

## SERVICE LEARNING

# The Neuroscience Behind Drugs of Abuse: A PharmD Service-Learning Project

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**Objective.** To evaluate a service-learning program that involved PharmD students at Duquesne University delivering the presentation, “The Neuroscience Behind Drugs of Abuse,” to area middle school and high school students, to dissuade these teenagers from experimenting with illicit drugs.

**Methods.** Student presenters administered exit surveys to students and teachers in the audience to assess the presentations, kept a reflective journal of the presentations and interactions with the student audience, regularly met with faculty mentors to refine the presentation and compare experiences with other students, and wrote a summative paper on an issue pertaining to substance abuse among adolescents.

**Results.** The middle school and high school students were interested in, appreciated, and learned from the presentations. All participating schools (“community partners”) indicated their interest in hosting the presentation again. PharmD students communicated their enthusiasm for the project and recognized the civic contribution, leading many to continue their involvement in a volunteer capacity after satisfying their curricular requirements.

**Conclusion.** This service-learning project educated Greater Pittsburgh middle and high school students on how drugs of abuse cause both euphoria and addiction at the molecular level. This approach allows teenagers to make a logic-based, informed decision on whether experimentation with such drugs is worth the risk.

**Keywords:** service-learning, curriculum, neuroscience, addiction

## INTRODUCTION

Over 22 million Americans suffer from drug or alcohol dependence or abuse.<sup>1</sup> While medications are now available that display some success in the treatment of heroin dependence<sup>2</sup> no cures currently exist for heroin addiction, or for addiction to cocaine, ecstasy, marijuana, or any other illicit drug of abuse. It is thus critical to dissuade individuals from experimenting with drugs of abuse, and intervention must begin in the teenage years or earlier. Experimentation with drugs of abuse in middle school or high school sets the stage for midlife drug use. Teenagers who experimented with marijuana by the twelfth grade were 8 times more likely to regularly use the drug at age 35, and those teenagers who had experimented with other illicit drugs were 5 times more likely to be cocaine users at age 35.<sup>3</sup> High-school age teenagers are the most susceptible to initiating illicit drug use. Five to six percent of cocaine users become dependent on the drug within a year of experimenting.<sup>4</sup>

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A major impediment to preventing teenagers from experimenting with illicit drugs is the perception by this population that occasional use of these drugs incurs little risk. This thinking is especially prevalent with regard to “ecstasy” (methylenedioxymethamphetamine; MDMA), as 55% of adolescents surveyed in one study saw no significant risk in experimenting with this drug.<sup>5</sup> The fact that heroin and cocaine are addictive is common knowledge; however, the general public is largely ignorant of the long-term health consequences of using these drugs, suggesting that teenagers are especially uninformed in this regard. The long-term health consequences attributed to illicit drug use are numerous and varied. A longitudinal study found early teenage illicit drug use was associated with the manifestation of major depressive disorder and other psychiatric disorders in subjects when they reached their late 20s.<sup>6</sup> Cognitive deficits from marijuana use persist after cessation of use.<sup>7</sup> Deficits in long-term memory have been linked to regular use of ecstasy. When marijuana and ecstasy were used concurrently, the deficits in long-term memory were exacerbated and short-term memory was affected as well.<sup>8</sup> Long-term brain damage has been documented in methampheta-

mine abusers in 2 independent studies.<sup>9,10</sup> Long-term adverse effects of drugs of abuse are not restricted to the brain, as cocaine has been reported to compromise the immune system<sup>11</sup> and ecstasy may damage heart valves.<sup>12</sup> Ecstasy is especially dangerous compared with other illicit drugs with respect to short-term use, as an overdose of this drug or structurally similar amphetamines can lead to hyperthermia, seizures, coma, and death. Ecstasy-related hospital emergency room incidents jumped 18-fold from 1994 to 2000.<sup>13</sup> Given the severe consequences of even first-time or short-term use of illicit drugs, a useful mechanism for educating teenagers on the risks associated with these recreational drugs is a high priority.

