STRATEGIC PLAN
V.4.

In the following pages, we hope to communicate the detailed vision of Sci-Inspire™ to you, our trusted partners. We look forward to incorporating your feedback in the future realization of the program.

The Foundation for Biomedical Research

APRIL 2014

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EXECUTIVE SUMMARY

American science education is burdened by the stubborn persistence of mediocrity. Compared to their counterparts in a growing number of countries, students in the United States score lower in science on internationally recognized exams and show proportionally less interest in pursuing science-related degrees and careers. Given the close ties between science-based innovation and the development of economy and society, securing the future of American prosperity requires testing bold new strategies to enhance science education, particularly at the K-12 level.

Embodying that boldness and novelty is Sci-Inspire™. The strategy? **Unleashing the power of near-peer role modeling**. Sci-Inspire will galvanize science college students across the country to partner with K-12 teachers in classroom instruction and to mentor K-12 students competing in science fairs. By promoting widespread exposure of K-12 students to positive science role models, close in age, Sci-Inspire stands to meaningfully improve the outcomes of science education, boosting science attitudes and aptitudes of American youth across geography and demography.

To realize this dream, Sci-Inspire will achieve two objectives: (1) Build a Web-based system that drastically reduces the difficulty of forging "science outreach" partnerships between K-12 educators and institutions of higher education (IHEs), and (2) activate a robust community of participants.

Sci-Inspire will first build a website that trains science college students for volunteer certification by compensated site coordinators, arms volunteers with an inventory of customizable science lesson plans, "e-matches" them with educators, and provides for back-and-forth collaboration before instructional activities take place. Professors and staff are also encouraged to participate. Secondly, Sci-Inspire will launch a social media-fueled campaign to aggressively attract, sustain, and regenerate interest and participation. As an experimental program, Sci-Inspire will rely on rigorous testing and evaluation to functionally mature and to ensure success.

Sci-Inspire answers the resounding call for a revitalized science educational pipeline. Guided by the known power of near-peer interaction and a strong faith in community service, Sci-Inspire will help launch America confidently into the 21st century and beyond. ***By inspiring each other, we can accomplish wonders.***

Matthew Schaff
Founder
Sci-Inspire™
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The Foundation for Biomedical Research

THE DREAM

Jane, a neuroscience grad student, had always thought of teaching kids about the brain, but she didn't know how to find an audience. Then from a fellow student, Jane learned about Sci-Inspire™—the new online science outreach community. Seconds after registering, Jane got a text message from the Sci-Inspire website connecting her with Dr. Waldo, a chemistry professor and Sci-Inspire coordinator for Jane's university. Once Dr. Waldo certified that Jane had completed outreach training on the Sci-Inspire website, the site instantly connected Jane with Mr. Parker, a 7th grade science teacher at a nearby middle school. Mr. Parker was about to start a two-week unit on the brain and Jane could be a big help. Not to mention, if she completed enough outreach projects, she could attend an exclusive Washington, D.C., award ceremony and networking event.

From the Sci-Inspire website, Jane learned about Mr. Parker's school, accepted the outreach offer, picked out and customized her favorite brain-related lessons, and rehearsed them with Mr. Parker via video chat. During her visits to the classroom, Jane was a big hit—on her last day, several 7^{th}-graders said they wanted to become neuroscientists. Mr. Parker sang her praises to Dr. Waldo, and from the Sci-Inspire website, Jane spread details of the success over various social media platforms. Her posts and tweets inspired Jane's graduate student friends to join Sci-Inspire and accompany her on future outreach projects, as well as galvanized online "friends" and "followers" at universities across the country. Before Sci-Inspire, none of them thought that getting young kids interested in science could be so easy…

INTRODUCTION

Rationale • • •→

Consensus is growing that dire consequences are in store for the United States if the outcomes of science education are not improved. A "gathering storm," as one expert committee has called it[1], threatens to undercut Americans' ability to compete for quality jobs. Fueling more than half of U.S. economic growth since World War II[2], science-based innovation will only become more critical for the future of American prosperity. With the world economy predicted to demand millions of additional workers skilled in science and technology[3], a moribund science educational pipeline could soon rob the U.S. of its global leadership.

"As it stands right now, America is in danger of falling behind," President Barack Obama said of science education on Dec. 6, 2010[4]. The next day it was announced that 15-year-old U.S. students ranked 23rd in science performance on the respected Program for International Student Assessment (PISA) exam, with Chinese students leading the participating countries by a large margin[5]. While the PISA results may reflect broader failures in the educational system—the U.S. has fallen to 13th place in high school graduation rates[6]—student attainment in science has lagged in particular. Thirty-two percent of U.S. college degrees were science-related in 2006, compared with 53 percent in China, 63 percent in Japan and 36 percent in Germany[7], and the U.S. percentage has actually shrunk in recent decades[8]. **Of all U.S. ninth graders in 2001, only four percent earned college degrees in science-related fields by 2011[3].**

At the K-12 level, widespread educational disparities may explain some of the lag: Students with lower socioeconomic status tend to have less access to quality science education[9]. However, an equally grave concern lies in a population that reformists often ignore: science-proficient K-12 students. Despite recent attempts to overhaul science education, the retention of students from high school to college for science-related fields has "steeply" declined for the highest performers, and about **60 percent of high school students proficient in science report no interest in pursuing it[10].**

Efforts to reinvigorate the U.S. science educational pipeline have taken several forms. In particular, cooperation between K-12 schools and institutions of higher education (IHEs) has long been considered an essential element of the toolbox. Often called university-scholastic "partnerships" or "science outreach," these programs primarily aim to mobilize the scientific expertise and resources of IHEs to enhance K-12 science education[11]. Together, scientists and K-12 educators have participated in programs that center on educational standards and lesson development, teacher training, independent student research, and in-classroom activities. **U.S. science outreach programs that feature direct interaction between K-12 students and IHE**

personnel have proven effective at increasing students' attitudes toward science and science careers, affinity with schooling, and performance in science[12,13,14,15,16,17,18,19,20].

However, the IHE-scholastic science outreach movement has yet to reach its potential. Part of the reason is that science outreach programs have limited their impact by leaving one participant population largely untapped: The eight million students pursuing undergraduate or graduate degrees in science fields[21]. Despite their youthful vigor, time surplus relative to their professors, and sympathies toward volunteerism—more than one fourth of college students volunteer[22], most commonly in education— these *science college students* tend to get involved with science outreach only when their own IHE departments offer programs. Even then, limitations abound: Institutional programs are sparsely distributed across the country and within IHEs, reach only some K-12 schools, fall victim to the vicissitudes of government funding, and feature rigid contrasts in educational aims, target audiences, participant types, and project durations[23].

Science outreach programs have limited their impact by leaving one participant population largely untapped: The eight million students pursuing undergraduate or graduate degrees in science fields.

The status quo is unfortunate because a more general mobilization of America's science college students would present a new, lucrative, and vast opportunity for K-12 science education. Rather than IHE professors and staff, science college students may be the IHE representatives most capable of stimulating interest in science among K-12 students, all for one variable: Age.

Exposing K-12 students to people who are who are (1) enthusiastic about science and (2) not far away in age stands to powerfully boost attitudes toward science and science performance. "Similarity begets friendship," Plato wrote in his 360 BCE dialogue *Phaedrus*[24], and when it comes to the socialization of children, similarity begets self-identification with peers. Not only do foundational theories of cognitive development propose important roles for peers[25], scholars have argued that peers exert heavy—if not primary[26]—influence on the personalities and behaviors that children will exhibit in adulthood[27]. To illustrate, immigrant children most often replace their parents' culture with that of their new peer group[28], and students who move in and out of different peer groups correspondingly change their attitudes toward achievement[29].

Educational interactions that utilize age proximity have been shown to be effective. Echoing field reports from the Big Brothers/Big Sisters program[30], one study found that access to mentors close in age increased academic achievement and connectedness to schooling among middle school student mentees[31]. Recruiting science college students to serve as role models garners comparable results: A majority of teachers who participated in the now-discontinued GK-12 program, in which the National Science Foundation paid select graduate student fellows to regularly assist with science instruction in K-12 schools, reported that the program had "positive effects" on their students' science-related knowledge and skills.[20]

This is all not to mention the benefits that science college students stand to gain from K-12 science outreach. At a time when 60 percent of undergraduates who enroll in science-related fields eventually choose different degree paths[3], it is a welcome fact that undergraduate service participation increases the perception of preparedness for work life and aspiration for advanced degrees[32], as well as enhances academic development, life skill development, and the sense of civic responsibility[33]. In addition, graduate student fellows of the GK-12 program report greater ability to conduct communication and teamwork tasks[32], a boon to their careers given that about half of Ph.D. recipients find initial employment outside academia[34].

