



The Science Ambassador Program: Partnering Scientists with Science Teachers

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ABSTRACT

This article focuses on the development and implementation of the Science Ambassador (SA) Program, which targets adolescents by working directly with science teachers who write and implement lesson plans that feature public health topics. The main goals of the program are to develop science lesson plans on public health topics, expose adolescents to health information at an earlier, formative age, and inspire adolescents to explore future careers in public health. The information presented in this article is intended to give other program planners insight into the structure and implementation of the program and to share valuable lessons learned.

BACKGROUND AND PROGRAM JUSTIFICATION

Adolescents have become a major target audience for health education programs over the years. This age group is increasingly at risk for a variety of health problems,¹ and public health messages designed for adolescents need to address their unique needs. Adolescents often experiment with—and establish—behaviors such as substance abuse, risky sexual behavior, and unhealthy eating habits, which can lead to increased risk for morbidity and premature mortality in adulthood.¹ If adolescents are introduced to public health topics at an earlier age, they might better understand how their behaviors affect their bodies and, ultimately, their health and well-being. Early introduction of health topics also gives them a chance to learn the importance of establishing and maintaining healthy habits that could reduce their risk for future health problems. Although knowledge is just one step toward

changing behavior, it is an important one. For example, according to Centers for Disease Control and Prevention (CDC) “Guidelines for School Health Programs to Promote Lifelong Healthy Eating,” some evaluations of school-based nutrition education programs have found that children are improving their eating activities.² Equipping students with the knowledge they need to make positive behavior choices at an early age can help them establish lifelong healthy habits.

Science education has received more attention in the United States over the past several years. Although science scores from eighth graders increased between 1995 and 2003,³ the Secretary of Education has stated that “we must make our high schools more rigorous and encourage students to take more advanced math and science classes. Employers today need...creative problem-solvers with strong math and science backgrounds. Whether children want to be auto

mechanics or cancer researchers, they must have these skills.”⁴ As a result of this emphasis on science, teachers are looking for activities and lesson plans to use in their classrooms that are relevant, engaging, interesting to students, and that meet the National Science Education Standards. However, these lesson plans must also be affordable, acces-

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sible, and come from credible sources. Just as employers in the corporate world seek employees with a particular skill set, public health agencies, like the CDC, seek talented individuals with a dedication to improving health. Teaching about public health topics in the classroom not only informs students about health issues relevant to their lives, but also encourages the development of a new generation of public health professionals.

The CDC is in a unique position to meet the needs of science teachers in the United States. Its work addresses an array of topics of interest to a wide range of consumers, including adolescents and their families. The CDC's website received an average of 598,215 hits per day during 2006. Information on a recent outbreak, updated rates of disease, and new health recommendations are all high-profile events that attract a great deal of media and public attention, indicating their relevance. The CDC's attention to scientific accuracy has been one of its hallmarks, making the agency a national leader in providing current and credible information on public health issues.

Science teachers searching for exciting, real-world, science-based topics to use in their classrooms can use the information the CDC provides to make public health "real" for their students. The inclusion of public health science in the classroom should be efficient, effective, and affordable. In the past, CDC researchers have found it challenging to develop effective public health-related lesson plans that meet the National Science Education Standards. Even more challenging has been getting those lesson plans into middle and high school classrooms. Although CDC scientists have the scientific expertise and communications know-how to reach the public, their expertise is limited on how best to incorporate health topics into school systems. This is why the knowledge and expertise of science teachers is so valuable—they are uniquely qualified to assist in translating the CDC's science into material that is useful in the classroom, meaningful to students, and in line with national standards. By creating a partnership between CDC scientists and teachers, the SA

Program plays to both the CDC's and science teachers' strengths.

THE SCIENCE AMBASSADOR PROGRAM

The SA Program began as a pilot project based in the National Center on Birth Defects and Developmental Disabilities (NCBDDD) from 2003 to 2006. It was created as a professional development program for middle and high school science teachers and select pre-service master's-level science education students. The program brings together the expertise of CDC scientists and the educational expertise of teachers. As part of the program, teachers come to the CDC for a summer weeklong workshop led by CDC scientists. Past workshops have featured a variety of science-based public health topics, including epidemiology, genetics, fetal alcohol syndrome, skin cancer, hantavirus, folic acid and the prevention of birth defects, and nutrition and physical activity. CDC scientists and science teachers work together to develop high-quality science lesson plans that meet National Science Education Standards and are based on workshop topics. To broaden the reach of these lesson plans, the CDC makes them available to the public for free via its website (<http://www.cdc.gov/excite/ScienceAmbassador/ScienceAmbassador.htm>).