Science-based drug abuse prevention programs in middle schools are effective in deterring initiation of substance abuse.<sup>14</sup> The key may be focusing more on educating students about the science underlying drugs of abuse, rather than merely providing legal or moral reasons to resist experimenting with drugs. A survey of over 6,000 seventh graders in 24 Minnesota schools indicated that the traditional Drug Abuse Resistance Education (DARE) program, which consisted of sessions on drugs of abuse taught by a police officer, was ineffective. The same survey showed that a modified version of the program (DARE Plus) that incorporated a curricular component led by specially trained teachers was clearly effective in dissuading drug use among adolescent boys.<sup>15</sup> National organizations such as the National Institute on Drug Abuse (NIDA; <http://www.nida.nih.gov>) have prepared literature and visual aids to supplement middle school and high school curricula; however, the teacher's knowledge of the subject is unlikely to extend beyond that found in the NIDA materials. Optimally, the materials would be presented by teachers with a neuropharmacology background suited to thoroughly educating and fielding questions from middle school and high school students.

The present article describes such a program, one in which the middle school and high school teachers were Duquesne University fourth-year PharmD degree candidates specifically trained for the task of presenting the neuroscience behind drugs of abuse. The Duquesne University School of Pharmacy's (DUSP's) required service-learning course was identified as the appropriate mechanism by which to implement this program.

Service-learning (SL) is a type of pedagogy in which students learn through serving others. Pharmacy educators and members of the American Association of Colleges of Pharmacy (AACP) have formally recognized the potential benefits of incorporating SL experiences into pharmacy

curricula for nearly a decade.<sup>16,17</sup> SL experiences improve students' communication skills<sup>18</sup> and ethical reasoning,<sup>19</sup> while increasing their awareness of the impact they can make on the daily lives of others.<sup>20</sup> Eyster and Giles have demonstrated that SL programs can enhance student problem-solving, critical thinking, civic-mindedness, maturation, professionalism, and self-efficacy as agents for change.<sup>21</sup> SL pedagogy should provide academic credit for learning as opposed to merely performing the service, should be challenging, is closely connected with course objectives, and meets real community needs.<sup>22,23</sup> With these criteria in mind, the project described here represented an intriguing addition to existing SL experience choices for students (eg, participation at a non-profit agency, or health presentations to lay audiences).

The service-learning objectives of the project were defined as follows:

- Service objective: Middle/high school students in Greater Pittsburgh will benefit from learning the scientific rationale behind the harmful effects of drugs of abuse, as well as clinically relevant information that may dissuade their experimentation with such drugs.
- Learning objective: Duquesne University PharmD candidates will improve their presentation and communication skills, enhance their interaction skills with younger clientele, and become more sensitive to the health and safety needs of populations, rather than solely the needs of individual patients.

## **COURSE AND PROJECT DESIGN**

The "Neuroscience Behind Drugs of Abuse" project was one of 3 options available to fourth-year (P4) PharmD students at DUSP for satisfying the requirements of the mandatory 1-credit service-learning (SL) course PHSLE 477W. The project was determined to be exempt from IRB review by the appropriate Duquesne University committee. The course was designed to accompany a survey course on the American health care system (PHBAS 410). In PHBAS 410, students are apprised of the roles of formal health care providers and non-profit service organizations in advancing public health, and are also provided some perspective on epidemiology and outcomes from both individual and population-based perspectives. Students are instructed that performance in formal work settings as pharmacists can be complemented by other activities that transcend these formal roles. The PHSLE 477W course utilizes active-learning strategies to facilitate student reflection and understanding of these types of activities.

This project was introduced to students in the PHSLE 477W course in the Spring 2004 semester, at which point 28 of 127 P4 students chose this option. The SL curricular requirement applied only to P4 students; nevertheless, 6 fifth-year (P5) PharmD students voluntarily participated in this project. The PHSLE 477W course consists of participating in a specific SL project, recording the experience in a reflective journal, discussing the experience in debriefing sessions, and writing a summative paper on an issue related to the project. The community partners for this SL project were area middle schools and high schools, and PharmD student participation meant delivering slide show presentations to students at these schools as well as fielding questions or engaging in discussions arising from the presentation. The summative papers for students selecting this project primarily involved a literature review on the effectiveness of various types of programs in curbing substance abuse among adolescents.