With or without such reciprocity in benefits, the state of U.S. science education could improve tremendously if K-12 students everywhere had access to positive science role models close in age. Thus, to secure America's future, a solution is needed that would galvanize the nation's science college students to volunteer in K-12 classrooms across the country.

That solution is Sci-Inspire™.

Aims • • •→

Primary Aims

- — Improve attitudes toward science of the K-12 students reached
- — Increase involvement in science of the K-12 students reached
- — Increase science performance of the K-12 students reached

Secondary Aims

- — Enhance communication skills for participating science college students
- — Increase retention in science-related fields of participating undergraduates

Objectives • • •→

Sci-Inspire aims to boost science attitudes and aptitudes in American youth by engaging science college students across the country to directly serve as positive "near-peer" role models in K-12 environments, partnering with educators to deliver interactive science lessons as well as mentoring K-12 students in science competitions. Accomplishing these aims would require the concurrent pursuit of two objectives:

Make science outreach easier—Build a website that matches K-12 educators and science college students, prepares and trains both parties for the interaction, provides a variety of customizable science outreach project templates that meet official standards, and welcomes the direct participation of enthusiastic science professionals

Activate a community of participants—Execute a social media-fueled targeted promotional campaign; embark on a tour of universities, school districts, and associations; hold an annual awards and development conference; and encourage participants to recruit others

TASK 1: MAKE SCIENCE OUTREACH EASIER

Sci-Inspire™ seeks to pursue a constellation of strategies in correct proportion to yield the most effective U.S. system of science outreach partnerships between K-12 educators and science college student volunteers. Five key philosophies guide Sci-Inspire, that (1) positive near-peer role modeling can substantially enhance children's learning, (2) participation is easy for all parties, (3) participants can customize the program to fit individual needs, (4) educational partnerships are fruitful, seamless and sustained, and (5) K-12 educators hold the "power" in the partnerships. Although the K-12 interaction will chiefly involve science college students working alongside K-12 educators, Sci-Inspire will also depend on school district administrators, faculty and administrators of institutions of higher education (IHEs), and compensated site coordinators from each participating IHE.

Making the K-12 interaction possible requires three strategic components of the Sci-Inspire website: Matching, preparation, and resources. Taking cue from the efficiency of existing matching websites, an electronic matching system will optimize across a variety of factors to connect registered educators with individuals or groups of volunteers, and both parties will either approve or reject each suggested match. Before the K-12 interaction, prospective volunteers will first take an audio-visual "crash course" on science outreach skills, pass a certification test in front of site coordinators, obtain necessary background checks, and learn about the specific K-12 environment they will visit. Educators will have the ability to access volunteer profiles, query an inventory of "Frequently Asked Questions," and engage in one-on-one conversations with volunteers prior to the K-12 interaction. To prime the content of each interaction, both parties will be able to access, comment on, and upload revisions to two organized inventories, one for science lessons and another for past winning submissions to science competitions.

Automated Match-Making• • •→

Background

Finding successful matches presents one of the most difficult challenges for science outreach today. Conventionally, matches are made when IHE representatives reach out to pre-established contacts within the K-12 community, be they friends, teachers of scientists' children, or participants in prior IHE outreach programs. But not all IHE personnel know people working locally in K-12 education, and even for those who do, a K-12 contact does not guarantee fruitful partnership. A successful match instead requires the coincidence of multiple wants, such as relevance of scientific content, availability of people and resources, and interest in volunteerism or enrichment. Furthermore, the growth of standardized testing culture has made achieving such a match more challenging, as K-12 teachers increasingly worry that outside enrichment opportunities may detract from standards-based teaching goals[35]. For college students, who often lack local connections, self-directed match-making becomes especially difficult.

Electronic matching (e-matching) software promises to significantly reduce the challenge of making outreach connections between science college students and K-12 educators. Users require no prior information—or attempt to acquire information—about other users to achieve a well-suited match. The Sci-Inspire software will derive from algorithms that already exist to optimize across users' distinguishing factors. The concept has been proven not only in the online dating industry, but also in science outreach[36].

The Sci-Inspire Plan

When science college students register on the Sci-Inspire website, they will build individual profiles by supplying at least: their IHE name/code, zip code, subject(s) of interest, and schedule of availability. To promote science outreach as a positive social activity, registered college students can build a profile for an outreach "team" or indicate membership of a particular "team," as approved by the IHE site coordinator. When K-12 educators register, they will build profiles by supplying at least: school code, zip code, and information about upcoming teaching "units," which includes subject area, time requirements, and type of volunteer preferred (individual, team, or no preference). The website will periodically remind all parties to update relevant information.

The "ready pool," eligible for e-matching, will be composed of the teaching units (from here on called "projects") of registered educators and the registered volunteers who are certified by IHE site coordinators (see "Training & Preparation," pg. 10). First splitting the ready pool of volunteers by the "type" requested by a particular educator, the matching algorithms of Sci-Inspire will then make connections between projects and volunteers by optimizing across the following four factors, ranked in order of decreasing priority:

1. <u>Geography</u>: Nearby registrants are more likely to be matched than far-away registrants.
2. <u>Time</u>: The less time before a unit begins, the more likely it will be matched; the greater the similarity in time schedules, the greater the likelihood of a match.
3. <u>Content</u>: The more relevant the unit subject area is to a volunteer's/team's interests, the more likely a match will occur.
4. <u>Need</u>: Lower performing schools—as measured on standardized science and math exams[37]—will be more likely to receive matches; volunteers/teams with less experience and fewer ongoing partnerships will be more likely to be matched; and schools with less exposure to Sci-Inspire will be more likely to be matched.

The match approval process will ensure the viability of all matches received by educators, thereby minimizing their time investment. The algorithms will run for each K-12 project, and a selection of the most closely matched volunteers/teams will first be notified and given access to the profiles of the unit, educator, and school. These volunteers/teams then have the choice of indicating interest in (i.e. bidding on) the project, and upon each indication of interest, Sci-

Inspire will notify the respective educator, who will then be able to view profiles of interested volunteers/teams and approve or reject them.

To build sustained relationships with preferred volunteers, an educator can choose to only notify certain volunteers/teams about a project, and if those volunteers/teams do not indicate interest, the project would then undergo the normal matching process.

Training and Preparation • • •→

Background

Before any interaction between volunteers and K-12 students can take place, all parties must be confident that the experience will be productive and safe. To breed such confidence, prospective volunteers need quality training and appropriate background checks, K-12 educators need access to preparation help, and both parties need open avenues of communication. The preparation tactics must simultaneously serve the interests of robustness and efficiency. For prospective volunteers, training should take no more than 6 hours total, approximating the training time for volunteers in the trans-Canadian science outreach program, Let's Talk Science[38].

Science Outreach "Crash Course"

Under the guidance of science outreach experts and K-12 educators, a short series of online lessons, or "learning modules," will be created to educate prospective volunteers about how to be effective in the K-12 environment. Housed on the Sci-Inspire website, the modules will be audio-visual and interactive, modeled on the acclaimed lessons of the free online school, Khan Academy[39]. The content of the course is currently under development[40], and once converted to digital format, the learning modules will seek to teach prospective volunteers how to…

- Achieve an effective and streamlined partnership with educators
- Share one's one background in science
- Make science intelligible to young audiences
- Encourage group collaboration
- Be fun, exciting, engaging and interactive
- Be approachable and sympathetic
- Engage shy or defiant students and counter disruptive students
- Respond appropriately to different levels of student ability, background and perspective
- Use educational technology effectively (and avoid "death by PowerPoint")

A quiz on each module must be passed before advancing to the next module, and the course will conclude with a final exam. Modules will be accessible to registered college students, educators, and site coordinators at all times, and a comment board will allow for additional tips and suggestions for module revisions.

In parallel with the student course, preparation materials will be made available to K-12 educators as well, but use of the materials will not be mandatory. These materials will include an advice sheet on how to work with college student volunteers and a searchable Frequently Asked Questions page.

Certification Screening[41]
A digital training course is not enough to breed confidence about volunteers' outreach capacity—there must be some level of human oversight. For each prospective volunteer, this will be accomplished through a one-on-one "screening" with the site coordinator. Given the time required to conduct certifications, the number of site coordinators at an IHE will be tied to the growth of the volunteer base.

When a college student completes the "crash course," the Sci-Inspire website will notify the site coordinator, suggest times for a future meeting, and promote e-conversation between college student and coordinator. The website will also provide instructions for the screening process: In front of the site coordinator, the student must deliver a practice science lesson as he or she would in a K-12 classroom.

For the content of their practice lesson, prospective volunteers will draw from Sci-Inspire's inventory of science outreach templates (See "Resources," pg. 13) and compose about 15 minutes worth of material. After the practice run, the coordinator will ask the prospective volunteer a series of scenario-based questions (i.e. "How would you adjust your presentation if …"), provide constructive feedback, and finally judge the student based on a pre-fabricated rubric. Then, based on his or her judgment and assuming the student has passed the "house rule" on background checks (See "*Background Checks"* below), the site coordinator will either "certify" the student by entering a certification code or ask the student to go home, revise, and try again.

