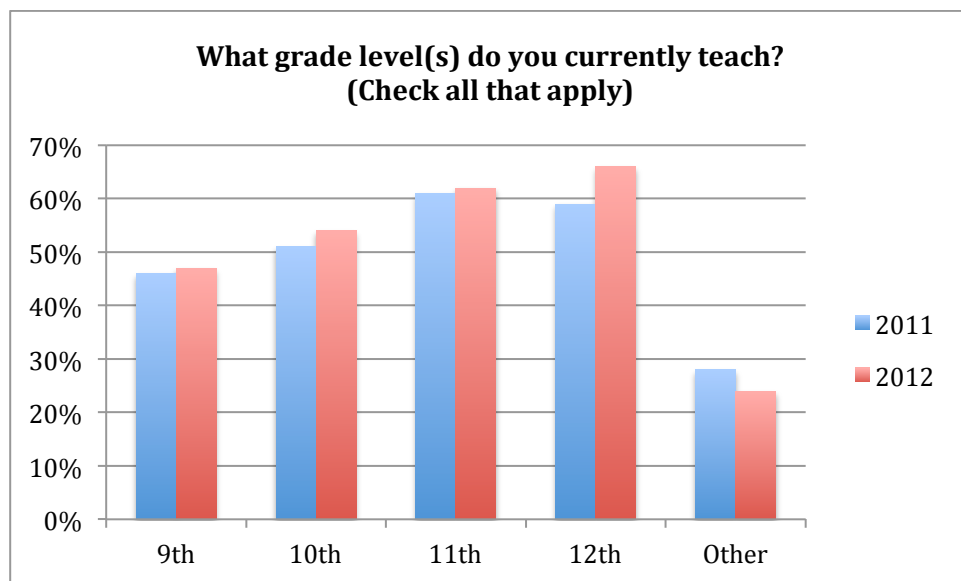
Near the end of the project, the leaders continued to explore a new communication platform while continuing to share ideas about climate change. They began to experiment with and have success with Google Hangout, which allows up to 10 people to meet with videoconferencing. Despite some technical issues, Google Hangout was the closest experience the group had to sitting with someone for a meeting. Other benefits to using Google Hangout were: good quality video, the ability to share desktops, windows, and screens; and even amusing options such as being able to place pictures on your own images (e.g. placing a hat on your head in your online photo). The main drawbacks are problems with getting everyone connected at first meeting attempts and then subsequent occasional failures of the system.

To adopt, develop, and refine the best techniques and strategies for remote professional development sessions, the project staff have consulted with other leaders in ESIP, the GEMS network, and in NASA Education projects, such as the Museum Alliance, that have held successful teleconference professional development events. The project also benefited from the fact that PI Alan Gould was active in numerous organizations that communicate online. For example, Lifelines

project staff also became involved with the NASA Innovations in Climate Education (NICE) leaders and were able to learn from the communication and networking styles used in that project. Climate Literacy Network (CLN) also holds weekly meetings and has a very active (daily) email list, which the Lifelines PI is able to learn from.

#### Grades taught by participants

In both years of the project, roughly half of the high school teacher participants taught 9<sup>th</sup> and 10<sup>th</sup> grade students, while about 60% of them taught 11<sup>th</sup> and 12<sup>th</sup> grades, as shown in the two charts below.



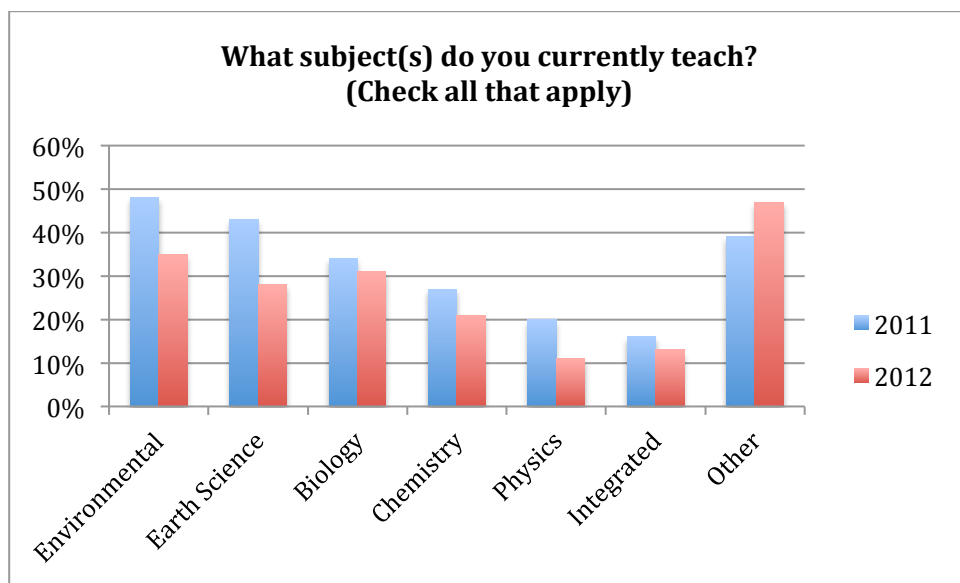
#### Courses taught by participants

In both 2011 and 2012, the teacher participants were most likely to teach the following courses (in descending order):