#### **Origin, Content, Design and Format of Presentations**

The first author had conducted basic research on brain receptors for cocaine and heroin/morphine for the previous 13 years, including 7 years at NIDA, National Institutes of Health. Experience in presenting the neuroscience underlying drugs of abuse to high school and middle school students suggested that teenagers were eager to hear the perspectives of scientists and health professionals regarding these drugs. The apparent appeal is that these students seek the unvarnished scientific facts concerning illicit drugs without having to endure the "Just Say No" message, overt scare tactics, or other forms of sermonizing. A slide show presentation was therefore developed that focused on the effects of cocaine, heroin, marijuana, and ecstasy on brain function, including clinical features of physical dependence on, and addiction to, drugs. The design was such that a PharmD student with the requisite neuropharmacology education could deliver the presentation to and field questions from student audiences ranging from grade 8 to grade 12. Employing PharmD students (as opposed to professors) as presenters carried 3 principal advantages. First, the presenter was close enough in age to members of the audience to serve as a peer as well as a career-development role model. This generational commonality also presumably enhanced the credibility of the presenter, in that the presenter did not look like a parent or other authority figure. Second, with 34 PharmD presenters, the number of presentations per semester was many-fold greater than could be delivered by 1 or 2 professors. Third, and most relevant here, a service-learning opportunity was created.

The slide show presentation consisted of 40 *PowerPoint* slides, the majority of which were culled and derived from freely available *PowerPoint* or TIFF graphics files downloaded from <http://www.drugabuse.gov/pubs/teaching/default.html>, a NIDA Web site. NIDA designed these graphics files expressly for high school science teachers, and provides suggested narrative for each slide. Two of the 40 slides used in the presentation not found at the Web site were generously provided by Dr. Nora Volkow, NIDA Director, and contain cutting-edge substance abuse research findings from Dr. Volkow's laboratory. The 40 slides depict the anatomy, physiology, and pharmacology relevant to the actions of drugs of abuse in the brain, with most of the neuropharmacology presented as schematic diagrams of drug-receptor interactions in the synaptic cleft between neurons. There are several real-time positron emission tomography (brain scan) images depicting the sites, extent, and duration of action of an abused drug in the brain. Two versions of the presentation were prepared that differed in their scientific depth, one targeted for students in grades 8 and 9 and the other for students in grades 10, 11, and 12. The slides were organized and the accompanying narrative was created or edited for a 30-minute presentation, with an additional 10 minutes allotted for questions and discussion throughout the talk and to administer surveys. PharmD students typically delivered the presentation in pairs, but teams of 3 or 4 were occasionally employed, depending on demand or scheduling convenience. A minimum of 3 site visits was required of each student to satisfy the SL course requirements. The 2002 National Survey on Drug Use and Health<sup>1</sup> revealed that teenagers most frequently initiate use of marijuana, tobacco, and alcohol in June and July (with alcohol initiation also peaking in December and January). Thus, visits to area middle schools and high schools were appropriately scheduled for the spring.

In the interest of facilitating interactions between the PharmD presenters and the teenage audiences, the middle school and high school audiences were typically 20 to 30 students. An effort was made to present to the entire grade of a given school; thus, up to 12 presentations were delivered on the same day, usually by 12 different PharmD teams. On 2 occasions, an audience of 80 to 100 was addressed, the entire student body of a small rural or private high school. Community partners (participating middle schools and high schools) were recruited by e-mailing an introductory letter to the principal, other appropriate administrator, or a science/health teacher for selected schools within a 20-mile radius of downtown Pittsburgh. Upon initiating the presentations,

“word-of-mouth” promotion of the program within this community served to recruit additional schools. More distant schools in Western Pennsylvania were occasionally visited when the student wished to present at his or her high school alma mater; an opportunity that served as a significant incentive in recruiting PharmD students to the program. In the inaugural year of the project, approximately 90% of the schools visited were public, and located in suburban and rural and middle-class and upper-middle class (economic) neighborhoods.

### **Training**

All P4 student presenters completed the required neuropharmacology course, PHBMS 420 (taught by the first author) during the fall semester immediately prior to initiating their SL project. Material for the neuropharmacology course included the neuroscience and basic/clinical pharmacology underlying drugs of abuse. Thus, the PharmD presenters had recently received a cutting-edge education on the molecular mechanisms of drugs of abuse and were already partially trained to deliver the presentations. While not explicitly stated in the PHSLE 477W syllabus, students electing to participate in the “neuroscience behind drugs of abuse” project were expected to have earned a grade of B or better in PHBMS 420. Students earning a grade of C in the course could still participate if they could demonstrate through a discussion with the primary author a solid understanding of the course material relevant to the project. A sample presentation was demonstrated by the faculty mentors (the authors) during an orientation session, at which time each participant was given a CD-ROM disk containing a *PowerPoint* file of the presentation and a *Word* file of suggested narrative and hints for presenting each slide. The *Word* file also contained answers to questions that they anticipated receiving from middle school and high school audiences. The student was expected to thoroughly learn and practice the presentation over the winter holiday break using the CD. Early in the spring semester, teams of students practiced the presentation in front of the faculty mentors, who provided constructive criticism and instruction in public speaking. When necessary, additional practice sessions were scheduled for students. The student presenters were trained to the point where they had an excellent working knowledge of the subject matter and could accurately and confidently answer basic science and clinical questions from the grade school students and teachers and deliver a compelling argument for avoiding experimentation with addictive drugs. No student was allowed to present to a middle school or high school audience until the faculty