Upon certification, volunteers become eligible for the e-matching process and will begin to receive project notifications. Site coordinators will be able to revoke certification, if for example they learn that a volunteer has graduated or has violated the Sci-Inspire code of conduct.

Background Checks
K-12 school districts and afterschool programs commonly require background checks on volunteers. Although the rules vary substantially between institutions, the checks fall into the following three categories, ranked from most to least frequently required: state criminal history clearance, state child abuse clearance, federal criminal history (FBI) clearance. State clearances typically cost about $10, federal checks about $20, and turnaround takes about two weeks.

As part of registration for Sci-Inspire, K-12 educators will be encouraged to note the background checks required at their institutions and whether volunteers could be reimbursed. The Sci-Inspire website will aggregate this information into a tool that graphically displays regional "clearance landscapes." Site coordinators will use this tool and knowledge of their IHE to develop their own "house rule" on clearances for volunteers: that is, which clearances prospective volunteers need to be certified.

House rules make sense because of multiple factors that are location-dependent and preference-sensitive. Each clearance landscape differs by what is required, whether volunteers can be reimbursed by school districts or IHEs, and whether acquiring clearances earlier makes sense. For example, if school districts in a region generally require just a state criminal history check and do reimburse, then site coordinators can encourage prospective volunteers to wait until their first match to worry about clearances (although waiting could delay the start of outreach partnerships). If the school districts do not reimburse, however, coordinators could require volunteers to gather background checks for certification. In this latter case, volunteers could either bare the cost, look to their IHE for reimbursement, or potentially apply for reimbursement from Sci-Inspire itself (reimbursement funding would be limited).

Site coordinators will keep copies of background checks on file, and volunteers will have the ability to present the documents if requested by educators.

Transportation

The e-matching system should ideally connect volunteers with nearby K-12 schools and afterschool programs to which volunteers can travel quickly, cheaply, and with minimal effort. Nonetheless, volunteers might have trouble getting to and from their science outreach destinations. These cases can be dealt with in multiple ways.

- Volunteers will hopefully be able to take advantage of contacts—even friendships they build—within the local Sci-Inspire community to negotiate rides.
- Site coordinators should gain a working knowledge of local transportation options, such as mass transit, rides from friends, or even chartered vans through the IHE, and coordinators should advise volunteers about these options.
- Sci-Inspire will seek an agreement with car rental companies (such as ZipCar®) so as to offer volunteers discounts on rental cars.
- If enough buy-in is established, school districts may be able to contribute transportation options.

Communication

Efficient communication between all parties is essential to building trust and expectations, facilitating logistics, and allowing customization of outreach content. To fill this function, the Sci-Inspire website will feature electronic messaging and links to an outside video chat client.

Site coordinators will be searchable by IHE, and registered volunteers (prospective or certified), K-12 educators, and other coordinators will be able to send them messages asking questions about the local Sci-Inspire program.

After an educator approves a volunteer/team for an outreach project, the Sci-Inspire website will prompt both parties to schedule a video chat meeting using a Doodle™-like scheduling platform. During the meeting, educators can help tailor the science outreach lesson to the needs of the respective K-12 students and to the educator's teaching goals. At any time, the educator will have the power to "abort" either a project or a volunteer/team, as the educator could become unsatisfied or uninterested in pursuing the project further.

Resources • • •→

Background
The content of each K-12 interaction, whether the interaction is the classroom teaching format or one-on-one science mentoring, will ultimately be decided between the educator and volunteer. However, Sci-Inspire can make producing that content easier. Notably, the website addresses the widespread concern among teachers that outside enrichment content should be relevant to educational standards.

Outreach Lesson Plan Template Inventory
After being approved for a project in a K-12 classroom, volunteers will be able to search for an appropriate science lesson plan in a streamlined inventory of templates housed on the Sci-Inspire website. The lesson plan templates will be designed to welcome customization, and a comment board will allow users to suggest changes and even upload their own modifications (e.g. perhaps one user modified a PowerPoint presentation about the solar system to include more content about Newtonian mechanics). Lesson plans will be tagged and searchable by:

- <u>Grade level:</u> Elementary, middle, high school
- <u>Subject area</u>: Physics, Chemistry, Biology, Mathematics, etc.
- <u>Educational standards:</u> With guidance from experts, Sci-Inspire staff will create a list of state-specific and federal standards and tag lesson plans accordingly. The standards that users see will differ depending on the state requirements associated with their zip codes.
- <u>Need for external resources:</u> Some lessons may require laboratory equipment or materials from a craft store. Lessons will be ranked on a 5-point scale of resource need.

Consistent with prevailing teaching philosophies in science education[42], all lesson plans will be highly interactive and designed to cultivate K-12 student-led inquiry, experimentation, and collaboration. Roles for the educator and volunteer will be clearly suggested, and volunteers will be clued into similar lessons—grouped in "project packages"—in the interest of supporting sustained K-12 interactions. The lesson plans will be aggregated from a variety of sources online[43], where thousands of vetted science lessons are available, many in the public domain and others merely requiring permissions and attributions.

To complement the lesson plan template inventory, volunteers will be able to access a list of available institutional resources at their IHE, compiled by the respective site coordinators.

Science Competition Guide

If volunteers are approved for projects that involve mentoring K-12 kids in science competitions, volunteers will have access to the "Sci-Inspire Guide to Science Competitions." Interactive and streamlined like the lesson plan inventory, the Guide will serve to educate volunteers—and by extension, their mentees—on what to expect when considering particular competitions. A profile will be built for each competition, and all competition profiles will be tagged and searchable by:

- Grade level: Elementary, middle, high school
- Subject area: Physics, Chemistry, etc., or all
- Location: Regional, state-specific, or nationwide
- Demographic eligibility: Some competitions are designated for a particular sex or minority status.

Each competition profile will provide at least the following information:

- Project Requirements: What judges are officially looking for.
- Mentorship rules: Some competitions have strict rules on what kind of help participants may solicit
- Competition Process: How to enter, who to contact, what deadlines to meet, etc.
- Past Winning Submissions: This list should promote realistic expectations, as well as arm volunteers and mentees with foundations off which to base their own ideas.

Unlike the science lesson inventory—the construction of which demands expertise on educational standards—the science competition guide can be appended by individual users, who will be able to create profiles for competitions they learn about independently. Furthermore, comment boards on each profile will allow users to supply additional advice and information.

T-shirts

To promote a sustained and recognizable image among K-12 students, and for Sci-Inspire and IHE branding purposes, visually attractive T-shirts (or polo shirts, if economical) will be designed, produced, and distributed at no cost to volunteers. The T-shirts will feature the Sci-Inspire logo and catchphrase, as well as the name of the IHE (and logo, if approved by the IHE marketing department). When site coordinators register with Sci-Inspire (for the process, see "People," pg. 25), they will receive 25 shirts of standard sizes, and they will receive another batch for every 25 volunteers certified at the IHE.

Science Professionals • • •→

Science college students will dominate the volunteer rolls of Sci-Inspire, given the program's "near-peer" learning philosophy. However, Sci-Inspire must welcome IHE faculty and staff interested in volunteering. Some science professionals who learn of Sci-Inspire will want more direct involvement than administration or coordination, and ensuring buy-in from these professionals is imperative. Therefore, Sci-Inspire will encourage professionals to get involved in small-scale volunteering as well as large-scale events.

Small-Scale Volunteering
Just like science college students, science professionals will be able to register for volunteer accounts (under the name "Sci-Inspire Pro") and partner with K-12 educators on small teaching projects. To be eligible for e-matching, professionals will similarly have to complete the online "Science Outreach Crash Course," pass the certification screening, and acquire clearances. In the "project builder," educators can request professionals as well as college student volunteers. However, to ensure high involvement of science college students, the volunteer checkbox will be auto-filled, such that if it is unchecked a message appears reminding educators about Sci-Inspire's mission and the greater availability of college students.

Large-Scale Events
A one-time, in-school assembly, talk, demonstration, or event that serves a large K-12 student audience is a common form of science outreach. Large-scale events appeal to science professionals because of the wider reach, the smaller time commitment, and the ability to control content. Sci-Inspire will capitalize on its registry of K-12 educators to facilitate these events.

On the Sci-Inspire website, educators will be able to indicate interest in such large-scale events. Once indicated, the website will present educators with the "team profiles" of nearby IHE science outreach teams, and the profiles would inform educators about the capabilities of each team. If satisfied, educators would notify the appropriate site coordinator to organize an event.

IHE professionals interested in getting involved with Sci-Inspire events will send statements of interest and qualifications to site coordinators, who will add that information to the "team profiles." Given their infrequency, events will not require professionals to go through the formal Sci-Inspire training sequence, and schools will be unlikely to require clearances for this reason. When K-12 educators desire an event, site coordinators may lead the planning, or delegate it to a star faculty or staff member. Professionals will likely lead events, but through the Sci-Inspire website, site coordinators will recruit college student volunteers to assist.

