Anatomical Outreach is Within Reach: Contemporary and Diverse Approaches

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ABSTRACT

Community outreach and service-learning are common components of medical and health profession programs. Outreach programs can provide diverse service-learning opportunities for students to work collaboratively with their communities. Many educational accrediting bodies require service-learning activities for students. The discipline of anatomy is uniquely suited for outreach as it engages students with the community and provides relevant, health-related educational materials and information. Anatomy is often a general interest to many and can aid in the promotion of students pursuing health professions careers. The objective of this work is to describe three unique anatomical outreach programs that integrate components of community service, service-learning, and/or pathway program initiatives in innovative ways. These programs are presented to inspire and/or be adapted in other medical or health professions programs. Variety in these programs range from duration, target audience age, resource and financial requirements, and necessary collaborations. The authors provide tips for success and potential pitfalls to consider. These three examples serve as successful, contemporary, and diverse approaches to anatomical outreach that can be implemented into medical or health professions education programs.

INTRODUCTION

The accrediting body for medical education programs across the United States and Canada, Liaison Committee on Medical Education (LCME), stipulates in Standard 6.6 "*Service-Learning/Community Service: The faculty of a medical school ensure that the medical education program provides sufficient opportunities for, encourages, and supports medical student participation in service-learning and/or community service activities.*" Outreach is often used as an umbrella term to broadly encompass closely related educational service opportunities such as service-learning, community service, and pathway programs. However, there are nuanced differences between these important opportunities. The LCME further defines service-learning as educational opportunities that allow students to address concerns identified by their communities, require student preparation, and provide reflection regarding relationships among their participation in the activity, their medical school curriculum, and their roles as citizens and medical professionals. A pathway program, which is also sometimes referred to as a "pipeline" program, has an objective endpoint to help underserved and underrepresented minority students reach matriculation in a health sciences career. An outreach program can therefore be defined as any program that accomplishes the requirements of service-learning but is missing one or two of the other components [Figure 1].

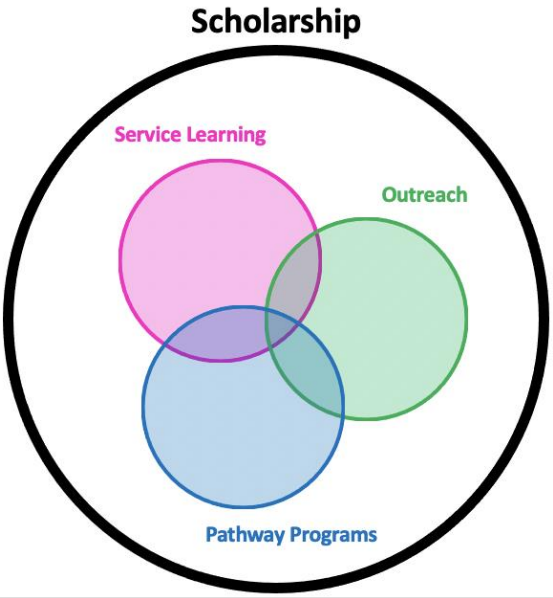

Figure 1. The intersection of service learning, outreach, and pathway programs.

Outreach programs can provide abundant and diverse opportunities for medical education institutions to collaborate with their communities. The discipline of gross anatomy is ideally suited to be utilized as a medical education outreach topic to help students engage with the community and provide relevant and health-related educational materials and topics. Many educational outreach programs that target younger learners can provide unique educational experiences that encourage the

pursuit of careers in healthcare (Cregler, 1993; Zhang et al, 2016), promote professionalism and scholarship at a young age, or minimize harmful or unhealthy behaviors (Block & Block, 1980; Burns, 2002). Programs that also involve teachers in learning experiences alongside or concurrently with their students allow new resources and lasting skill sets to be brought into classrooms and learning environments across the community (Burns, 2012). Medical students who participate as educators in these service-learning opportunities gain valuable experience working with diverse and medically underserved populations (Bennard et al, 2004, Meah, et al, 2009; Theoret et al, 2021).