mentors made a reasonable effort to ensure that the student would deliver an “anti-drug” message. Presenters were instructed to display professional dress and conduct. For quality control purposes, a faculty mentor occasionally attended a presentation at a nearby school.

### **Reflective Journal Component**

All student presenters kept a journal of their visits to area schools. The journals contained their impressions on a given presentation, a self-evaluation of their interpersonal and presentation skills, and their perception of the value of the program to the presenters and the recipients. Student presenters also reflected on the civic responsibilities of pharmacists and the impact that they may have outside of their normal practices. The reflective journal represented 35 out of 100 course points, along with 25 points for a “goals and objectives” paper and 40 points for an “issue” paper. While journal scores were based in part on proper grammar and spelling (10 points), more weight was placed on the ability to reflect on how community needs were addressed and how pharmacists might play similar roles.

### **Debriefing Sessions**

Student presenters met periodically with faculty mentors in debriefing sessions that included participants from all 3 SL projects. Experiences, journal entries, data from audience exit surveys, and strategies were discussed. The faculty member advised the student presenters on how to resolve perceived problems or weaknesses in the program, and how to improve the presentation in general. The sessions gave students participating in the “Neuroscience Behind Drugs of Abuse” project the opportunity to share their experiences with class members participating in the other 2 service-learning projects, and vice versa. The enthusiasm expressed by students in the “Neuroscience Behind Drugs of Abuse” project sparked interest among the other SL students, to the point that some inquired about participating in this experience on a voluntary basis. Students in all 3 groups asked thought-provoking questions of one another, stimulating productive substantive discussions of pharmacists’ roles in the community and their obligation to promote positive health outcomes to populations. The students largely agreed that such efforts would likely serve to advance the profession and increase its visibility to the lay public.

### **Summative Paper**

At the end of the semester, student presenters wrote a summative paper of 4 to 5 double-spaced pages on an issue related to their SL experience. The paper included a



Table 1. Mean responses of middle/high school students to each exit survey item

Item No.	Item	Mean (SD)*†
1.	The presenters clearly stated their names and the name of the university they represent.	4.72 (0.60)
2.	The presenters spoke loudly and clearly.	4.54 (0.67)
3.	The presenters spoke with proper pace (not too slow or fast).	4.45 (0.72)
4.	I was able to understand and follow along with the presentation.	4.40 (0.79)
5.	The presentation provided good background information on the anatomy of a neuron.	4.54 (0.72)
6.	The presentation helped me to understand the difference among terms such as addiction, tolerance, and dependence.	4.59 (0.66)
7.	The presentation helped me to understand the effects of morphine on the brain.	4.60 (0.70)
8.	The presentation helped me to understand the effects of cocaine on the brain.	4.68 (0.62)
9.	The presentation helped me to understand the effects of ecstasy on the brain.	4.70 (0.58)
10.	The presentation helped me to understand the risks of experimenting with drugs.	4.64 (0.64)
11.	The presenters made themselves available to answer questions after the presentation.	4.73 (0.69)
12.	The presenters did a good job of answering questions after the presentation.	4.66 (0.74)
13.	I believe that all students in my grade should see this presentation.	4.42 (0.89)

\*SD = standard deviation

†Responses scored on a 5-point, Likert-type scale of agreement from 1 = strongly disagree to 5 = strongly agree.

literature review of programs that address drugs of abuse at the middle school and high school levels. Papers also included subjects such as the legality of drug testing, the nature and relevance of the parent-teenager relationship, and the roles of pharmacists and other health professionals in drug abuse awareness education. The summative paper represented 40% of the final grade for the SL course, and was graded in accordance with the guidelines established in the PHSLE 477W course syllabus.