TASK 2: RECRUIT, SUSTAIN, & REGENERATE PARTICIPANTS

With its combination of e-matching, preparation, and resources, Sci-Inspire™ could represent an ideal in science outreach pipelines. But without galvanizing a grassroots community, no one will register. Science outreach programs often fail to invest in marketing, and they suffer for it. Smart marketing allows programs to achieve more and last longer than appeals to altruism alone. Attracting a steady supply of enthusiastic participants to Sci-Inspire requires building the perceptions of universal benefit and, eventually, of prestige. Volunteers should expect the Sci-Inspire name on their resumes to carry weight with potential employers. Therefore, to flourish, Sci-Inspire must first capture broad attention and build a community of participants, and then, Sci-Inspire must sustain and regenerate its community.

Sci-Inspire will accomplish recruitment and solicit institutional buy-in through an initial wave of strategic marketing, which utilizes social media-fueled targeted messaging to activate all relevant audiences. Sci-Inspire will then directly accomplish sustenance and regeneration by encouraging participants to "pass the torch," reminding them to keep match-relevant information up to date, staying on their long-term radar via social networks, and using an annual meeting to reinforce star participants, develop strategy, and communicate as an organization. In reality, the marketing wave should also serve as an indirect agent for sustaining and regenerating participants if successful, as it should help confer on Sci-Inspire an aura of prestige. Furthermore, the marketing wave could be repeated later on, depending on program progress.

The Strategic Marketing Wave • • •→

Background

The quality of Sci-Inspire's first impression is perhaps the most important determinant of its later success. The promise of Sci-Inspire must be communicated to four key audiences: science college students; IHE faculty, staff and administrators; K-12 educators; and parents of K-12 students. Audiences will be reached via traditional media, social media, earned media, and in-person interaction. Advertisements will be produced and placed in audience-appropriate TV, radio, news, and online platforms. Friends and followers will be garnered on various social media sites, and content about Sci-Inspire and science education will be regularly shared. Press releases will be produced and pitched to journalists at high-profile news outlets. Finally, Sci-Inspire representatives will tour colleges, universities, school districts, and associations across the country, proclaiming the benefits of Sci-Inspire and distributing pre-produced brochures. The wave will aim to achieve recruitment as well as institutional buy-in, which could come in the form of IHEs offering academic credit for participation or of school districts offering to reimburse volunteers for the cost of obtaining clearances. All components of the marketing wave will attempt to draw audiences to the Sci-Inspire website and its social media presence.

Audience-specific Strategies, Tactics, and Messages

- Science College Students must be galvanized to use the Sci-Inspire website to find and act on volunteer opportunities. The college students most likely to participate in Sci-Inspire would already have a busy extra-curricular schedule, so marketing tactics have to be powerful enough to convince students to move around their other commitments. Media, messages, and messengers must be honest and respectful, taking care not to confer any false impressions of a partisan agenda or profit mindset.

  Strategy 1: Produce and smartly distribute attractive media
  - Produce 30-second TV and radio ads that use targeted messaging, showcase specific Sci-Inspire stories of near-peer interactions, and appeal to the emotions and practicality
  - Produce print advertisements along the same theme
  - Produce tri-fold 8½" by 11" brochures along the same theme
  - Place ads on TV, college radio, and Internet radio stations and shows popular with college students (e.g. "The Daily Show with Jon Stewart")
  - Place print ads in college newspapers and popular websites (e.g. BuzzFeed); buy Google AdWords and Facebook promoted posts
  - Build a contact database for IHE advising centers, and send brochures to advising contacts

  Strategy 2: Leverage the impact of media products through social media platforms
  - Make Sci-Inspire website compatible with social media platforms, allowing users to "like" and "share" pages from the site
  - Create social media presence on various social media platforms, including Facebook, Twitter, YouTube, and Instagram
  - Regularly push press releases, updates, science/education facts, etc. to potential followers over social media platforms through promoted posts

  Strategy 3: Directly and personally interact with science college students
  - Produce Microsoft PowerPoint presentation promoting Sci-Inspire to the college audience
  - Produce cookie cutter Sci-Inspire T-shirts
  - Using email, Facebook, and other communication, arrange meetings with graduate and undergraduate student associations from select IHEs
  - Deliver PowerPoint presentation at student meetings, offering brochures and sample T-shirts, encouraging students to talk about Sci-Inspire with peers, and recruiting site coordinators
  - Deliver brochures to IHE undergraduate offices.

  Strategy 4: Hold contests, fueled by social media
  - Via traditional and social media, invite college students to submit videos of themselves delivering Sci-Inspire science outreach lessons

- With permissions, post top 10 videos on YouTube (comments disabled), and deem that the video with the most likes within a week wins a prize.
- Post, tweet and blog about the ensuing social media buzz, as contestants appeal to friends to like their videos

Messages: "Sci-Inspire …"

- "lets you directly and meaningfully share your passion with others"
- "helps young students succeed"
- "is emotionally rewarding"
- "enhances communication skills"
- "is something fun to do with friends"
- "provides a unique experience to talk about in interviews"
- "serves as preparation for future careers"
- "provides award opportunities"

— <u>K-12 Educators (Teachers and Afterschool Program Providers)</u> must be galvanized to use the Sci-Inspire website to initiate meaningful partnerships with volunteers and their institutions. In an era when standardized testing reigns over K-12 education, educators are inclined to believe that any outside enrichment opportunity stands to distract from speedily preparing their students. Therefore, not only must educators be made aware of Sci-Inspire, they also must be convinced that participation in Sci-Inspire does not distract from schoolwork objectives, that it actually will help achieve those objectives, and that it comes with the opportunity to win funding for their classrooms.

Strategy 1: Produce and smartly distribute attractive media

- Produce 30-second TV and radio ads that use targeted messaging, showcase specific Sci-Inspire stories of near-peer interactions, and appeal to the emotions and practicality
- Produce eye-catching print advertisements along the same theme
- Produce tri-fold 8½" by 11" brochures along the same theme
- Place ads on appropriate TV and radio stations
- Place print ads in newspapers, magazines and websites popular with educators

Strategy 2: Directly and personally interact with K-12 teachers and administrators

- Produce Microsoft PowerPoint presentation promoting Sci-Inspire to K-12 educators
- Via phone or email, arrange one-on-one meetings with superintendents and curriculum supervisors of districts surrounding major universities; invite interested teachers.
- Deliver PowerPoint presentation, offering brochures and encouraging superintendents to share the program with teachers
- Attend conferences of associations such as the National Science Teacher Association (NSTA), School Superintendents Association (AASA), the National

Associations of Elementary and Secondary School Principals (NAESP and NASSP)

Message: "Sci-Inspire…"

- "helps your students learn and get excited about science"
- "makes curriculum enrichment easy"
- "fosters meaningful, productive partnerships with IHEs"

— IHE Faculty, Staff and Administrators must be encouraged to support Sci-Inspire, promote it among students, make available institutional resources, nominate site coordinators, and get directly involved in Sci-Inspire K-12 interactions. Ideally, IHE administrators would be convinced to offer academic credit to students who participate, giving student volunteers extra incentive and sometimes even insurance protection. There is a risk that some faculty might worry that Sci-Inspire would distract graduate students from their primary responsibilities. In addition, administrators might worry that their institutions cannot afford to support the program. Therefore, this audience must be convinced that participation in Sci-Inspire would not negatively affect their students' work or put undue strain on institutional resources.

Strategy: Interact directly and personally

- Produce Microsoft PowerPoint presentation promoting Sci-Inspire to IHE faculty and administrators
- Via phone or email, arrange meetings with administrators related to research and public relations, and with faculty committees that address outreach; invite any interested faculty
- Deliver PowerPoint presentation at meetings, offering brochures and encouraging those attended to promote Sci-Inspire at their institution
- Recruit an enthusiastic site coordinator
- Attend conferences of academic associations such as the American Association for the Advancement of Science (AAAS), the Society for Neuroscience (SfN), the American Chemical Society (ACS), the Association of American Colleges and Universities (AACU), the American Physiological Society (APS), the Federation of American Societies for Experimental Biology (FASEB), the Association for the Study of Higher Education (ASHE), the Professional and Organizational Development Network in Higher Education (POD), and the Student Affairs Administrators in Higher Education (NASPA) in order to provide information to academic institutions as a group

Message: "Sci-Inspire …"

- "is largely self-sufficient"
- "is low-cost and low-maintenance"
- "is an excellent recruiting technique"
- "encourages brand awareness and positive perception of an institution"

- “can advance research goals”
- “can keep bogged-down students in touch with their passion for science”
- “can enhance grad students’ communication skills”
- “can address the reality that many of grad students get jobs outside academia”
- “can help grad students write grant proposals in the future”
- “is something you could do yourself, in terms of in-school events”

— K-12 Parents must be encouraged to support the adoption of Sci-Inspire in their children’s schools. Schools are often very responsive to the needs and requests of parents. If properly motivated, parents could serve as a driver of associations between IHEs and K-12 schools.