These types of important learning opportunities can also provide unique ways to promote diversity, equity, and inclusion (DEI) initiatives both within the medical education institution and across the broader communities in which they reside. Outreach programs that focus on creating service-learning opportunities with demographics that pre-professional and professional students may be less routinely exposed to can promote professional, and even personal, identify formation crucial to serving diverse patient populations; indeed, developing empathy with more inclusive and culturally sensitive ethical standards, can prepare students to practice medicine in various communities. Outreach or clinical rotations programs aimed to create service-interactions between medical students and protected or underserved groups such as those experiencing homelessness (Batra et al, 2009), persons with disabilities (Theoret, 2021), the incarcerated (Alemagno et al, 2004), or those in rural communities (Bennard et al, 2004; Stuhlmiller & Tolchard, 2015) enrich both the community and the medical student's ability to competently practice medicine.

The objective of this work is to describe three unique anatomical outreach programs that integrate components of service-learning, pathway programs, and community service initiatives in innovative ways. These programs are currently used in accredited medical or Doctor of Physical Therapy programs in the United States. For each outreach program example, the basic structure, pearls, pitfalls, and strategies for successfully navigating common hurdles associated with running these programs will be discussed. These programs were described and reported as a panel discussion to the American Association of Clinical Anatomists at their annual meeting in 2022.

OUTREACH PROGRAM EXAMPLES

The following section provides an overview of three anatomy outreach programs. Each program brings a unique perspective on implementation of community outreach. Summary Table 1 provides a snapshot of each program's variety in target audience age, duration, resource and financial requirements, and necessary collaborations.

Program	Duration of program	Target Audience	Resources Needed	Cost (total or per participant)	Collaborations required
Anatomy Academy	7 weeks, 1 hour/week	-Elementary school-aged children (5th or 6th grade)	-Models -Visual aids -Videos -Handouts -Games	Free for participants. Varies for supplies, dependent upon if you use mostly digital resources, or if using models or visual aids.	- Principals & administrators of schools -Teachers, parents, students.
(WVSOM) Anatomy Lab Educational Program	2-hour program divided between classroom and anatomy lab	-High School Students in advanced sciences, health sciences -Adult Students in allied health programs -High School Science Teachers	-Gross anatomy lab -Classroom -Plastination specimens -Models -Cadavers -Embalmed specimens -Microscopes -Creativity	Free for participants. Must provide own transportation to and from West Virginia School of Medicine.	- Teachers/Instructors from regional schools - West Virginia School of Medicine
(UNMC) High School Alliance	1 academic year for all students. Students may apply for a second year which is	-Junior and Senior level High School students interested in healthcare	-Gross anatomy lab and cadavers -Lecture classroom -Certified High School teachers	Free to participants. Program costs are mostly funded by The Sherwood Foundation, although the associated school districts and University of Nebraska Medical	- Program and funding sources - Students, parents, and educators - School districts and administrators - Local/community stakeholders - University and program

	focused on research experience. The anatomy course is typically taught only in the spring semester.	related careers	-University faculty -Lab assistants (e.g., graduate students)	College add significant contributions as well.	- Faculty and their department Chair - High School Teacher and faculty

TABLE 1. Summary of Outreach Programs

Anatomy Academy

Anatomy Academy is an outreach program designed to combat childhood obesity through educational intervention. Established in 2012 at University of California Los Angeles (UCLA), the program aims to teach anatomy, physiology, and nutrition to elementary school students to promote healthy lifestyles and inspire children to pursue higher education, especially in the sciences (Diaz et al, 2019).

The program consists of seven lessons lasting between 40-60 minutes based on the needs and availability of the school, preferably given once per week over seven consecutive weeks to older elementary-aged students, usually fifth or sixth grade. Programming could be given during a class such as a health or physical education class, or as an after-school program. The program allows for freedom to choose from a variety of resources, such as anatomical models, video games and guided hands-on activities in the classroom or outside. The extent to which these resources are used may depend on individual group needs or funding. The program is free for participants, so the only cost would be to purchase models or other resources needed to run the program.

This program provides opportunities beyond outreach. The mentors involved in Anatomy Academy, who are preclinical undergraduate and professional school undergraduate students and preclinical professional students, also value the service-learning aspect of this program as they self-reflect on challenges and successes to evaluate themselves and see how they can improve the program for future sessions. Receiving formal and informal feedback from stakeholders is an important feature of Anatomy Academy that helps ensure the program is not solely self-serving, but in fact is accomplishing program goals for those it serves.