### Evaluation Component

Middle school and high school students and teachers and administrators in the audience were asked to complete separate exit surveys for the purpose of evaluating the presentation. The PharmD presenters administered and collected the anonymously completed student surveys during the last 5 minutes of the class period. The host teacher or administrator survey was also anonymously completed, but at the leisure of the host, and was faxed directly to the faculty mentor. Surveys evaluated the appropriateness, clarity, and tone of the presentation, its educational value, its adequacy in covering the subject matter, and the presenters' speaking skills and willingness to engage participants following the formal presentation. The survey measured respondents' agreement to items on 5-point, Likert-type scales. Statistical analysis of survey results was conducted using SPSS 11.0 software.

### ASSESSMENT AND RESULTS

Over 900 middle school and high school students at 12 schools received the "Neuroscience Behind Drugs of Abuse" presentation in the inaugural semester of this SL

project. The project proceeded quite smoothly for a first effort, and the rare complication encountered typically involved a last-minute scheduling change by the host school or a technical problem with the projector. The latter problem was minimized by having the PharmD student presenters bring both the *PowerPoint* CD and a carousel of conventional slides to each school, and asking the host school in advance to make available projectors that accommodated both slide types. Over 95% of the students receiving the presentation completed most or all of the exit survey and 892 student surveys were collected (Table 1).

For both surveys, a response of 5 ("strongly agree") for a given item was the best possible score with respect to presentation content and performance of the PharmD presenter. The student survey mean scores for the 13 questions ranged from 4.40 to 4.73, indicating that the middle school and high school students held a very positive view of the presentation and saw little room for improvement (Table 1). Scores of 1 ("strongly disagree") were occasionally recorded, but most, and possibly all, of such cases were apparently due to the student misinterpreting the direction of the scale. For example, a student occasionally scored every item at 1 and then wrote "Good job!" on the bottom of the survey, suggesting that the student actually meant to score the items at 5. Other surveys had 1 and 5 circled for each item with the 1's column scratched out. Thus, the mean scores for all items would have been slightly higher if the apparently erroneous scores of 1 had been replaced with 5s. The final mean scores in Table 1 also do not make apparent the improvement in the performance of the presenters

Table 2. Mean responses of middle school teachers/administrators to each exit survey item

Item	Mean (SD)*†
(1) The presenters clearly stated their names and the name of the university they represent.	4.86 (0.35)
(2) The presenters spoke loudly and clearly.	4.54 (0.61)
(3) The presenters spoke with proper pace.	4.14 (1.00)
(4) The presentation was at the appropriate level of difficulty for students of this age.	4.37 (0.73)
(5) The presentation was informative.	4.68 (0.59)
(6) The content of the presentation was interesting.	4.69 (0.58)
(7) The graphics used in the presentation were helpful in maintaining the attention of the students.	4.78 (0.49)
(8) The presenters were professional in their appearance.	4.89 (0.32)
(9) The presenters were professional in their demeanor.	4.86 (0.35)
(10) The presenters were effective in answering questions at the conclusion of the presentation.	4.66 (0.73)
(11) I would like Duquesne University to deliver a similar presentation next year.	4.92 (0.50)

\*SD = standard deviation

†Responses scored on a 5-point, Likert-type scale of agreement from 1 = strongly disagree to 5 = strongly agree.

with each school visit. The mean scores on 6 of the 13 student survey items improved significantly between the first and third (last) school visits for the group of presenters as a whole. Notable differences were observed on Item 2 ( $\mu= 4.42$  vs  $\mu= 4.61$ ,  $t = 4.33$ ,  $p < 0.001$ ) and item 3 ( $\mu= 4.36$  vs  $\mu= 4.50$ ,  $t = 2.86$ ,  $P = 0.004$ ), indicating that even though they made an impressive first effort, students' presentation abilities improved after gaining some experience. The student audiences believed that they learned useful information about the effects of certain drugs of abuse and gained a better appreciation of the risks of experimenting with such drugs. By any measure, the presentation was educational for, and valued by, the middle school and high school students.

