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# Lessons learned from ten years of distance learning outreach*

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**Objective:** The study tested the efficacy of providing distance learning with real-time videoconferencing to broaden high school student knowledge of health careers.

**Methods:** A pilot program was tried out and extended over ten years to include other schools in four different time zones and the National Library of Medicine. Survey results, site visits, and continued school participation were used as effectiveness indicators. Student ratings, site visits, and ongoing discussions were used to evaluate critical factors in the program.

**Results:** Nine program factors contributed to success.

**Conclusions:** Synchronous communication can be effective for outreach to special populations given appropriate infrastructure, technology, program design, and implementation.

## INTRODUCTION

The National Library of Medicine (NLM) has managed a distance learning program for ten years with the objective of addressing health disparities by increasing minority high school students' interest in a range of health careers and understanding of health sciences subjects and resources. This case study identifies strategies that affected the program's development that may interest others who are considering use of synchronous, interactive online videoconferencing technology to reach special populations.

The program started as a modest pilot, proof-of-concept project involving a solitary class at a single high school but evolved to include other classes and, eventually, other schools serving additional minority populations. The program's origins and evolution are

described in this case study. Factors affecting program development were identified based on experiences of NLM staff and their collaborators, site visits to participating schools, interviews with students and teachers, and student ratings of individual class sessions.

Searching PubMed with the terms ''Distance Learning'' and ''Medical Libraries'' did not retrieve many references, and the terms ''Videoconferencing'' and ''Medical Libraries'' retrieved even fewer. Medical library use of online tutorials has been well documented [1], since tutorials reside online and are easily accessible, while synchronous instruction is temporary, unless recorded and archived. Still, there is evidence that medical libraries began using videoconferencing over the Internet from the time the technology emerged [2, 3]. The use of co-streaming (simultaneously webcasting classroom instruction in real time) [4, 5]; embedded, scheduled, synchronous library education in the context of asynchronous online courses [6]; and desktop-sharing software to augment reference services provided by phone [7] indicate the novel ways that librarians have used real-time technologies to teach users. The videoconferencing intervention described here is unique because it reached new users, not existing ones, from populations who are underrepresented in the health professions [8].

## METHODS

The NLM Distance Learning Outreach Program was inspired by the library's Adopt-a-School Program that mentors students and teachers at local high schools. The aim is to extend some of these outreach activities beyond metropolitan Washington, DC. A program was conceived that would expose students to a range of health professionals, not just physicians and nurses, who would come from a variety of ethnicities and backgrounds, including those of the students. Health professionals would discuss the problems they solve and their research interests, when relevant, while also explaining why they chose their careers. Information resources relevant to health careers and health concepts and issues would be discussed in these contexts. Real-time interaction is considered paramount so that students can observe and engage with role models directly.

The program focuses on three recommendations in NLM's long-range plan: (1) improving service to underserved populations, (2) enhancing information infrastructure to increase access to health information, and (3) encouraging a more diverse workforce through enhanced exposure to biomedical informatics in kindergarten through twelfth grade [9]. The program employs a modeling approach having a long tradition of empirical and theoretical support in both social and learning psychology [10], and it shares pedagogical attributes with other distance learning efforts that the library sponsored [11, 12].

Initially, NLM was linked to the King Drew Magnet High School of Medicine and Science in Los Angeles.

The school was recommended because it was located in Watts, next to the Charles R. Drew University of Medicine and Science, and was one of the few medical magnet schools serving minorities. A site visit was made to assess interest and infrastructure at the school and university. Although the concept was backed by school and university administrators, the science department chair lacked interest. Consequently, only one teacher volunteered his class, which fortuitously met at the only time of the week that the university auditorium with videoconferencing equipment was available. The class walked to the auditorium for presentations about twice each month. Although some university faculty made presentations locally, most presentations originated at NLM. Medical librarians would guide students to information resources related to topics covered by health professionals.

Interviews with teachers and students at the end of the year indicated other faculty were frustrated by not being able to participate, and a new department chair supported the program [13]. More classes were included the following year. A dormant network line connecting the university and the high school that was part of an earlier NLM-funded telemedicine study was reactivated, effectively extending access to Internet2, a high-speed research and education network separate from the ''commodity Internet,'' into the high school, bypassing the district's network. This access could be directed to any classroom, adding flexibility while circumventing the university auditorium bottleneck.