Some of the possible barriers include finding supportive school partners, having the resources needed to implement the program, and having to compete with school schedules, for both participants and mentors. The successes observed to date include students reporting that they have asked parents to implement some of the healthy changes introduced through the program. Also, repeated invitations from elementary school administrators to return for future sessions indicate success because they feel that Anatomy Academy helps to make positive changes for their students.

One of the keys to the program is establishing sustainability. The resources necessary (such as a supply list and lesson outlines) to begin implementing the program are publicly available (Anatomy Academy). It is suggested to implement the program across classes of students, so that a group of second year students can mentor the first year students for the following year. Then as classes “move on” and are no longer able to participate, other students are trained to take their place, requiring very little administration to continue the program.

(WVSUM) Anatomy Lab Educational Program:

The focus of the West Virginia School of Medicine Anatomy Lab Educational Program is to bring participants into the anatomy lab to challenge their knowledge and engage in human anatomy at a deeper level through self-directed experience. The program began in the mid 1980's with a significant redesign in 2013 allowing for the current hands-on station-base experience.

This program was designed to expose visiting students to anatomy, healthcare occupations, osteopathic philosophy, and the medical school experience. Participants begin with didactics in the classroom to determine their depth of knowledge, then are divided into small groups for activities in the lab. Upon completion of the stations, they return to the classroom to debrief the experience. The two-hour sessions are led by faculty and osteopathic medical students who help engage the participants in the stations.

The program benefits the participants (high school and undergraduate allied health students) and medical students through one-on-one learning and peer teaching. Originally developed as outreach, this program has since developed both pathway and service-learning attributes. Participants have gone on to attend and complete healthcare training, fulfilling the pathway objective of the program. After a session, the faculty member meets with the medical students to debrief and reflect on the experience. This time allows the medical students to reflect on their confidence with knowledge, adapting communication level to the learner, and their own journey. While this is not part of their curriculum currently, it could be easily adapted for this purpose.

Resources for the program include items typically present in most gross anatomy labs along with faculty and student time allocated for teaching. The largest barrier to the program is travel cost for the participants. To solve this, the necessary materials were brought to the schools to replicate the original experience as much as possible. The program's success is driven by collaboration with teachers. In 2017, this initiated the creation of a three-day workshop for secondary school teachers to experience cadaver dissection and develop a learning module for their classroom. The sustainability of the program depends on building relationships with science teachers across the region, as well as recruiting and mentoring medical school students as educators. With dedicated time and facility availability, the program will continue for many more years.

(UNMC) High School Alliance:

The University of Nebraska Medical Center (UNMC) hosts a High School Alliance (HSA) for Junior and Senior high school students from varying educational and socioeconomic backgrounds who are interested in pursuing healthcare-related careers. The mission of the program is to generate a more diverse Nebraska workforce by immersing these students in professional-level health sciences educational experiences and setting them on a trajectory to achieve their healthcare-related interests. The HSA began in 2010 and currently enrolls about 85 students per year from 14 surrounding Nebraska and Iowa school districts. The program spans the entire academic year and provides learning experiences students would not typically get in their local high school curricula. Junior students who successfully complete one year of the program may apply to return a second year for a focus on a yearlong research project.

While cadaver-based anatomy courses are well-represented amid professional-level health science programs, they are rare in undergraduate programs and almost non-existent among high school curricula. Of the many science-based courses offered by UNMC HSA, the cadaver-based Human Gross Anatomy course is the most sought after by the students and represents many of the program's outreach values. The course is taught by faculty of UNMC's College of Medicine from the Department of Genetics, Cell Biology, and Anatomy who teach the HSA students a systems-based approach to learning human anatomy via lectures, prosected cadaver laboratories, and other interactive learning methods (*e.g.*, augmented reality). Faculty involvement is incentivized primarily by the opportunity to participate in service and outreach, and they also earn a modest stiped for their professional development accounts.

The successes of UNMC HSA leans on many key resources and financial contributions. The program receives significant financial support from The Sherwood Foundation, the program's benefactor, which allows students to participate in the program at no cost to them – an especially critical factor for the 35-40% of HSA students that self-identify as being from low socioeconomic status. This financial support in conjunction with UNMC resources (*e.g.*, classroom space, cadavers, faculty expertise, campus resources) sustain the HSA. Another key factor for the HSA's success is the many effective collaborations it demonstrates. A certified public-school teacher works with the UNMC faculty to support class instruction, maintain student organization, and ensure state standards are met; professional-level UMNC students help teach the HSA students in the anatomy labs; and partnerships with local and regional stakeholders and the community help the program achieve its goals, overcome challenges, and grow.