The 36 teacher/administrator evaluations of the presentation and its presenters were even more positive (Table 2). Mean scores exceeded 4.50 on all but one of the statements. A comparison of scores from the first group of presentations with those from subsequent presentations revealed several marked improvements, most notably a statistically significant increase in scores for item 10 ( $\mu= 4.00$  vs  $\mu= 4.96$ ,  $t = 4.57$ ,  $p < 0.001$ ). These increases, along with mean score increases (not statistically significant) on items 2 ("spoke loudly and clearly") and 3 ("spoke with proper pace"), were further evidence of improvement with respect to student presentation skills, preparedness, and mastery of the topic. The second-lowest score (4.35 for item 4: "The presentation was at the appropriate level of difficulty for students of this age.") appeared to be primarily due to differences among the schools for a given grade in their level of scientific literacy, and whether the class visited was an "honors" or otherwise "gifted" audience. The PharmD presenters reported that students in eighth-grade honors classes with some neuroscience education followed the presen-

tation easily and asked more thoughtful questions than students in some of the eleventh-grade classes at other schools. Because the PharmD students were not apprised of the educational background of their audience until after the presentation, they could not adjust the level of the talk accordingly. This was an oversight on the part of both the DUSP and the teachers/administrators at the host schools, who should have more thoroughly discussed the composition of the audience prior to the visit. Nevertheless, all but one teacher/administrator unequivocally indicated their desire to host the presentations during the next academic year (Table 2, item 11).

In the future, the authors plan to conduct a follow-up survey between the middle school and high school presentations for a given school system. By assessing the impact of the middle school presentation, the high school presentation could be adjusted if necessary to remedy any deficits. Future surveys will also determine the longevity of the presentation's impact. Teachers and administrators cannot be expected to accurately assess whether the presentations discourage individual students from experimenting with drugs; however, they may be able to discern general trends in substance abuse at the school, and whether students, particularly student leaders, make reference to the presentations. Additionally, students may be asked 1 to 2 years later to reflect upon the presentations and opine whether they made an impact on themselves or their peers.

Students participating in the project performed well in the PHSLE 477W course. The average score on the reflective journal papers was 32.0 out of a possible 35 points, while an average score of 37.3 out of a possible 40 points was earned on the summative papers. These scores were comparable to scores for students in the other SL projects (mean scores of 31.9 on the reflective

journal papers and 36.9 on the summative papers). PharmD presenters commented in their reflective journal papers on their amazement in holding the undivided attention and interest of the students attending their presentations. Several PharmD students indicated that “prompting” questions from presenters sometimes led to discussions on legal prescriptions and nonprescription medications. Two groups of presenters noted in their reflective papers that they improvised active-learning strategies, such as role-playing, in the course of their presentations. Nearly one third of the 28 PharmD students participating in the project earned a perfect score of 40 on the summative paper, reflecting their effectiveness in relating their SL experience to the appropriate literature on strategies to curb substance abuse among adolescents. Several participants identified possible strategies for expanding the role of pharmacists and other health care practitioners in diminishing the deleterious effects of dangerous abused substances in their communities.

The presentations were tightly focused on the neuroscience underlying drugs of abuse, and no time was allotted to discuss pharmacy as a career path. Nevertheless, several high school students approached the PharmD students after the presentation to inquire about the DUSP and about career opportunities in pharmacy. Thus, this SL program may also serve as an effective recruiting tool for pharmacy schools and possibly other health-related professional programs.

## CONCLUSIONS

Western Pennsylvania is no different from most areas of the country in that ecstasy, cocaine, heroin, oxycodone, and marijuana are easily obtained by high school and even middle school students. This service-learning project provided these teenagers objective, science-based reasons for choosing not to experiment with such drugs. This service-learning project educated Greater Pittsburgh middle and high school students on how drugs of abuse cause both euphoria and addiction at the molecular level. This approach allows the teenager to make a logic-based, informed decision on whether experimentation with such drugs is worth the risk. The student audiences were interested in, appreciated, and learned from the presentations. Host-school teachers and administrators were enthusiastic about the presentations and overwhelmingly indicated their interest in hosting the presentation again next year. The PharmD presenters and host teachers agreed that students in the audience appeared to be affected by what they were learning.

In the course of the project, the presentation and communication skills of the PharmD students improved

markedly. All PharmD student presenters expressing an opinion of the project reported a positive experience. In fact, most students were jubilant upon returning from a visit, enjoyed recounting the details of the presentation in impromptu debriefings with a faculty mentor, and stated that they could not wait to visit the next school. In addition to building presentation and communication skills, the authors hope that these students will become more aware of their civic responsibilities. Feedback from the student presenters indicated that several will continue to make these presentations in a volunteer capacity, possibly even after graduating and entering professional practice. Whether implemented as a voluntary program or a mandatory curricular component, this service-learning model could be applicable to any United States school or college of pharmacy. To obtain a copy of the PharmD student training CD containing the “Neuroscience Behind Drugs of Abuse” presentation and narrative files, please e-mail the corresponding author.

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