The ultimate goal of the SA Program is threefold. First, it can serve as an effective tool for producing and distributing interesting lesson plans that feature public health topics for middle and high school science classes. Second, exposing adolescents to information that can positively impact their personal health and well-being could benefit them throughout their lives. Because risky behaviors and other poor health habits often begin during adolescence,¹ reaching this group with important public health information can be one step toward improving overall health outcomes and instilling healthy habits that will last a lifetime. Finally, introducing public health in new and creative ways can inspire students to pursue college coursework or even explore careers in public health in years to come.

The SA Program has six major components: (1) recruitment, (2) selection of teachers and CDC scientists, (3) workshop implementation, (4) lesson plan development, review, and publication, (5) lesson plan implementation, and (6) evaluation. An overview of each of these components is included below, followed by specific "lessons learned" about development and implementation of the program.

Recruitment Process

Teacher recruitment. The SA Program seeks science teachers who are not only extraordinary teachers and mentors, but also good writers. They must be able to write engaging lesson plans that other teachers can easily follow and replicate in their own classrooms. The program begins recruiting teachers in the winter and spring. Information about the program is distributed through a variety of listservs and contacts, including national and state science teacher associations, biology teacher associations, and science supervisor associations. Additionally, science teachers who have been named national biology teacher of the year or teacher of the year in their state are personally invited to apply. Teachers can also sign up for the SA mailing list, which notifies recipients when applications become available. Applications are available online.

Scientist/lecturer recruitment. Based on a combination of which Centers are funding the program and feedback from former participants, the SA Advisory Committee determines a list of possible workshop topics. SA staff recruit CDC scientists with expertise in these topic areas to participate in the program. Recruitment of scientists occurs through presentations, e-mail announcements, in-person meetings, and telephone calls. CDC scientists are given detailed descriptions of the time commitment and expectations before agreeing to participate. Time commitment is approximately 20 hours over 10–11 months, and activities include preparing a 45-minute presentation, attending two pre-workshop meetings, delivering a 45-minute presentation followed by a 45-minute question-and-answer session, participating in two one-on-one



teacher meetings to react to teachers' lesson plan ideas, and reviewing two lesson plans for scientific accuracy.

Selection Process

The selection process is highly competitive. Science teachers must submit a resume, two confidential letters of recommendation, a personal statement, and a sample science lesson plan that they themselves developed. Applications are reviewed by two independent reviewers on the SA Advisory Committee. Qualified applicants then participate in a 30-minute telephone interview with members of the committee. These interviews allow committee members to assess an applicant's fit with the program to ensure that he or she would have a positive experience developing lesson plans and working with SA staff and other teachers. Final selections are made, and alternates are chosen. All applicants are notified of their status within 2 weeks of the telephone interviews.

Workshop Implementation

The SA workshop, held in the summer, begins with an overview of the CDC and a basic introduction to two of the CDC's main activities, epidemiology and surveillance. This is followed by specific workshop sessions. Sessions last 90 minutes; CDC scientists present for approximately 45 minutes and then moderate a 45-minute question-and-answer session along with a discussion in which teachers, CDC scientists, and SA staff brainstorm ways to translate the information for the classroom.

The SA workshop gives teachers time to learn about new topics and discuss them with colleagues and CDC scientists. Teachers then use their new knowledge to develop complete drafts of lesson plans based on different workshop topics. Two lesson plans are developed for each topic presented, with teachers being able to choose their areas of interest within that limitation. Throughout the week, teachers work in pairs to develop draft lesson plans and meet with the scientists to discuss their ideas and ensure that educational activities accurately represent the science. At the conclusion of the workshop, each pair submits completed drafts of their two lesson plans to SA staff

and presents their ideas to colleagues and CDC staff.