1. Environmental Science
2. Earth Science –or- Biology
3. Chemistry
4. Physics –or- Integrated Science

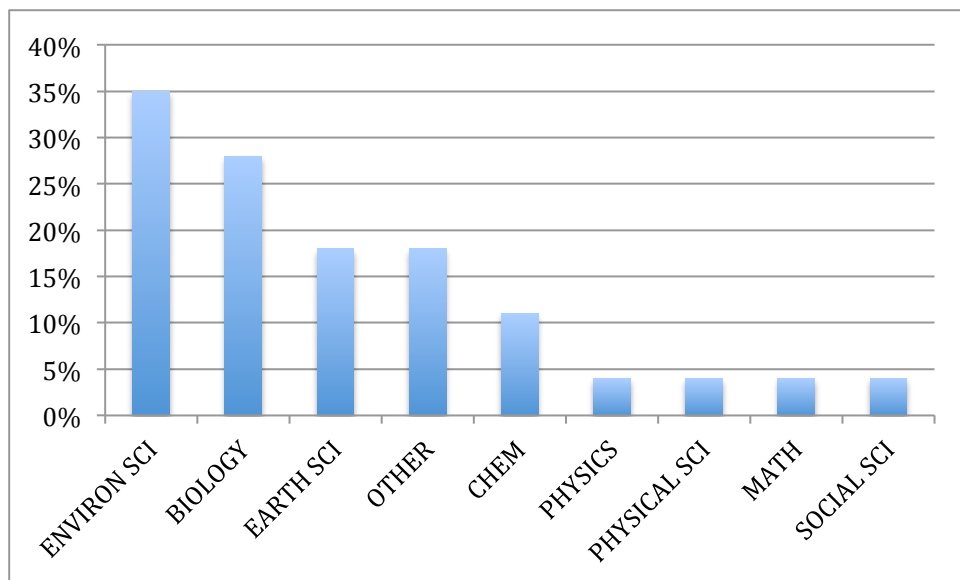
About 40-45% of respondents who chose “Other” taught subjects such as physical science, math, Algebra, statistics, oceanography, astronomy, media studies, various technology courses, and others. This finding suggests that the benefits of the climate change professional development the Lifelines participants received may not be limited to students in traditional science courses, but may also have the potential to impact students in other courses, even non-science-based courses.





#### Courses in which climate change is being taught

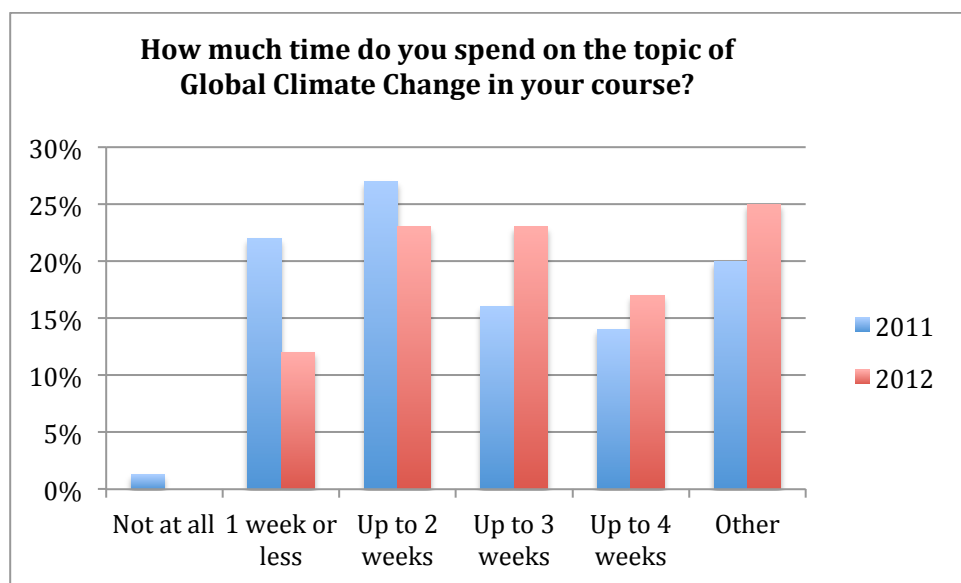
Participants were asked for the title of the course in which they teach Climate Change topics. The most common course title cited was “Environmental Science” with 35% of respondents indicating this as their title. The next most common course title cited was “Biology” with 28% of respondents reporting this as their course title. Eighteen percent of respondents indicated the course titles “Earth Science.” Another 18% indicated “Other,” a category that included various course titles, such as Global Systems, Geosystems, Oceanography, Geology, Geography, Space Science, and Science Research.