The program was extended to Kotzebue Middle High School in Kotzebue, Alaska, in 2007 to reach Alaskan Native students [14] and to Governor Wallace Rider Farrington High School in Honolulu, Hawaii, in 2009 to include Hawaiian Native and other Pacific Island students. The schools were recommended by consultants who were familiar with educational needs in the two states. Located thirty miles north of the Arctic Circle, Kotzebue had high turnover of medical center staff who were not locally recruited and was starting a magnet health program to address the problem, while Farrington had an established health academy. Site visits were made to determine administrator and faculty interest, technology infrastructure, and alignment of school schedules and calendars. Farrington's Internet connection was via undersea landlines, while Kotzebue's was via satellite. Kotzebue's satellite and videoconference service provider agreed to host the videoconferences gratis on its devices managing multisite communication in Anchorage, a point where faster landline connections could be made with NLM and the other schools.

Presentations now originate at any of the participating sites, usually by having health professionals and faculty come to the schools or NLM, but presentations have also originated from other sites that are able to connect by videoconference. Most presentations are recorded and archived at NLM. One or two teachers from each school come to NLM for one week in the summer, every other year, for program planning and information resource seminars.

## RESULTS

Student ratings, site visits, and ongoing discussions with teachers and support staff have identified the following factors contributing to the program's success and growth.

### Program relevance

One major factor affecting the program's acceptance was the program itself [15]. Unneeded or poorly designed and executed programs are usually not successful. The schools either had or were planning curricula for students who were interested in health careers, with the intention of raising students' awareness of careers other than physician and nurse. The NLM distance learning program was highly compatible with school goals, and sites could share specialist presenters, some of whom might have been hard to recruit locally. In addition, students could be exposed to specialists from the National Institutes of Health (NIH), metropolitan Washington, DC, and other academic centers. The methodology fit the program, enabling direct interaction with health provider role models, most of whom represented the students' varied minority groups. It became apparent that the program also fulfilled an unstated need: students in Hawaii and Alaska felt isolated, and they valued connecting to peers on the mainland and lower forty eight.

### Advocacy and administrative support

Common ground or overlap of the existing parties' needs and interests are key factors in collaboration [15]. In-person site visits were needed to gauge faculty interest and administrative support, key factors in educational innovation [16]. The visits indicated NLM's commitment, and NLM staff meeting with school administrators added to each local program's credibility. Lack of administrative support can be detrimental, as evidenced by the resistance of the first department chair, which limited participation. Word of mouth and a change in department chair made a difference.

### Appropriate infrastructure

Videoconferencing consumes bandwidth, especially if a videoconferencing experience is needed for groups of students, and requires video superior than can be realized with Skype and other desktop applications. Moreover, videoconferencing requires accessing other networks and allowing outside access to one's own network. Standardized, interoperable technology for capturing, compressing, sending, and decompressing video streams; sufficient bandwidth; and adjustments to network firewalls and routers to allow access are needed. If these technologies are not aligned, schools may be unable to connect, connections may be interrupted, or there may be video and audio latencies, jitter, and other artifacts that threaten program success.

### Effective technology deployment

Standardization ensured that presentations could originate from any institution having the technology and bandwidth, not just participating sites. The technology, however, is limited when presenting content because slides and other computer applications are sent as video, and the visibility of end points shrinks to a small picture-in-picture window, which reduces a sense of presence or being together, a factor affecting level of dialog and critical thinking in distance learning [17]. Consequently, a separate connection is made for content sharing, and video from the sites and presenter desktops is simultaneously displayed. Channeling video traffic through a multipoint conferencing device outside Kotzebue's satellite link and sharing content via a server also outside the link shield other sites from any satellite latency. Finally, over the years, video technology has been upgraded to high definition to keep current with new standards.

### Technical support

Technical support varies among schools and, unsurprisingly, is highest in Alaska, where videoconferencing is routinely used for distance learning and telemedicine. Kotzebue provides support staff for every program, while there is de facto technical support at King Drew because the technology coordinator's classes participate in the program. Farrington has a single support person serving its more than 2,500 students. The support deficit has been made up by training participating teachers and scheduling tests with the school technician prior to scheduled presentations. Technical support and training are essential because teachers must become familiar with technologies and successfully use them before they adopt them and integrate them in their classrooms [18].

### Scheduling

Finding mutual program times is essential for programs requiring synchronous, real-time communication. Each school has its own bell schedule, and some vary daily because students intern in hospitals and clinics. The problem is compounded because participating sites span five different time zones and Hawaii does not have daylight savings time. A compatible time and day of the week has always been identified, but periods do not align exactly, necessitating a modest wait time until all schools connect. Daylight savings time has not been an issue for Farrington because two teachers who have back-to-back classes participate and most of the students are enrolled in both. School calendars also must be aligned, accounting for differing start and end dates, breaks, holidays, teacher preparation, and test days. Consequently, the program begins when the school with the latest start date begins and ends when the school with the earliest end date closes, a time span sufficient to offer ten to twelve classes annually, twice monthly.