Lesson Plan Development, Review, and Publication

To maintain consistency, SA staff developed a *CDC Lesson Plan Essentials* booklet that outlines detailed expectations and formatting specifications for all SA lesson plans. This booklet includes a standard template for the plans and any supplemental documents as well as suggestions on finding and using appropriate websites, guidelines for referencing materials, and examples of previously published lesson plans. Once submitted to SA staff, draft lesson plans undergo a rigorous review, with staff checking them to make sure they are complete, in line with the CDC's guidelines, and scientifically accurate. Lesson plans are also sent to the appropriate CDC scientist for scientific review. Once reviewed and approved by the scientist, the plans are sent to the teachers who developed them for a final review. SA staff make any necessary changes based on the teachers' comments and then submit the lesson plans through the CDC's formal clearance process, which includes review by high-level scientists and communication specialists. After the plans have been cleared, they are published on the CDC's website.

Lesson Plan Implementation

Teachers are asked to implement two lesson plans as part of the requirements for completing the SA Program. Teachers must implement one of their own lesson plans; they may choose from among all lesson plans for the second implementation.

Evaluation

Evaluation, a major component of the SA Program, enables changes to be made to more fully meet the needs of all participants, including CDC staff. Evaluations are conducted throughout and after the workshop and when lesson plans are implemented. Workshop evaluations assess individual sessions for major strengths and weaknesses and for how well the information presented can be translated for the classroom. They also assess the overall workshop experience, including major strengths, weaknesses, ap-

plicability of information to the classroom, teachers' intention to share the information with colleagues, and degree to which teachers' understanding of science and public health increased.

After the workshop and lesson plan development, teachers and CDC scientists are contacted about their impressions of the program. Teachers are asked about the lesson plan development process, including strengths and weaknesses, communication with SA staff, integrity of their original lesson plan after review, implementation of the lesson plan in their classroom, general impressions of the program, and possible improvements. CDC scientists are asked about their overall experience with the program, including communication about expectations, experience during the workshop, experience interacting with the teachers, experience with reviewing lesson plans, and their desire to participate again. Finally, lesson plan implementation is also evaluated by both teachers and students. Teachers are asked to implement lesson plans in their classroom and provide feedback about how well the lesson plan was received by students, how difficult it was to implement, and whether students' knowledge increased. Students can also provide feedback about whether they enjoyed the lesson and make suggestions about other potential topics to study.

LESSONS LEARNED

Recruitment

- *Getting the word out.* Overall, teachers responded favorably to receiving information about the SA Program. Listservs and other teacher organizations appeared to be highly effective means of spreading information about the program. By using listservs, web announcements, and personal invitations e-mailed to award-winning teachers, program staff were able to more than triple application numbers within 4 years, from 27 applicants in 2003 to 91 applicants in 2006.

Selection

- *SA Advisory Committee involvement.* The SA Advisory Committee was integral to the



process of selecting teachers. Committee members reviewed each application and interviewed candidates. Having dedicated committee members who participated in all aspects of the selection process ensured that all applicants received a thorough review by several individuals, allowing for multiple perspectives offered in the application of common criteria. Selection decisions were made by everyone.

- *Review process.* Over the years, the review process became much more effective, with streamlined yet detailed guidelines and criteria on each section of the application (e.g., academic and professional experience; personal statement) that were followed by all committee members. These guidelines and criteria ensured that each applicant was evaluated by the same rubric regardless of which committee member reviewed the application.

- *Teacher traits.* The program required teachers to work extremely hard, be detail-oriented, follow a specific format for lesson plans, have the ability to assimilate and translate new information quickly, and be able to endure the CDC's rigorous review process. The SA Advisory Committee looked for these traits in both the letters of recommendation and the probing done during the telephone interview.

- *Lesson plans that can be easily replicated.* Not all teachers can write a lesson plan in a way that other teachers can follow easily. Selecting teachers with this skill was critical to the success of the teacher and the program. Requiring the inclusion of a previously developed lesson plan as part of the application packet allowed the advisory committee to assess a teacher's ability in this area. Lesson plans that were easy to follow and had all supporting documents (e.g., answer keys, worksheets, rubrics) were considered an indication that the teacher could develop an effective lesson plan for other teachers.