#### Time spent teaching climate change

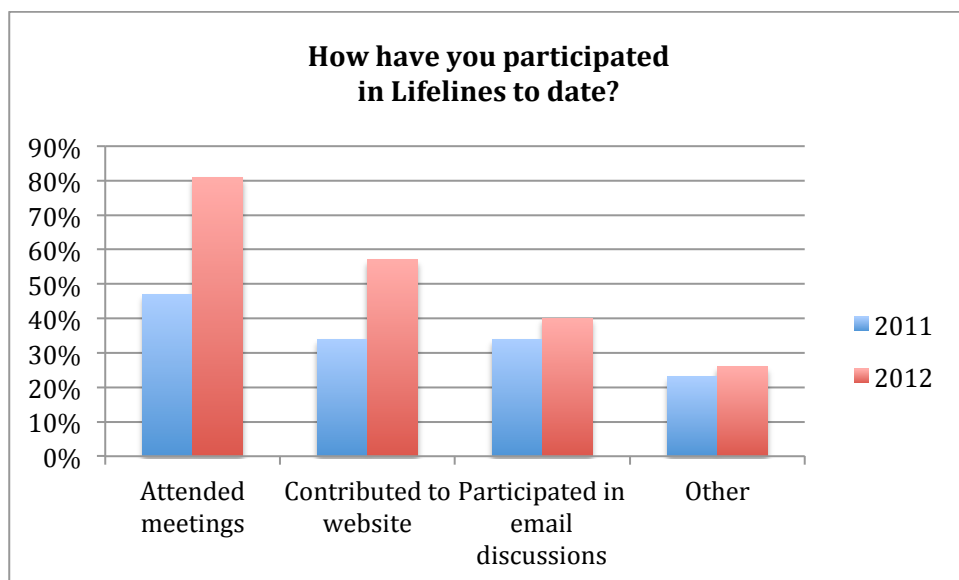
In 2011, the most respondents spent one to two weeks teaching Global Climate Change, whereas in 2012, teachers reported spending two to three weeks on the topic. In both years, respondents who chose “Other” explained that they had other arrangements for teaching Global Climate Change, which could not easily be

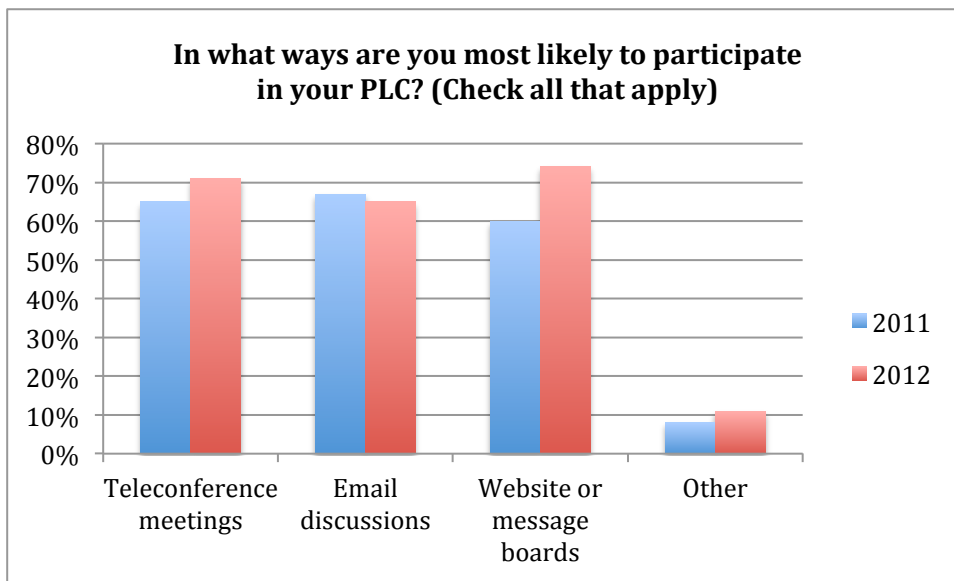
measured by just 1, 2 or 3 weeks. This usually meant that they would weave the topic throughout their course over longer periods of time, including over the whole year. This suggests the possibility that climate change is being addressed for greater amounts of time than we have been able to measure here.



#### Participation in Lifelines Project

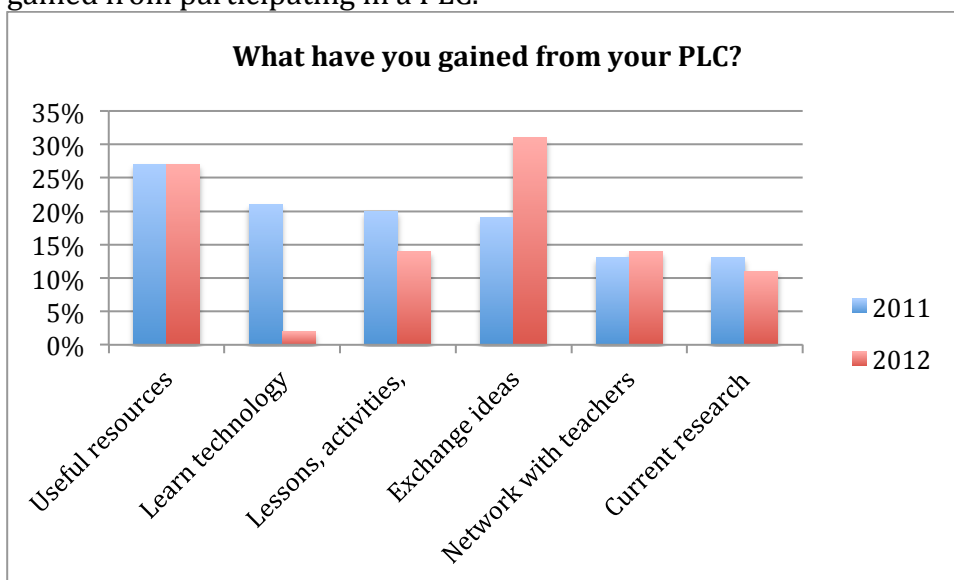
When asked about how they have participated in the Lifelines project, the largest percentage of respondents in both 2011 and 2012 report having attended the meetings, which means that they were present for their PLC's online meeting at the time it occurred. In 2011, the next highest percentage of respondents indicated that they participated in email discussions or contributed to the website. In 2012, a higher percentage of respondents reported contributing to the website than joining the email discussions.