Strategy 1: Produce and smartly distribute attractive media

- Produce 30-second TV and radio ads that use targeted messaging, showcase specific Sci-Inspire stories of near-peer interactions, and appeal to the emotions and practicality
- Produce print advertisements along the same theme
- Produce tri-fold 8½” by 11” brochures along the same theme
- Place ads on popular TV, radio, and Internet radio stations
- Place print ads in college newspapers and popular websites; buy Google AdWords and Facebook promoted posts
- Build a contact database for IHE advising centers, and send brochures to advising contacts

Strategy 2: Leverage the impact of media products through social media platforms

- Make Sci-Inspire website compatible with social media platforms, allowing users to “like” and “share” pages from the site
- Create social media presence on various social media platforms, including Facebook, Twitter, YouTube, and Instagram
- Regularly push press releases, updates, science/education facts, etc. to potential followers over social media platforms through promoted posts

Message: “Sci-Inspire…”

- “helps your child learn and get excited about science”
- “provides children with effective, positive science role models”
- “encourages students to pursue a college education”
- “fosters a stronger relationship between parent, teacher, and community”

Note: In practice, a strategic product (e.g. TV advertisement, cross-country tour) indicated above for one audience may be designed and used for multiple audiences.

Strategies for general publicity

— Earned media must be obtained to leverage the impact of the promotional campaign and reach a wider audience.
  Strategy 1: Smart, targeted story pitching
  - Press releases that advertise Sci-Inspire roll-out events will be composed, posted to the Sci-Inspire website, and sent to major media outlets. Telephone pitches will also be conducted.
  - Film Sci-Inspire participants during and outside the classroom interaction and compile B-roll
  - Process footage into video campaign updates
  - Send campaign updates to media contacts, in addition to pushing them on social media
  - Alert media contacts to any buzz caused by pushing campaign updates on social media

  Strategy 2: Media relations
  - Appropriate Sci-Inspire staff will receive media training, will be informed about organizational movements, and will be given access to unrestricted descriptive documents, so as to prepare them to handle calls from media outlets

Sustaining and Regenerating Participants • • • →

Background

After the initial flood of interest and participation, Sci-Inspire must keep the flow going. Participants must be enticed to continue their participation, and Sci-Inspire must compensate for the inevitably high turnover in volunteers—college students constantly graduate and move on. Hopefully, the initial marketing wave will spread belief in Sci-Inspire's mission and begin to establish the prestige of the program. More directly, Sci-Inspire will maintain an active social media presence, ask volunteers and site coordinators to recruit replacement participants, send regular "adherence reminders" to participants, and hold an annual "Sci-Inspire Summit."

Social media presence

A strong social media presence will be essential to sustaining participants' interest. Over the long term, effective use of social media will yield two interactive effects for Sci-Inspire participants: The perception of group identity and a sense of vitality in the organization. To achieve these effects, Sci-Inspire will pursue four overlapping social media strategies: Communications on social media will be…

1. Relevant: As suggested above, social media campaigns will work for participants invested in social media; in Sci-Inspire's case, those participants are college student volunteers, tech-savvy K-12 educators, and K-12 students. More generally, Sci-Inspire

social media communications will be tailored to the audience and will appeal to what the audience cares about. Social media strategy will emphasize event promotion, such as pushing lesson plan contests (See “Strategic Marketing Wave”) and updating followers on contest progress.

2. Regular: Note that this does not mean “overwhelming.” A social media campaign should not inundate audiences just as it should not neglect them. Sci-Inspire will aim for 3-5 Tweets per day and 3-5 Facebook status updates per week. .
3. High-quality: Communications will be engaging and interactive. In part through links to the Sci-Inspire blog, organizational updates will be pushed over social media, as well as news relating to science, education, and their combination. Videos and pictures that tell human stories (e.g. of volunteers, teachers, parents) will take a central focus. Sci-Inspire will appropriately “re-tweet” or “share” the relevant social media communications of Sci-Inspire community members, as well as those of partnering organizations.
4. Humanized: Social media users do not want to read posts that appear sterilized and corporatized. As much as possible, Sci-Inspire will attempt to appear relatable, almost person-like. Tactics will include the circulation of science- or education-related Internet “memes,” pictures of Sci-Inspire staff’s pets, etc.

Adherence system

Various websites send emails to remind users to take medications, pay bills (Mint.com), or consider additional products. In addition to pushing reminders over social media, a similar email reminder system is needed to ensure that Sci-Inspire participants don’t forget about the program amid the bustle of their lives.

The Sci-Inspire system will send out several kinds of email reminders to registered volunteers, K-12 educators and site coordinators. Everyone will receive seasonal reminders in mid-December and mid-August (some participants will receive additional reminders if they indicate their institution runs on a different schedule; e.g. trimesters). Seasonal reminders will encourage educators to add new projects, volunteers to update their availability and recruit other college students, site coordinators to contact student groups (see “Pass the Torch”), and everyone to nominate participants for the “Sci-Inspire Awards” (see “The ‘Sci-Inspire Summit’”). These seasonal reminders will be echoed via Sci-Inspire’s social media outlets. Additionally, relevant parties will receive reminders in advance of scheduled meetings (between volunteers and educators, and between volunteers and site-coordinators; see “Training and Preparation”).

‘Pass the Torch’ recruitment

Once Sci-Inspire establishes a presence at an IHE, there’s no better way to expand and regenerate the volunteer base than through existing participants. Large organizations with local chapters (such as fraternities) take thorough advantage of this strategy.

At the start of each semester and when a volunteer completes his or her first project, the Sci-Inspire website will encourage the volunteer to recruit other college students to the program. On the Sci-Inspire website, volunteers will have access to a list of talking points and possible recruitment avenues: booths at student activity fairs, meetings with student groups, classroom visits, etc. Site coordinators will be encouraged to suggest to volunteers recruitment avenues best suited for their specific IHEs (i.e. pitching to which classes would be most effective?), to develop appropriate relationships with professors and student leaders for this purpose, and to schedule Sci-Inspire "site meetings" for older volunteers to mentor the less experienced. If they so choose, coordinators may also require that volunteers devote some measurable effort toward recruitment and mentorship of new volunteers.

To complement the volunteers' efforts each semester, site coordinators will reach out to relevant student groups: honors societies, science academic groups, service-oriented groups, etc. Depending on availability and the growth of Sci-Inspire at their IHEs, coordinators will either offer Sci-Inspire promotional material (such as the student brochure from "The Strategic Marketing Wave"), their own presence, or that of certain volunteers. When site coordinators leave the IHE or decide to relinquish their coordinator responsibilities, they will be asked to identify prospective replacements for Sci-Inspire to vet appropriately.

The 'Sci-Inspire Summit'

High schools have proms, colleges have homecoming football games, and academic fields have conferences. High-profile, interactive events allow large communities to share ideas, forge new friendships and collaborations, reward high performance, and reinforce group identity. Capturing these effects would help ensure the long-term commitment of the Sci-Inspire community of participants, so Sci-Inspire should regularly hold a program-wide conference.

This annual "Sci-Inspire Summit" will be open to all registered participants: science college students, K-12 educators, and site coordinators from across the country. News of each conference will be pushed over social media and through press releases to media outlets, as in the marketing wave (See "Strategic Marketing Wave" above). The "Summit" will feature three main components: strategy and development sessions, team building activities, and a "glitzy" award ceremony.

The strategy and development sessions will serve as the formal agent of professional communication. Much like during an academic conference, 15-minute talks with Q&A and discussion groups will be delivered by pre-selected Sci-Inspire staff, participants, and outsiders (e.g. experts in science education, policy). All Sci-Inspire participants will be invited to submit briefs for proposed talks or discussions months before the conference, and Sci-Inspire staff will vet the briefs and notify participants selected. Sessions will fall into the following categories: strategic innovations, field reports, new directions.

Few would attend the “Summit” if all they expect is the bread and butter of formal talks. To build a more casual atmosphere, ripe for collaboration, sprinkled throughout the event will be dinners, dancing, and networking events.

The “Sci-Inspire Awards” will wrap up the “Summit.” At the evening ceremony, an emcee will introduce the winners of various awards, which will go to star K-12 educators and volunteers, coordinators who bring about extraordinary campus activation, and administrators who champion Sci-Inspire at their institutions. The awards will have attached cash prizes. Any registered Sci-Inspire participant can nominate another registered participant, and the Sci-Inspire staff will choose among nominees and announce their selections months prior to the “Summit.” A special award—or series of awards—will be designed for partnerships that emphasize educational content related to biomedical research[44].