Workshop Planning and Implementation

- *Time.* Planning the workshop is time consuming. Planning for the upcoming program year began at least 9 months before the workshop. This allowed for ample time to ensure that all aspects of the workshop were completed.

- *Personnel involvement.* The SA Advisory Committee became more involved throughout the years and took on specific tasks, including planning meals, transportation, and evening activities, in addition to assisting with workshop activities. Delegation and organization are important components of getting everything done and meeting the needs of the teachers during the workshop.

Lesson Plan Development and Review

- *The peer review process.* The CDC's culture relies heavily on peer review. The SA Advisory Committee felt that this process applied to the SA Program as well. During the program's first 3 years, SA staff and CDC scientists reviewed lesson plans and provided feedback to the teachers. The teachers were then asked to revise the lesson plans and re-submit them for further review. However, because many science teachers do not work in environments where they receive regular critical review, these critiques were often difficult to accept and resulted in frustration for both CDC staff and teachers. In addition, teachers were spending a lot of time and energy during the school year revising lesson plans. To rectify this situation, the review process was changed during the fourth year. Teachers still developed lesson plans, but SA staff became responsible for finalizing them and then asking teachers to provide a critique of the final version. This change has resulted in both challenges and benefits. It works more effectively and requires less time and energy on the part of the teachers; however, it has resulted in more work for SA staff.

- *CDC template.* SA staff developed the *CDC Lesson Plan Essentials* booklet during the third year of the program in order to decrease the considerable amount of time spent making lesson plans consistent in format. These guidelines provided all participants with the CDC's expectations for lesson plan format, reducing the amount of time SA staff spent revising documents and giving teachers readymade templates they could easily follow and use.

Lesson Plan Implementation

- *Fully completing the program.* Lesson plan implementation has been the most difficult aspect to track. Although the SA Program requires teachers to implement the lesson plans

in the classroom, the staff is often not informed when, or if, this occurs. Most participants see the workshop as the "reward" and are not always motivated to implement the lesson plans. Frequent e-mail correspondence with teachers reminding them of their obligation has not been effective. Incentives for completing the lesson plans were proposed; however, budget constraints made that option impractical. Instead, the CDC's website invites users of the lesson plans to send comments via e-mail.

Evaluation

- *Workshop evaluation: more time.* Overall evaluations for the workshop were very favorable. Teachers enjoyed the different sessions and left the CDC with a better understanding of public health and science. During the first 3 years of the program, teachers expressed a desire for more time to develop lesson plans during the workshop, to develop lesson plans with a partner, and to interact with the CDC scientists. The 2006 workshop was restructured to meet these requests.

- *Teachers and lesson plan development: time matters.* Teachers have limited time during the summer and even less during the school year. When the lesson plan development process continued throughout the summer and into the school year, teachers became frustrated. As mentioned earlier, the change in the lesson plan development and review process in year 4—i.e., having SA staff revise and finalize lesson plans—seems to have relieved the time burden for teachers, though it has increased the time required of SA staff.

- *CDC scientists' post-workshop evaluation: more interaction.* CDC scientists enjoyed the interaction with teachers throughout the workshop; however, many wanted more time to answer questions and discuss various issues. As a result, the 2006 program implemented two one-on-one sessions throughout the workshop week to give teachers a chance to ask questions and to discuss ideas for lesson plan development.

- *Lesson plan implementation: less is more.* The lesson plan implementation has been the most difficult stage to evaluate because many teachers do not return implementation evaluation forms. Of the teachers who have



returned evaluations, many have commented that the lesson plans were lengthy and sometimes quite complex. They recommended that lesson plans not be longer than one or two class periods. This recommendation could be considered as an addition to the *CDC Lesson Plan Essentials* booklet.

LIMITATIONS AND RECOMMENDATIONS

The SA Program was developed as a pilot project to transmit information about birth defects to adolescents. Because it was designed as an information dissemination strategy rather than a behavior change program, behavioral change theories were not incorporated as a basis for its structure. However, concepts from McGuire's hierarchy of effects, information processing model (communication/persuasion matrix) (e.g., exposure, attention, comprehension) were considered.⁵ Future program planners, teachers, and/or health educators could strengthen the current program by incorporating various behavior change models such as the Theory of Reasoned Action or Theory of Planned Behavior in future manifestations of the program.