### *Benefits of the Lifelines Project*

When asked what they had gained from their PLC, respondents most frequently indicated “useful resources,” “learning about lesson plans or teaching strategies,” and “exchanging ideas with other teachers about what worked or did not work well.” Participants had a strong interest in learning more about useful resources that they could use in teaching about climate change. Respondents also felt they learned about how to make use of specific technologies, especially the iPad, apps, and remote meeting platforms. Although the percentage of responses were lower, teachers also indicated an interest in networking with other teachers and accessing current research and information that would enhance their knowledge of climate change science. The following charts reflect what the PLC members feel they have gained from participating in a PLC.



### Exposure to Important Resources through Lifelines

An important goal of the Lifelines project was to have participants learn about important resources that address the issues of climate change and global warming.

As a direct result of their participation in the Lifelines project, many teachers indicated having learned of the following resources:

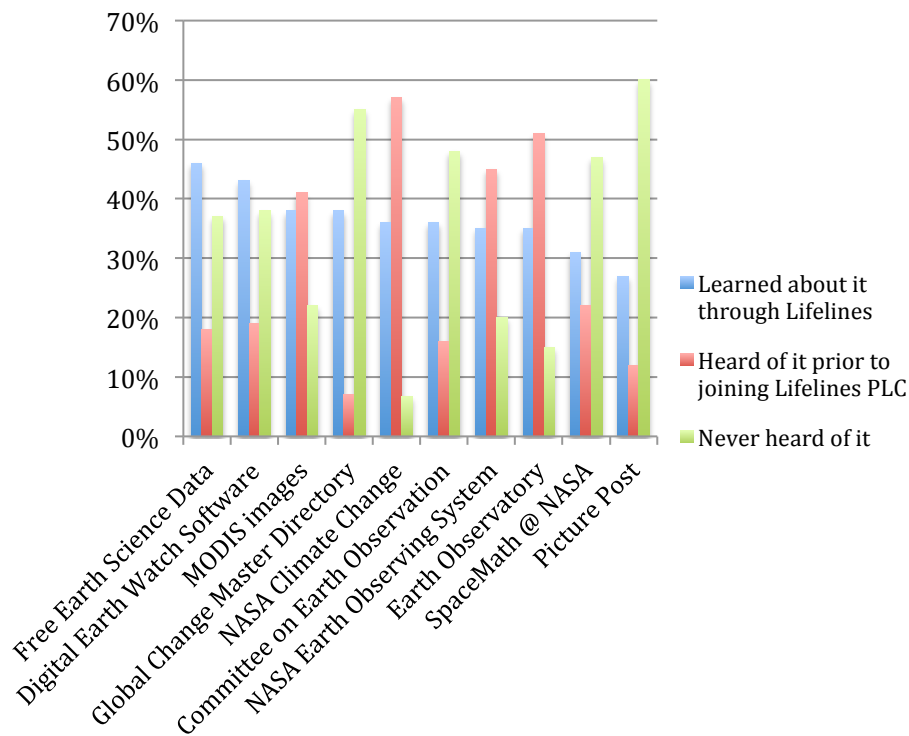
- My NASA Data
- Digital Earth Software
- Eyes on Earth (NASA)
- NASA Climate Change Website
- Earth Observatory
- NASA Earth Observing System
- Committee on Earth Observation Satellites
- Picture Post
- MODIS Images
- Global Change Master Directory
- Global Systems Science (GSS)
- EOS Webster
- SpaceMath@ NASA
- Other

Additional projects that address the issues of climate change and global warming were presented or discussed:

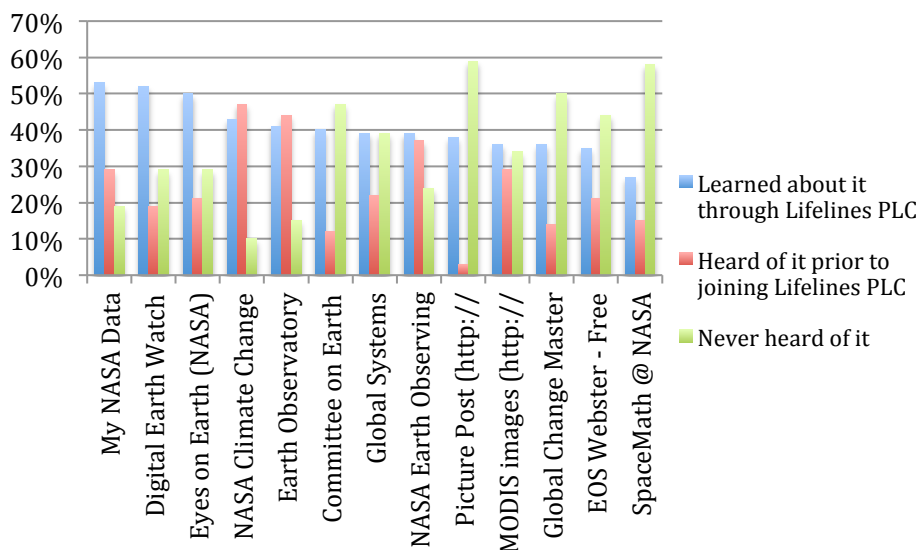
- Measuring Vegetation Health tools
- Earth Exploration Toolkit
- Climate Change Education (<http://climatechangeeducation.org>)
- NASA Earth Observatory (<http://earthobservatory.nasa.gov>)
- NOAA National Climatic Data Center (<http://www.ncdc.noaa.gov>)