THE PEOPLE

The success of Sci-Inspire™ will depend on a variety of people playing distinct roles.

Site Coordinators • • • →

The keystone of Sci-Inspire's operations at each IHE, the site coordinator will preferably be a faculty or staff member with a science background, a passion for community outreach, and a proven ability to communicate and to handle responsibility. Theoretically, one IHE could house multiple coordinators and graduate students could be coordinators (say, for example, the existing coordinator experiences an overwhelming influx of volunteer interest). Regardless, coordinators must be carefully vetted by Sci-Inspire staff. The initial marketing wave will seek to recruit site coordinators, and anyone will be able to apply for the position by contacting Sci-Inspire. All prospective coordinators will be personally interviewed, either in person or remotely, before Sci-Inspire can register a coordinator. Attempts to compensate coordinators for this part-time responsibility will be made, although IHE rules sometimes make receiving outside income difficult, especially for graduate students. As for their roles, site coordinators will:

- Administer certification tests for the IHE
- Compose and enforce house rules on background checks
- Gather and publish information for volunteers about institutional resources
- Prepare volunteers to recruit others, and inform student groups of Sci-Inspire each semester
- Supply content to the section of Sci-Inspire website local to the IHE ("team profile")
- Field requests for large-scale outreach events, and delegate planning responsibilities
- Answer questions any party might have about Sci-Inspire in that area
- Store records securely (i.e. background checks)
- Participate—and enforce participation among volunteers—in evaluation procedures
- Nominate participants for awards
- Distribute T-shirts
- Handle disciplinary issues

Sci-Inspire Administrative Staff • • • →

The program will need to employ full-time staff members to run smoothly. They will:

- Set course on project strategy and creative (branding, press releases, etc.).
- Identify, certify, and maintain contact with site coordinators.
- Procure outside contracts and manage relationships with contractors (media, web design, software engineering, evaluation, event planning).
- Manage social media presence.
- Represent Sci-Inspire publicly (social media, media relations, cross-country tour).
- Secure external funding (write grant proposals).

— Organize and oversee execution of the "Sci-Inspire Summit."

Science College Student Volunteers • • •→

Roles:

- Use the Sci-Inspire website to engage in partnerships with K-12 educators.
  - Complete training process.
  - Communicate closely with K-12 educators.
  - Prepare projects along with K-12 educators.
  - Serve as role models and mentors for K-12 students.
  - Update availability information regularly.
- Help recruit site coordinators (if applicable).
- Help recruit other volunteers.
- Participate in evaluation procedures.
- Nominate participants for awards.

K-12 Educators (teachers & afterschool program providers) • • •→

Roles:

- Use the Sci-Inspire website to engage in partnership with volunteers.
  - Complete registration.
  - Communicate closely with volunteers.
  - Update project information regularly.
- Promote Sci-Inspire to other teachers.
- Participate in evaluation procedures.
- Nominate participants for awards.

IHE Faculty, Staff & Administrators • • •→

Roles:

- Promote Sci-Inspire to colleagues and students.
- Make available IHE resources to site coordinators ($, people, equipment).
- Help recruit site coordinator.
- Participate in small-scale and large-scale K-12 interactions

DEVELOPMENT, PILOT TESTING, AND EVALUATION

Before Sci-Inspire™ goes nationwide, its concept must be proven with an IHE partner. Models for most program components already exist—e-matching, educational training, resource banks, recruitment campaigns—and research and previous programs leave little room for doubt regarding the positive effects of near-peer role-modeling on children. However, Sci-Inspire's targeted combination of components, audiences, and objectives makes it one-of-a-kind, and therefore rife with contingencies that demand careful attention. Each moving part must be evaluated with a before and during the national roll-out. That requires a pilot test and a sustained evaluation.

Development, Pilot Test, & Evaluation Strategy • • •→

The purpose of the pilot test is threefold: to assess methodology and impact and utilize that knowledge, to measure and ensure outcomes, and to gather promotional material for the national campaign. Both of Sci-Inspire's major objectives—making science outreach easier, and recruiting, sustaining, and regenerating participants—will be piloted in a scaled-down form. Given the high stakes of the pilot test, the expertise of an independent, experienced evaluation consultant will be procured, and design details will remain to be finalized until the evaluator confers with all relevant stakeholders. (The following strategy provides a sense of what a reasonable development, pilot test, and evaluation phase could look like.)

A complete but adaptable website prototype will first be built and populated with preliminary content. While developing the prototype, an IHE partner will be sought (the ideal partner would have history of involvement in science outreach). Once an IHE partner is secured, Sci-Inspire and its partner will together seek funding for the development and pilot phases. Communication will commence between Sci-Inspire and representatives of the partnering IHE, of the school districts, and of other community stakeholders, and a "development & pilot strategic plan" will be composed that respects these varied interests.

Barring requirements specific to the stakeholders, the development phase will entail producing content, extending and refining the website, slowly integrating Sci-Inspire components with the existing IHE science outreach program (a prove-the-concept-as-you-go approach), and preparing for the pilot test (See Figure 1). All aspects of the development phase will involve collaboration between stakeholders, potentially mobilizing undergraduate teams in the computer sciences and business to extend the website and refine the marketing plan, respectively.

Upon the completion of development, the pilot test will commence. Site coordinators will be recruited, and a marketing wave will take place at the IHE and its surrounding school districts (see "Objective 2"). During the pilot test, the Sci-Inspire partners will gather marketing material, produce more content, manage recruited participants, run the evaluation, and continually adjust the website and strategy pursuant to the evaluation's findings.

As explained below, targets for evaluation will include the Web interface and the experiences and behaviors of all participants. An appropriate mix of quantitative and qualitative evaluation tactics will be employed, reflecting the complexity of each experience with Sci-Inspire. Depending on available resources and preferences of stakeholders, the evaluation may employ some level of an experimental approach, wherein participants are initially divided into experimental and control groups and later compared. For the more laborious tactics (i.e. interviews, focus groups), small samples of the participatory population will be selected for assessment. Participation in the evaluation will be incentivized, and proper permissions will be granted to Sci-Inspire before evaluation procedures ensue in the K-12 environments.

The pilot test should last between six months and one year, and evaluation reports will be distributed to stakeholders on a regular basis.

Formative Evaluation

The evaluation will rigorously investigate the soundness of Sci-Inspire's processes and functions. Such formative evaluation will prove more important for Sci-Inspire than will summative evaluation. Whereas evidence already exists to support the hope that Sci-Inspire could effect its overarching educational outcomes (see "Introduction"), it remains to be shown whether the Sci-Inspire model can operate practically.

Formative Evaluation Questions

The evaluation will seek answers to the following formative questions, among others:

- Are roll-out objectives being met, and on time?
- How fast and in what ways does the interest and involvement in Sci-Inspire grow within a community?
- Which marketing strategies, tactics, and messages are effective at activating participants, and which are not?
- How do stakeholders perceive the program? What do they find worthwhile, and what do they find useless or disruptive?
- How much time and effort does participation in Sci-Inspire require of stakeholders?
- Do the match-making algorithms operate with efficiency and equity?
- What ratio of college student to professional volunteers do educators request?
- What factors facilitate or impede partnerships between volunteers and educators?
- How long do partnerships last, and what do they entail?
- Are the volunteers practicing effective teaching techniques?
- What logistical difficulties, if any, do volunteers encounter when trying to get into schools and afterschool programs, and how are these difficulties resolved?
- How do volunteers and educators make use of the educational content on the Sci-Inspire website, and how could it be improved?

- How sustainable is participation once it begins?
- Do the training and preparation components effectively prepare volunteers and educators for the partnership? If not, why not?
- How do K-12 students interact with their near-peer role models?

Formative Evaluation Methodology

- Collection of Process Data: "Roll-out" of the strategic marketing wave will be measured, in the form of impressions of TV, radio, print, and online ads; the number of site coordinators recruited; and the numbers of IHE administrators, IHE faculty members, IHE students, IHE student groups, K-12 educators, and K-12 students met on the pilot tour. "Traction" of the wave will be measured, in the form of traditional and social media buzz; clicks, likes, favorites, views, etc.; the number of registration accounts for site coordinators, volunteers, and educators; the number of resource inventory downloads; the number of suggested partnerships and actual partnerships; the number of online comments on the resource inventory and the training modules; and the ratio of successful to total recruitment attempts.

- Focus groups: Before the pilot roll-out begins for Sci-Inspire, educators and students will be invited to participate in an initial focus group, which will test marketing strategies. During the pilot test and at its conclusion, selected teachers, volunteers, and site coordinators will be invited to participate in focus groups that address the other formative issues.

- Observation: Evaluators will attend selected interactions between volunteers, site coordinators, educators, volunteers, and K-12 students.

- Interviews: At the conclusion of the pilot test, in-depth interviews of selected site coordinators, educators, and volunteers will be conducted.