Because this program was focused on developing science lesson plans, science teachers were the main target. However, many of the topics covered throughout the workshops were also appropriate for health educators. Health educators often work with adolescents, teachers, school administration, and school-based programs. It is because of this that the lessons learned from the SA Program are valuable to health educators. Future work with such educators could be explored to help ensure that lesson plans (current and future) include National Health Education Standards. Moreover, health educators could perhaps be included as future participants to ensure that even more adolescents are exposed to important public health topics.

Finally, the SA Program was lucky to have the financial support of the CDC. However, there are other avenues for program planners to obtain financial assistance. Local universities or community colleges with

science education or health education departments could be valuable partners. The program worked with several universities that provided significant insight/technical assistance and had several future teachers participate in the program. Also, local health departments could provide local expertise and become engaged in the development of their community and schools.

CONCLUSION

In the current educational environment, teachers are held accountable for ensuring that their students meet National Education Standards via standardized tests. Although this is a positive step in ensuring that all students are equipped to meet the challenges of tomorrow, it requires teachers to provide interesting and relevant topics to engage their students while still preparing them to succeed on these standardized tests. The SA Program acknowledges this challenge and attempts to equip science teachers with feasible, teacher-developed lesson plans that inform adolescents about relevant health topics and careers in public health while still meeting National Science Education Standards.

Students often claim that science is just something that happens in books or labs and is not applicable or "real." By talking about public health topics that are often featured in the media and that can affect (or have already affected) their personal lives, students tend to become engaged and more apt to retain the knowledge. For example, researchers have found that nutrition education is more likely to be successful if students can understand its relevance to them.² Other programs that have introduced public health to students have found that their knowledge of the subject increased, with some indicating that they were interested in future careers in the field.⁶ Similarly, using public health topics to explain scientific concepts allows students to use real-life scenarios and apply what they have learned. This relevance and applicability are hallmarks of the SA Program. Additionally, the scientific concepts covered in the SA lesson plans meet National Science Education Standards, giving teach-

ers additional tools for attaining mastery of science competencies that are used to evaluate students.

Given that adolescents are at an increased risk for serious health issues and that many health behaviors are initiated in adolescence,¹ it is important for public health professionals to reach this audience with key health messages. The SA Program has improved the CDC's ability to do that. The program (1) works well with teachers, who often act as gatekeepers of information for adolescents, (2) has resulted in more than 60 relevant, readily available science lesson plans that illustrate public health concepts, and (3) has developed a cadre of committed public health professionals and science teachers. The program has been implemented for 4 years and has improved each year as a result of feedback from participants and program developers.

The following practices have contributed to the success of the SA Program:

1. Employing existing and frequently used communication channels to disseminate information about a program (e.g., listservs from national organizations, websites frequented by the target audience, interpersonal communication)
2. Presenting specific guidelines for all material development (i.e., *CDC Lesson Plan Essentials*)
3. Working to each partner's strengths (e.g., teachers translating the topics and CDC staff formatting and checking them for accuracy)
4. Allowing ample time for program planning
5. Enlisting the help of other committed individuals (i.e., SA Advisory Committee)
6. Keeping leadership informed of progress and successes so that momentum builds and practical support is offered when needed (e.g., funding)
7. Building in evaluation and/or reflective activities so that improvements can be made to the program
8. Building a program that focuses on achieving the desired outcomes of each participant (e.g., teachers want lesson plans that



meet National Science Education Standards; the CDC wants lesson plans that feature their science to be created in a way that is appealing, affordable, and accessible to teachers and their students)

The SA Program is also a great example of effective collaboration. Although the public health community is well-versed in the public health literature and understands the health issues adolescents face, science teachers are better equipped to translate that information into something that is meaningful and useful in a science classroom. The partnership between scientists and teachers brings the best of both worlds to adolescents. The lessons learned from the SA Program are not unique; they can be used to assist in the planning, development, and implementation of other programs targeting adolescents.

DISCLAIMER

The findings and conclusions in this article are those of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention. As a result of the success of the SA Program, it expanded in 2007 to encompass all of CDC. It is now under the direction of the Office of Workforce and Career Development. For more information about the program go to <http://www.cdc.gov/excite/ScienceAmbassador/ScienceAmbassador.htm>.

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