The following two charts reflect the participants' familiarity with the various resources listed above. The first bar (in blue) indicates the percent of participants who learned about a particular resource through their Lifelines PLC; the second bar (in red) indicates the percent of participants who learned about a particular resource prior to joining any Lifelines PLC; and the third bar (in green) indicates a resource that the participants have not heard of.

**2011: Please indicate your knowledge of the following  
NASA Global Climate Change resources**



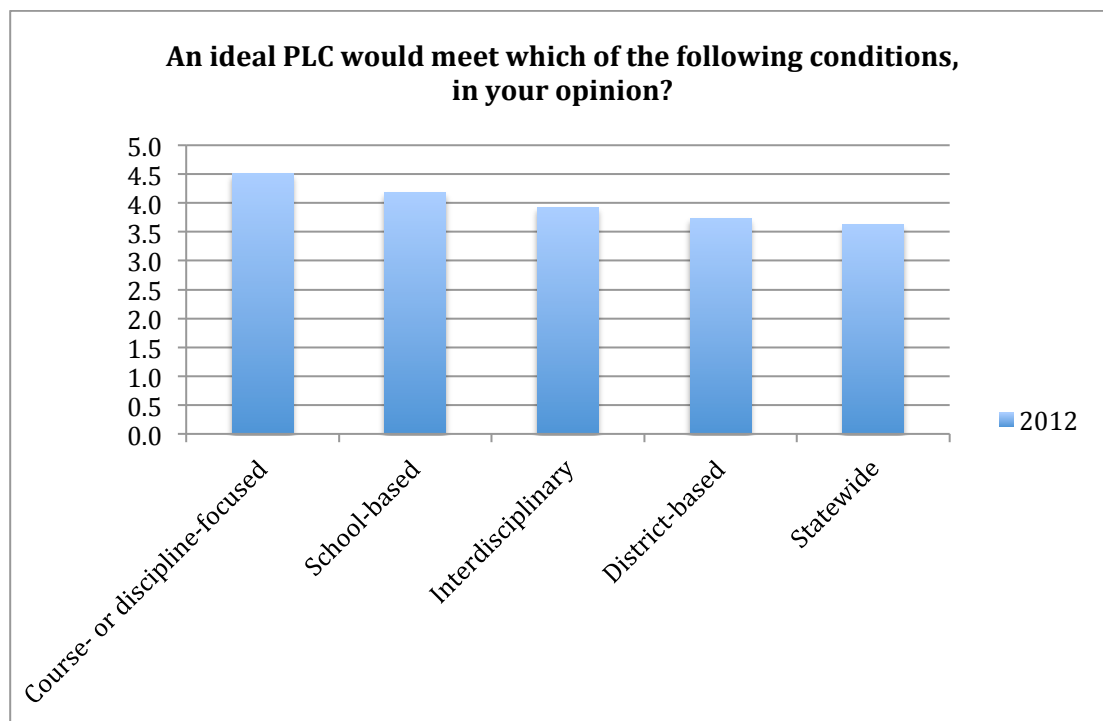
**2012: Please indicate your knowledge of the following  
NASA Global Climate Change resources below**



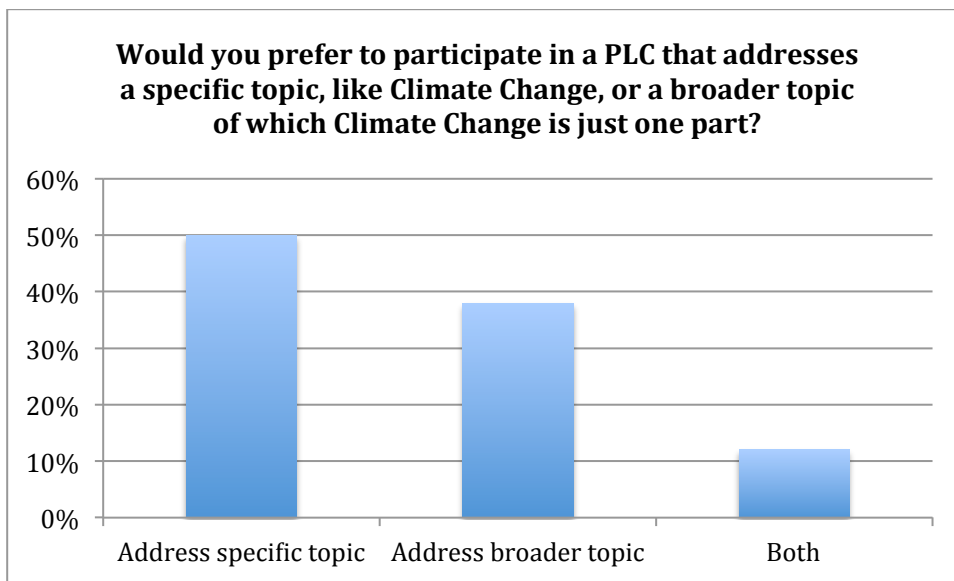
Participants were asked to rank the order in which they thought a PLC should be organized. The following chart shows a summary of what participants feel is most important organizing factor for a PLC. Note that highest ranking appears to support