- Surveys: All volunteers, educators, and K-12 students involved in experimental environments will complete surveys that assess formative issues. Educators and K-12 students will complete one survey when educators are accepted into the experimental group, and they will complete a follow-up survey at the conclusion of the pilot. Educators will have the option of choosing Web-based or paper-and-pencil surveys for themselves and their students.

- Real-time commentary: All participants will be encouraged to communicate questions, concerns, and complaints to site coordinators via email or phone. The site coordinators will send these and their own commentary to the evaluator for compilation and analysis.

Summative Evaluation

The short timeframe of the pilot test creates challenges for assessing achievement of Sci-Inspire's aims, which would, like education goals in general, require multiple years for realization (See "Introduction"). Nonetheless, measuring early indicators of summative success is necessary and viable.

Summative Evaluation Questions

Attitudes (K-12 students): Do students in experimental environments demonstrate…

- More positive attitudes toward science and scientists?
- Increased interest in science-related careers?
- Increased interest in getting involved with science?

Behavior (K-12 students): Do students in experimental environments demonstrate…

- Increased understanding of scientific concepts and methods?
- Increased self-efficacy to take on scientific challenges?
- Increased engagement in science?

Behavior (volunteers): Do volunteers demonstrate…

- Enhanced communication skills?
- Increased retention in science-related fields?

Summative Evaluation Methodology

- Surveys: On the same surveys that assess formative questions, volunteers, site coordinators, educators, and K-12 students involved in experimental environments will respond to summative questions. Additionally, surveys addressing summative issues will be provided to educators and K-12 students in "control cohorts." Of note, K-12 students will answer questions adapted from the Modified Attitudes Toward Science Inventory[45], and educators will address changes in attitudes and behavior toward science among their students.
- Standardized tests (if feasible): State government-administered standardized tests are a potentially appropriate outcome measure for Sci-Inspire, given its emphasis on being standards-relevant. Ideally, comparing test results between experimental and control groups would help quantify the effect of Sci-Inspire on the science performance of K-12 students, in a way that is particularly meaningful to educators and policymakers. In reality, the standardized test measure may not lend itself well to the pilot program. States differ on how frequently the tests are administered and how much science is emphasized, and the time needed for Sci-Inspire to translate into test scores may fail to track to this test frequency or take longer than the pilot

program length. As an alternative, the evaluator could develop an in-house, standards-based assessment of science performance that the evaluator could administer, either in cross-sectional or change-over-time designs[46].

Sustained Evaluation Strategy • • • →

After the pilot test, sustained evaluation will be necessary to continue improving Sci-Inspire. Although less intensive than during the pilot, the sustained evaluation will feature quantitative and qualitative tactics and emphasize summative issues, taking advantage of the extra time allowed to assess outcomes.

The sustained evaluation will address the same formative and summative questions and utilize the same tactics as in the pilot test (see "Development, Pilot Test, & Evaluation Strategy "), with some important differences. Given the magnified costs of a nationwide program, the sustained evaluation will touch a smaller proportion of participants—only participants in randomly selected projects will be asked to complete surveys, and fewer participants will be involved in laborious evaluation tactics (i.e. interviews, focus groups) as a percentage of total participants. Two additional tactics will be introduced: longitudinal tracking and case studies.

Additional Tactics for Sustained Evaluation

- Longitudinal Tracking: The behavior of K-12 students and college students who participate in Sci-Inspire, including students from the pilot test, will be tracked over multiple years. This tactic most directly addresses the summative questions and programmatic aims—comparing the life paths of experimental and control (or average) populations could powerfully assess the impact of Sci-Inspire on the science educational pipeline. However, longitudinal tracking also has garnered a notorious reputation from evaluation experts for being difficult to conduct[47]. Keeping experimental and control populations separate is almost impossible with an education program, and evaluators invariably lose contact with more subjects as each year passes. Nonetheless, the Sci-Inspire evaluation stands to benefit from lessons learned after decades of longitudinal studies of children[48].
- Case Studies: Given the high levels of complexity that characterize educational programs, case studies—"focused, in-depth description, analysis, and synthesis" that look at programs in "geographic, cultural, organizational, and historical contexts"[49]—present a highly appropriate tool for evaluating a scaled-up Sci-Inspire. The evaluation would regularly select particular Sci-Inspire communities for in-depth study based on pre-determined evaluation goals, and the evaluation would proceed to holistically assess the results of a variety of evaluation methods deployed in that community.

Summative Evaluation Logic Model (* = applies only to long-term evaluation) • • • →

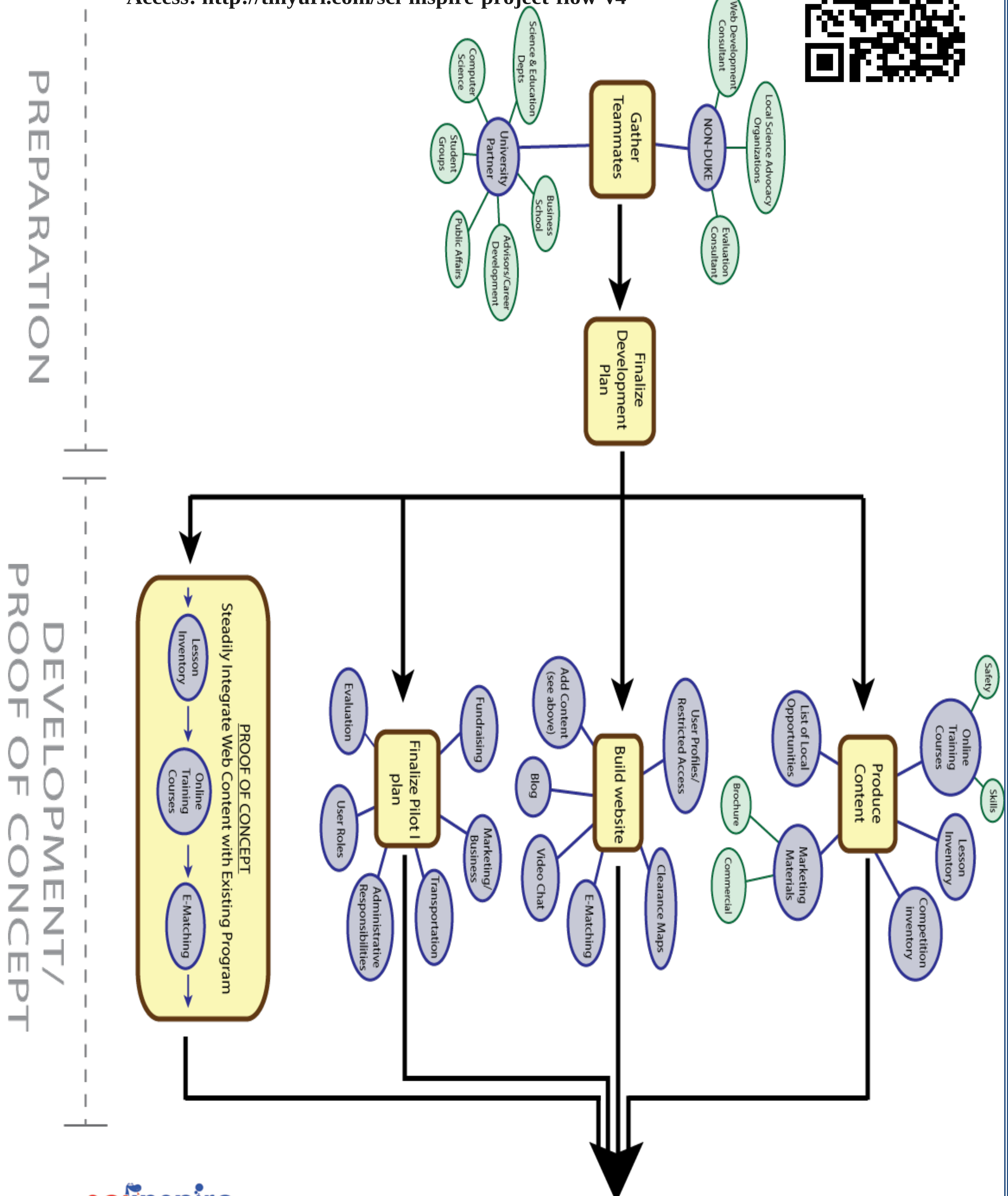
Intended Outcome	Indicators	Evidence that Outcome was Achieved
Attitudes (K-12 Students) ▪ More positive attitudes toward science and scientists ▪ Increased interest in science-related careers ▪ Increased interest in getting involved in science	▪ K-12 student survey responses ▪ Educator survey responses, interviews, focus groups	▪ Students report more positive perception of science teacher and volunteer ▪ Students report reduced anxiety toward science ▪ Students report increased value of science in society ▪ Students report increased enjoyment of science ▪ Educator reports students care more about science ▪ Students report more positive self-concept of science ▪ Students report increased desire to do science ▪ Educators report students inquire more often about science careers ▪ Students report increased desire to get involved with science ▪ Educators report students inquire more often about science activities
Behavior (K-12 Students) ▪ Increased understanding of scientific concepts and methods ▪ Increased self-efficacy to take on scientific challenges ▪ Increased engagement in science	▪ K-12 educator survey responses, interviews, focus groups ▪ K-12 student survey responses ▪ Standardized test scores	▪ Educators report students perform at higher levels in science ▪ Test scores reveal higher levels of student performance in science ▪ Educators report students are more willing to approach scientific challenges ▪ Test scores reveal students perform higher on tougher questions ▪ Students report greater involvement in science ▪ Educators report greater involvement in science among students o Competing in science fairs o Joining science clubs o Enrolling in science classes o Sending questions to Sci-Inspire volunteers o Seeking additional science opportunities o *Enrolling in college, choosing science major o *Choosing science-related career
Behavior (Volunteers) ▪ Enhanced communication skills ▪ Increased retention in science-related fields	▪ Volunteer survey responses, interviews, focus groups ▪ Site coordinators survey responses, interviews, focus groups ▪ Evaluator observations	▪ Volunteers report reduced presentation anxiety ▪ Volunteers report increased ability to adjust to diverse audiences ▪ Site coordinators report increased communication skills among volunteers ▪ Evaluator observes increased communication skills among volunteers ▪ Volunteers report greater intention to continue studying science ▪ Volunteers continue studying science at a higher rate ▪ *Volunteers choose science-related career