DISCUSSION

Anatomy is an Ideal Place for Outreach

Anatomy education serves as an ideal platform for service-learning as everyone from grade school children to college-level students have some conceptualization, and often interest, in the structure and function of the body. Beyond this, anatomy education utilizes teaching and learning techniques and materials that engage all types of learners, especially through producing hands-on experiences that promote knowledge retention (Keim Janssen, 2013). The programs discussed in this work illustrate prime examples of anatomy outreach programs that engage and interest learners from elementary school children to college students.

Promoting DEI & Health-Related Careers in the Community

A major goal of anatomical outreach is to promote careers in the health professions to young people in the community by providing unique and engaging educational experiences that get them excited about their futures, potentially in the healthcare fields. Many of these types of programs also strive to support diversity, equity, and inclusion initiatives by breaking down barriers of participants of low-

socioeconomic status within their communities. One of the programs highlighted in this work identified local elementary schools with a high percentage of children on free-lunch programs to invite those schools to travel to the medical school and participate in their program. The Anatomy Academy described in this work offers a good example of outreach that extends to underserved school-aged children and works to cultivate healthy lifestyle choices and prevent harmful ones all while teaching them about health and human anatomy. There have been many other previously published examples of programs that have been successful with these same goals (Meyer et al., 2018; Ortug et al., 2021).

Synthesis and Summary of the Programs

Anatomical outreach was offered to elementary students, high school students, high school science teachers and adult students in allied health programs. The educational purposes were quite different between elementary school-aged children compared to others; models, games and videos were typical learning aids. High school students were juniors and seniors or were in advanced placement courses, therefore their experiences often looked similar to college-level opportunities that used organs or full-body cadaveric donors. Youth programs such as Anatomy Academy were low-stakes and lasted for seven weeks with a single hour session per week. Programs targeted for high school students ranged from one-day offerings up to an entire year with regular meetings and potential research opportunities provided after completion. All programs were free to participants; the greater the utilization of human tissue or full-body dissection the greater the operating costs were provided from a charity foundation or provider institution. All programs required collaboration between students, educators, administrators and other community entities.

Challenges in Designing Outreach

The need to carefully consider the curriculum of the outreach program was a challenge that existed with each offering. In some cases, cost and location spurred ample discussion related to designing the curriculum. If transportation for participants to an off-site laboratory can not be provided, abbreviated, transportable, or virtual programs may be offered. In high school-aged programs there were challenges discussed based on selected content to be presented. Determining what regional anatomy is necessary or appropriate in a high school program is a consideration given the participants are minors and are still under the close care of parents. A disclosure and/or parent acknowledgement statement (“permission slip”) should be required for programs utilizing human tissues or full-body dissection to respect the personal parental positions. One high school program included reproductive anatomy in the curriculum. Proper visualization and dissection of regions such as the external genitalia was received by students and parents with varying reactions. While the vast majority supported the importance of learning reproductive anatomy at high school age, some found it uncomfortable or against parental approval. In this regard, sensitive content should only be made available to those interested in holistic healthcare and attaining a comprehensive understanding of human function.

Program Sustainability

An important consideration in implementing an outreach program is creating a design that is sustainable and reproducible year-to-year and at different schools, labs, or campuses. Programs should consider financial, resource and effort sustainability. Financial sustainability was maintained by several programs with funding from the participating school, such as funding provided to high school teachers for their participation in the programs. Charitable foundations and community organizations also contributed financially to anatomical outreach programs. Resource sustainability is critical to allowing a program to progress long term. Hosting institutions often must be willing to provide classroom or laboratory spaces. Developing a digital bank of resources, material lists and activity explanations was deemed helpful in programs that have run for multiple years. Effort sustainability is crucial because without the faculty and staff to run a program, months or years of inactivity may be experienced such as when faculty change institutions. One outreach program encouraged participation by providing modest stipends to faculty's development funds. Advocating for student involvement was also shown to be beneficial. Student-instructors that participated in the elementary school program the prior year served as mentors to the new student cohort and aided in the organization of the deliverables. Professional-level students filled the role of teaching assistants in the anatomy labs for the high school program.

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