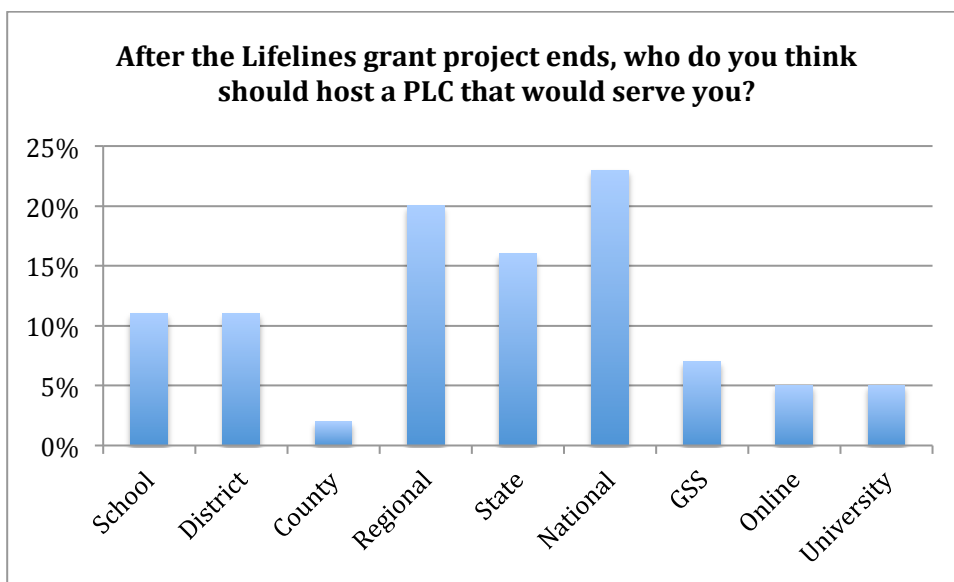
a course- or discipline-based PLC, and the lowest ranking appears to be for the one focused on Statewide issues. This may reflect a preference for more immediately relevant focus for one's PLC. The highest percentage (68%) of respondents indicated that having a course- or discipline-based PLC would be ideal. The next highest percentage (63%) indicated that having a school-based focus would be ideal. It would be a reasonable assumption that responses on this question were also influenced by participants' local circumstances, e.g. whether their schools were in rural or dense urban locales. Data on this factor will be seen on the next pages.



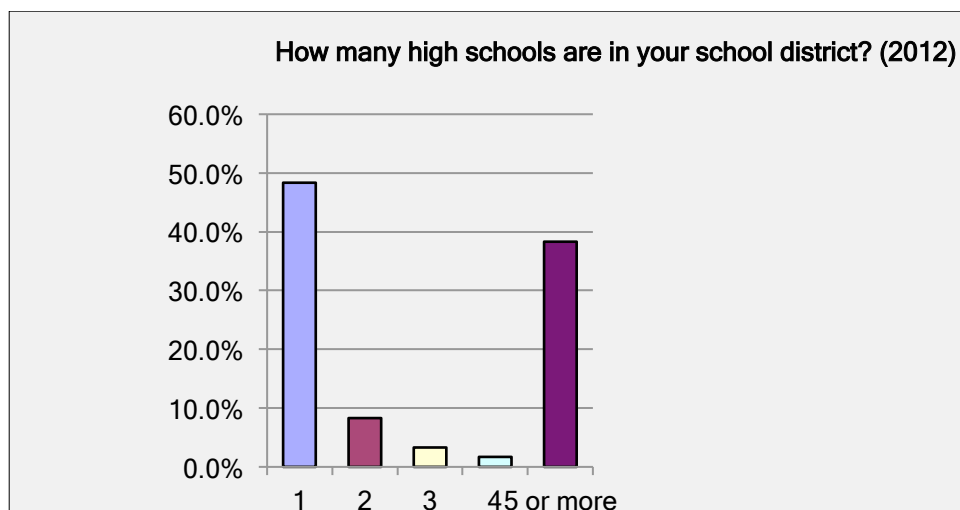
Asked whether they would rather participate in a PLC that addresses a specific topic, like Climate Change, or a PLC that addresses a broader topic of which Climate Change is just one part, respondents were fairly split, with 50% indicating they would favor a specific topic, 38% indicating they would prefer a broader topic, and 12% indicating they would appreciate having both. Arguments in favor of a specific focus were that they would be able to acquire deeper knowledge, have greater focus, stay on track and enjoy efficient meetings; whereas arguments in favor of a broader topic were to connect to other subject areas, and to allow for more flexibility and opportunity to incorporate broader topics in their teaching. In weighing the results of this question, it is important to note a confounding factor that the topic of climate change is a very broad topic to begin with! If the Lifelines PLCs had been focused on a narrower topic (e.g. assessment strategies for teaching about the greenhouse effect), the response may have reflected greater desire for broader focus of the PLCs (e.g. course or discipline focus).