TIMELINE

A rough approximation for the Sci-Inspire™ action plan appears below. Within three years, the program would roll out nationwide.

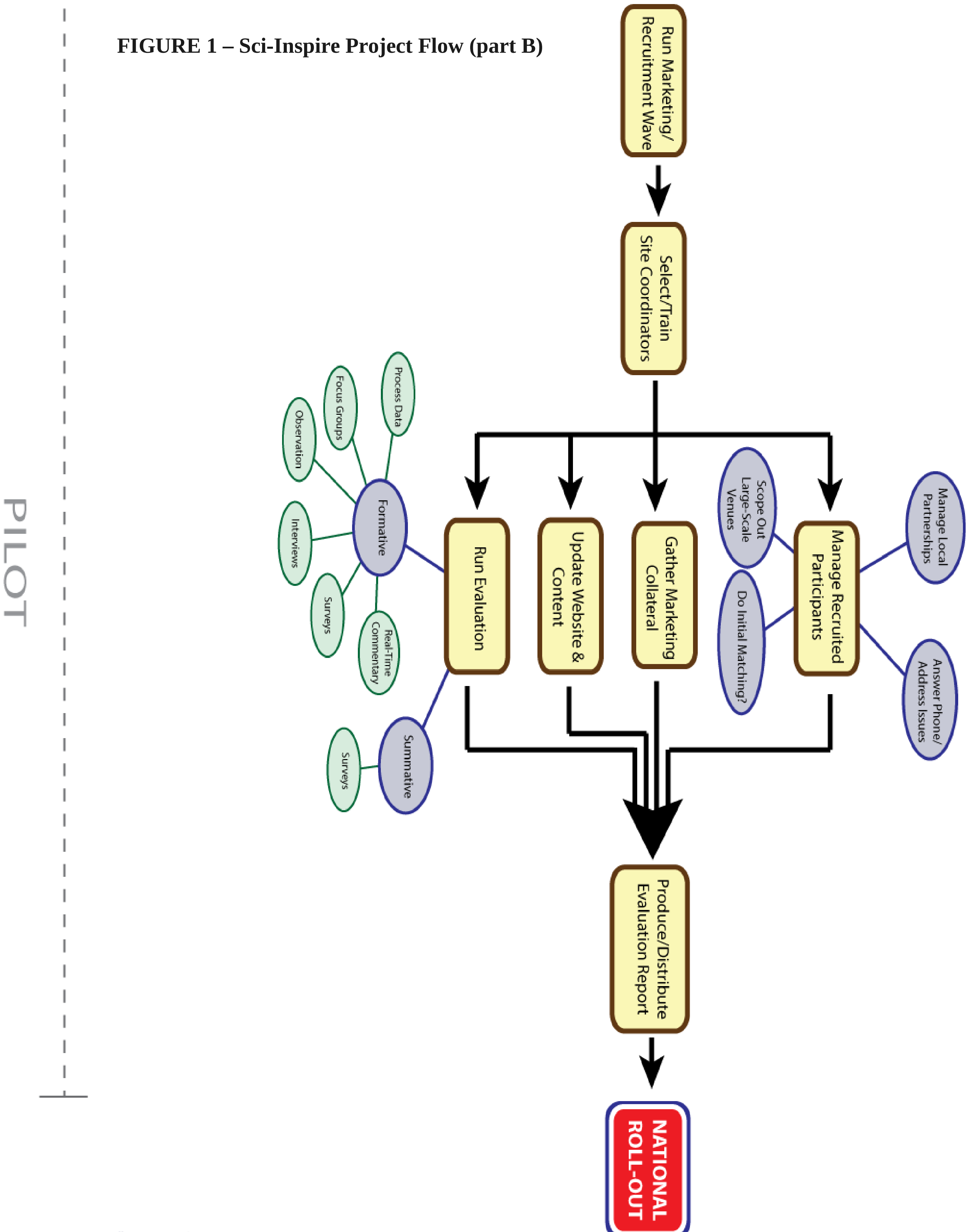
1. (Y1) Website prototype development
    - i. Design/Branding
    - ii. CMS, DBMS
    - iii. Resource inventories
    - iv. Apps
      -Messaging platform
      -Scheduling client
      -Maps
2. (Y1)Partner gathering
3. (Y1)Grant writing
4. (Y1)Website development
    - a. Procure contractors/core staff/enthusiastic advisers skilled in:
        - i. Software/Web engineering
        - ii. Efficient & judicious e-matching algorithms
        - iii. Web design
        - iv. K-12 issues & educational standards
        - v. Online education
        - vi. Evaluation
    - b. (Y1) Extend & refine Web functionality
        - i. Security
        - ii. Matching algorithms
        - iii. Training module structure
    - c. (Y1) Develop Web content
        - i. Develop & sort lesson plan templates into inventories
        - ii. Develop & sort science competition content
        - iii. Develop training module content
5. (Y2)Pilot program
    - a. Customize initial "marketing wave" strategy to pilot locale
    - b. Run the initial "marketing wave" for recruitment
    - c. Evaluate pilot, adjust pilot concurrently
    - d. Publish pilot evaluation report
6. (Y2)Grant writing for national program
7. (Y3)Adjust program to lessons & products of pilot program
8. (Y3)Amplify Web functionality & resources
9. (Y3)National roll-out

FIGURE 1 – Sci-Inspire Project Flow (part A)
Access: http://tinyurl.com/sci-inspire-project-flow-v4



-sciinspire

FIGURE 1 – Sci-Inspire Project Flow (part B)



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[40] Since 2011, University of Pittsburgh psychiatry professor and science outreach leader Judy Cameron, Ph.D., has been developing the "Speaking of Science" course, which aims to teach undergraduate and graduate students most of the skills that Sci-Inspire volunteers will need. Dr. Cameron has positively entertained the prospect of converting that course into a series of online modules, but proper permissions must first be acquired.

[41] It is possible that, even with multiple site coordinators, the stress of conducting certification screens will become overbearing. To relieve the coordinators, Sci-Inspire employees could potentially pick up the slack of certification, either by one-on-one video chat with prospective volunteers or group certification workshops. However, such alternatives might be financially difficult to sustain for a nationally scalable program.

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American Physiological Society (http://www.apsarchive.org/); American Chemical Society (http://www.middleschoolchemistry.com/lessonplans/, http://www.acs.org/content/acs/en/education/whatischemistry/landmarks/landmarks-lesson-plans.html); K12lab (http://k12lab.com); Howard Hughes Medical Institute (http://www.hhmi.org/biointeractive/classroom-activities-mirror-tracing-activity); American Society for Engineering Education (http://teachers.egfi-k12.org/category/lessons/); The Geological Society of America (http://www.geosociety.org/educate/resources.htm); Science Kids (http://www.sciencekids.co.nz/lessonplans.html); Smithsonian Education (http://www.smithsonianeducation.org/educators/lesson_plans/science_technology.html).

[44] The Foundation for Biomedical Research believes that only broad efforts to support science education can meaningfully enhance the long-term educational pipeline that produces biomedical researchers, ("A rising tide lifts all boats"). K-12 curriculum spends little time on biomedical topics until high school, and often the people most interested in conducting science outreach come from fields unrelated to medicine. However, the "Sci-Inspire Awards" offers FBR a way to directly address its mission while not sacrificing the program's relevance or power.

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