**Table 1**
Presentation Likert scale ratings for years 2006–2014
(5=highest rating)

| Presentation/presenter | Mean | Standard deviation |
|---|---|---|
| Had clear goals | 4.46 | 0.82 |
| Used a relevant topic | 4.36 | 0.86 |
| Was organized | 4.49 | 0.83 |
| Stayed on subject | 4.57 | 0.96 |
| Used visual aids | 4.50 | 0.89 |
| Showed respect | 4.60 | 0.76 |
| Fostered discussion | 4.30 | 0.97 |
| Encouraged further learning | 4.37 | 1.01 |
| Motivated students | 4.24 | 1.00 |
| Overall | 4.42 | 0.91 |

### Student interest alignment

Students at the participating schools have different educational and career aspirations. King Drew students seek careers requiring baccalaureate and graduate degrees, while those at the other schools consider careers requiring associate degrees or special certification. Consequently, presented topics involve careers with a range of educational requirements. This strategy not only accommodates different interests, it also underscores teamwork. Moreover, many topics such as personal privacy, disaster preparedness, and pandemics are important to health professionals at all levels.

### Cultural differences

Students at King Drew have African American and Latino backgrounds and reside in a large urban area that is well represented in popular media; those at Farrington reside in a smaller, popular urban environment and have Hawaiian and Pacific Island backgrounds; and those at Kotzebue are mostly Alaskan Natives (Inupiat Eskimo) and live in a small, rural community. King Drew's students are more assertive, while Kotzebue's have been raised in a tradition of honoring and listening to elders. Each year, the program begins with students making presentations about themselves, their communities, and their cultures. These presentations have helped students appreciate cultural differences, especially the lives of students in Alaska. Content in student presentations is often reinforced by health professionals who have the same cultural backgrounds.

### Budget and evaluation

The program costs are low because existing technology and infrastructure are leveraged. The largest expense is bringing teachers to NLM every other summer. Presenters are given modest stipends, and occasionally equipment upgrades are needed. Many presenters donate their stipends to the schools, but presenter recruitment would be harder without compensation. After each presentation, students complete a short, but highly reliable rating instrument, derived from a longer one originally validated at Stanford University Medical School [19]. These ratings of various aspects of presentation quality have been consistently high (Table 1) and, along with other information, show high satisfaction, justifying program expense. An ideal assessment would document the number of students actually going into health sciences careers, but such data are extraordinarily hard to obtain and would require schools tracking and surveying students for years after graduation.

### DISCUSSION

The NLM distance learning program employs real-time communication technology in a cost-effective way to reach minority students. It shows that, with planning and coordination, it is possible to leverage network and standardized videoconferencing technology to simultaneously reach varied minority populations in different locations and time zones. Success depends on having common ground, administrative and technical support, and appropriate infrastructure. It requires deploying technology to ensure communication can be done reliably and effectively, accounting for different school calendars and schedules, aligning student interests, ensuring appreciation of cultural differences, and providing modest but sufficient funds and assessment data. These factors are probably paramount in fielding any collaborative, technology-based distance learning program. There is, however, another key factor because the program involves outreach. An entrée is needed to one's target audience. NLM was fortunate in having an established network of consultants from varied constituency groups and minority populations who knew of communities and schools that would be good partners. If established relations with these leaders do not exist, they should be developed as a way to introduce outreach programs to groups that might otherwise be wary of outside interventions.

There is an undoubtable practical limit to the number of different minorities and schools that can be accommodated with a single program. Three schools; four sites, including NLM; and sometimes additional sites for certain presenters appear to be a reasonable number. Still, it is uncertain whether a maximum has been reached.

### CONCLUSION

The NLM distance learning program is succeeding in providing health education and career guidance to varied minority students with high levels of teacher and student satisfaction.

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# Harnessing health information to foster disadvantaged teens' community engagement, leadership skills, and career plans: a qualitative evaluation of the Teen Health Leadership Program

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This paper describes a qualitative evaluation of a small-scale program aiming to improve health information literacy, leadership skills, and interest in health careers among high school students in a low-income, primarily minority community. Graduates participated in semi-structured interviews, transcripts of which were coded