The following chart reflects the thoughts of the 2012 survey respondents on who should host a PLC that would best serve participants such as those in the Lifelines project. The majority of responses fall under “regional,” “state,” and “national” organizations, suggesting a need for contact with people outside of one’s own local area, alignment with state or national standards, and, perhaps, a broader perspective on the subject of climate science overall.



The following chart shows the number of schools in each participant’s district. It seems that most of the districts are relatively small with one high school or large with 5 or more high schools.



## Evaluation Findings

### Successes of the Lifelines project:

The Lifelines project has succeeded in the following:

- Creating a network across the country of PLC leaders who have the expertise and commitment to further the collective knowledge in climate change science.
- Testing online communication platforms and refining the necessary strategies to support regular meetings for the Lifelines project.
- Developing the Lifelines leaders' experience and comfort level needed to use the online communication tools with their own local PLCs.
- Creating "local chapters" of the climate change networks in the form of high school PLCs in which teachers could meet regularly to share best practices high-quality resources for the teaching of climate change science.
- Identifying motivated and committed individuals who were able to invest the time and effort to determine the best communication structures in detail, such as best meeting times, frequency of meetings, mechanisms for sharing resources, and recruitment of new team members.
- Introducing participating teachers to the critical knowledge, information, and resources needed to implement effective teaching of climate change science, which should subsequently improve climate change science instruction for students.
- Influencing the teacher participants who taught many courses beyond the typical science courses, which expands the potential for increase climate change education in these other courses.
- Providing support to teachers who report feeling encouraged, more confident, and inspired to do their best to teach the topic in their courses.

Participants feel that they have benefited from the Professional Learning Communities (PLCs) in the following ways:

#### *By exchanging information*

- Sharing lessons, activities, best practices

- Sharing ideas and resources
- Sharing what you know
- Becoming better informed
- Troubleshooting

*By improving their teaching strategies and pedagogy*

- Having opportunities to discuss and distill the best resources
- Receiving the support of other practitioners
- Extending one's own classroom practice

*By communicating with other climate change educators*

- Learning together
- Connecting with people interested in climate change
- Feeling less isolated (because it's a small community to begin with)

Overall, participants came away with a deeper understanding of the benefits of having a PLC, an educator's role within a PLC, how to get the most out of a PLC, as reflected in the quotes below:

- *"A PLC is a venue where teachers can share and discuss best practices that promote student learning in their discipline."*
- *"A PLC is a group of professionals dedicated to enhancing their practice by sharing ideas and resources."*
- *"A PLC is a group of people committed to learning together. ...All members should be willing to share what they know and also be open to new ideas."*

### **Challenges faced in the Lifelines project:**

The Lifelines project experienced the following challenges during the course of the project.

- Finding the time to be involved in the Lifelines project. Teachers are busy to begin with, and it was difficult, at time, getting busy people to do "one more thing."
- Recruiting was a challenge in getting the "right" people—those who will participate and contribute. It is possible that leaders who are **not** teachers have more time to devote to managing a PLC.
- Retaining participants was challenging, and resulted in some were less active or who had to drop out of the project altogether.
- Because teachers tend to be busy, getting teachers to upload their materials (e.g. lesson plans, updates, etc.) required frequent reminders. Stipend incentive helped in this regard.

### **Lessons Learned**

The following are recommendations from the Lifelines leaders on how to run a successful PLC group:

- Have regular meeting times
- Meet consistently
- Focus the discussions (having an agenda helps)
- Having a leader helps (or expert)
- Have sufficient time to meet
- Offer synchronous meetings allow for more flexibility
- Have assignments/projects for participants to work on

- Have reasonable, doable requirements or expectations.
- Have a partner to help manage the PLC and run the meetings
- Everyone should participate
- Have round robins; having each person say things at meetings
- Use communication tools other than meetings: email discussions/announcements and group-edited websites.

### **What are best means of distance communication?**

The following are useful online communication tools explored by the Lifelines leaders and their PLCs:

For meetings:

- Adobe Connect + telephones
- Google: Voice & Hangout
- NSTA's Learning Center
- Skype is good for 2 to 7 people for audio, but just 1-to-1 for audio+video.
- ReadyTalk is good for larger groups and has desktop sharing, but need to learn the tools.
- WebEx, Elluminate (commercial products)
- Webinars, web conferences

For asynchronous communication:

- Wiggio
- Wikis
- Facebook
- Twitter
- Websites, Google Sites
- Email lists (with threaded discussions):  
Google Groups, Yahoo Groups, NSTA lists

### **Conclusion**

The Lifelines project succeeded in establishing a national network of PLCs for teachers in climate change science education. Through the project website and regular monthly meetings, Lifelines leaders were able to share resources and exchange ideas on climate change. Although not all leaders were able to establish successful PLCs, those who did facilitated sharing of knowledge and teaching strategies with members of their own local PLCs, extending the reach of the project. In addition to establishing a network of PLCs, the Lifelines project also succeeded in exploring different forms of online communication tools and proving that the project could be sustained through “travel-less” meetings. By forming online communities and eliminating the need for participants to travel, this project addresses the very issue lying at the heart of our focus on Climate Change—limiting the release of greenhouse gases in our daily lives at work and at home.



## **Appendix B**

### **Telephone Interviews with Lifelines PLC Leaders**

Phone interviews were scheduled during the 2nd year of the project, thereby providing the opportunity to reflect upon the 1st year as well as include some initial data from the 2nd year. The interview protocol was crafted with the goal of learning about the experiences of leading a PLC and the successes and challenges leaders faced in using online platforms as their only venue for meeting.

Key quotes from PLC Leader Phone Interviews  
(Evaluator, Shirley Lee, June 2012)

#### ***Successes***

The biggest success PLC leaders experienced were

- being able to bring together colleagues interested in the topic of Climate Change Science.
- they were able to meet by telecon, so the leaders were not limited by their geographical location.
- members did not have to drive; this especially benefited participants who live long distances from each other.
- leaders felt they were able to benefit in some way from interacting with PLC members, either by learning about additional resources, exchanging their experiences with classroom lessons, or discussing publications such as reports and books addressing issues related to Climate Change Science.

#### ***Challenges***

One of the biggest challenges for all PLC leaders was in recruiting participants to become part of their PLC. While many potential teacher participants had initially expressed interest in learning about Climate Change Science, many of them did not actually “show up” for the virtual meetings. An exception to this occurred with one PLC where the group was already formed by a pre-existing grant and in need of a communication platform, which the Lifelines project readily provided.

Most PLCs had less than 10 participants, of which only a subset of participants consistently took part in the meetings. Two outlier PLC groups had 52 participants and 90 participants. All meetings were held monthly with the exception of one group, which met bi-monthly.

In addition to recruitment challenges, all of the PLC leaders faced other common challenges in running their groups:

- Difficulty scheduling meetings

- Low attendance

- Lower commitment on the part of participants to attend a virtual meeting

- Lack of time on the part of participants to attend meetings

Another big challenge for PLC leaders was in setting up the communication platform that they would use to speak to their PLC members at every meeting. This took some trial and error on the part of the PLC, but, eventually, they were able to communicate successfully using one of the following teleconferencing platforms:

- Wiggio

- ReadyTalk

- Adobe Connect

- Skype (for smaller groups under 20)

## ***Lessons Learned***

Lifelines PLC leaders shared many insights into how to run successful online meetings as well as what barriers may exist to prevent meetings from running smoothly. Below are some key quotes that emerged from the interviews.

### ***Filling a critical need***

“If we didn’t have a PLC, we’d be really weak as a project because we would’ve lost communication. We send out emails, but voice is far better. I don’t know what we would have done with out the Lifelines PLC. Maybe something else, but it was the perfect piece that we needed.”

### ***Increasing participant commitment***

“I think having up front a really clear date and time [to meet] makes a big difference. People know it. It’s frustrating to play around with when we’re going to meet. If there’s always a time... Otherwise, there’s always something that can get in the way. Maybe if it’s in the calendar, it really makes a difference.”

“Meeting first in person and then meeting online would work better. If I know the people first, then I’ll be more willing or able to talk with them online once we’ve met in person. I know the goal of the project is to do the meetings online, not in person. Maybe some of what’s going on might be generational. I’m not that old; I’m 30. But I’m not sure we’ve embraced online

communication like the kids have. It's not a seamless transition; it takes extra effort."

"Developing a personal connection has to be more than just email and phone. Otherwise, it's too much like a call center. It really needs to start with face-to-face, so there's a commitment made first. If at a national or regional meeting, if there's a special agreement, like a kick-off meeting, it might work better. ...Warm fuzzy kickoff, start it off right, make them commit. Have a meal, dinner together, say we want to do this. I look at how organizations do this, and that's what they discovered. They've got to have the face-to-face first before good teleconferencing can happen."

"Any given time, not everybody will show up. 50% would be a good rate. Keep things going, you want to have enough people to have ideas and work together, maybe 5-10. But 15-20 total would be great."

### ***Technological demands***

"I really liked [the online platform]. Thought it had great potential, but it's still scary for other folks. Their technology is not up to speed. They're sort of there. It's an idea whose time has come, but the market hasn't quite gotten there. The tech level of teachers is not there. I told them about the new teleconference technique, and to please contact me. They say it's a nice idea, but it's not going to make their day, not going to work for them. The market is not ready for this. They're thinking, "Another meeting with technology that I'm not comfy with? With strangers? Once a month for 2 hours? Sharing stuff? No, I've got better things to do."

"A leader needs technological expertise and a desire to manage the group. Management skills and tech skills are usually not in the same person. I've got a complete package. I've got a PhD, experience in corporate settings, experience in management, so I'm comfortable, but not many people are. I can do it efficiently, so it's not a big deal. But for others, it's a big, huge wall. You're asking us to market a concept, form a cohesive group and run the technology."

"Is there a technology that will allow us to time stamp [a virtual meeting]? When we're doing the meetings? Or is there... technology to verify people are where they say they are? A time-clock kind of thing. That would be acceptable to people like the administrator [in my district]. A time stamp would be cool."

### ***Other reasons teachers cannot attend meetings***

"Seems like teachers out there teaching have materials. They have what they need. They're so busy and trying to teach it and do it well. They are involved in so many things. [Climate change] is only one topic, and it comes up once a year for 2 weeks."

“Most of the active [PLC members] were not brand new teachers because they’ve taught before and have things in place. They’re not running around, not knowing what they’re doing. [They have] time to enjoy, to play with thoughts. [New teachers] are worried about tomorrow.”