INSTRUCTIONAL DESIGN AND ASSESSMENT

Effects of Academic Service Learning in Drug Misuse and Addiction on Students' Learning Preferences and Attitudes Toward Harm Reduction

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Objective. To examine academic service-learning pedagogy on student learning and perceptions of drug misuse and addiction.

Design. Third- and fourth-year pharmacology students were exposed to an academic service-learning pedagogy that integrated a community service experience with lectures, in-class discussions and debates, group projects, a final paper, and an examination. Reflective writing assignments throughout the course required students to assimilate and apply what they had learned in the classroom to what they learned in their community placement.

Assessment. Changes in students' responses on pre- and post-course survey instruments reflected shifts toward higher-order thinking. Also, subjective student-learning modalities shifted toward learning by writing. Students' perspectives and attitudes allowed improved context of issues associated with drug misuse and harm reduction models.

Conclusion. Academic service-learning pedagogy contributes to developing adaptable, well-rounded, engaged learners who become more compassionate and pragmatic in addressing scientific and social questions relating to drug addiction.

Keywords: pharmacology, service-learning, drug addiction

INTRODUCTION

The majority of university-level pharmacology courses rely on lecture- and seminar-based approaches to teaching. Students are expected to memorize the information presented, develop and use critical-thinking skills, and apply the knowledge learned to research questions. Connections between classroom material and real world application are not always apparent, which can negatively affect student engagement.¹ Faculty members thus face the challenge of illustrating relevant, real-world connections for students. Within the basic medical sciences, experiential learning usually occurs through hands-on laboratory and research courses which consolidate theoretical concepts through laboratory techniques, trouble-shooting experience and the practical application of student knowledge. Research internships or cooperative placements

Corresponding Author: Michelle Arnot, PhD, 1 Kings College Circle, Department of Pharmacology and Toxicology, University of Toronto, Toronto, ON, M5S 1A8. Tel: 416.978.3164. Fax: 416.978.6395. E-mail: michelle. arnot@utoronto.ca provide field experiences and opportunities to apply knowledge to practice in industrial, clinical, or research settings. In light of these practices, the call to provide students with socially relevant, engaging, and experiential learning opportunities has intensified in recent years.²⁻⁴ Accordingly, there is a shift to novel pharmacy education which supports evidence-based pedagogy that challenges students to think critically and improve communication skills, while moving away from traditional "factual transmission."⁵ This mix-methodology study describes the process of incorporating a service-learning pedagogy in a pharmacology course at the University of Toronto to create a novel education experience. The course design meets the Accreditation Council for Pharmacy Education (ACPE) standards 10-15 for curriculum⁶ and further emphasizes a number of areas highlighted by the most recent guidelines (eg, communication skills, experiential education). The course also meets the pharmacology and pathophysiology learning outcomes outlined by the Center for the Advancement of Pharmaceutical Education (CAPE).⁷

Academic service-learning is a pedagogical model that integrates relevant, community-based placements or projects within a credit-bearing academic course in which students make sense of their learning through critical reflection on their community-based experiences in light of course concepts and themes. Academic service-learning challenges deeply rooted norms of traditional pedagogical practice characterized by the "information-dissemination" model⁸ and disrupts the norms of a traditional classroom by engaging students in the process of bringing personal experience to bear on knowledge creation. The servicelearning pedagogy uses student critical reflection to integrate academic concepts and theories with communitybased learning. Professors of service-learning courses shift from being the source of information⁹ to being discussion facilitators, learning alongside students as they return from their placements with new community-based knowledge to supplement, challenge, or illuminate course material.^{8,10}

Considerable research has been published documenting the transformative nature of academic service-learning.¹¹⁻¹⁵ Following academic service-learning experiences, students develop enhanced leadership and communication skills, identify an increased sense of civic responsibility,¹⁶ and have stronger critical-thinking skills than students who do not participate in academic service-learning.¹⁷ Various studies have demonstrated that academic servicelearning activities sensitize students to community needs and resources, instil a sense of social responsibility, and highlight the "real world" implications of educational content.^{14,15,17-21} The inclusion of reflection opportunities is key within academic service-learning and improves students' ability to connect their involvement in the community (ie, the service) with their learning.¹⁷ Further, providing structure to the reflection (ie, prompts and formative feedback) allows students to attach a deeper understanding to their experience.²² Although, there is limited literature detailing how academic service-learning is used within basic medical sciences courses, previous findings support an academic service-learning-based teaching and learning approach while providing an opportunity to examine the pedagogical effects on student learning and engagement.

Pharmacology courses are typically taught from a basic medical science perspective, focusing on the scientific principles and physiological effects of drug use. Many undergraduate students studying within this field progress to professional and graduate work in the health sciences yet are rarely given opportunities to connect their knowledge and realize the role their discipline plays in society outside of drug development. The objectives for incorporating academic service-learning within the University of Toronto⁴ and this course align with ACPE⁶ and CAPE⁷ guidelines and help students identify how their assumptions and perceptions are formed, while developing their thinking about external community needs. The course design included the goals to facilitate students: to identify the applicability of their knowledge, appreciate the human dimension of scientific knowledge, and realize the complexities of society through exposing them to a range of ideas and perspectives.⁴

This pilot study explored how academic servicelearning helps students to connect the scientific theories and research of drug addiction and misuse with communitybased experiences gained through working with communitybased outreach groups who use public health policies to reduce the harms associated with drug misuse. Using preand post-course surveys as well as reflective writing, we examined the effect of academic service-learning pedagogy on students' perceptions and attitude towards drug misuse, awareness of the societal implications of their knowledge and discipline, communication and thinking skills, and learning modality preferences. Following completion of the course, the instructors/researchers hypothesized that students would: (1) have an increased awareness of their discipline and knowledge as it applies to society; (2) demonstrate a better understanding of the basis of their perceptions with an improved awareness of the harm-reduction philosophy; (3) have an improved ability to communicate; and (4) develop advanced learning preferences as outlined by Bloom's Taxonomy of Learning.²³

DESIGN

The Role of Pharmacology and Toxicology in Society course was created to address the interdisciplinary nature of drug misuse, identify potential student biases towards issues relating to drug addiction and misuse, and broaden student learning. The course was introduced in 2009 at the downtown (St. George) campus at the University of Toronto, a large research-focused university which draws local, regional, national, and international students with diverse backgrounds. Using an integrated approach, the course was conceptualized as a set of mutually determined relationships rather than a sequential set of discrete moving parts. While creating this course, the course instructor asked questions regarding situational factors such as institutional priorities and community needs, academic learning goals, student skill development, effective feedback and assessment procedures, and as a service-learning course, the necessary critical-reflection teaching and learning activities.²⁴ Unlike traditional courses, student-learning outcomes in this course took into consideration goal categories beyond course-specific academic learning, but also skills for learning how to learn, community learning, and interand intra-personal learning.²⁵ Crafting the course by first asking what should students learn as a compass for determining appropriate activities and community-based placements, or backwards design, is the most effective course design strategy.²⁶

Enrollment in this elective undergraduate Pharmacology and Toxicology course was open to no more than 30 third- and fourth-year undergraduate students who have completed appropriate pharmacology and physiology course prerequisites. Students attended 2-hour classes once a week for 12 weeks, which included lectures as well as active-learning activities such as in-class debates, in-class discussion, and critical analysis of articles in scientific and popular publications. The lectures examined the neurobiological theories of drug misuse and the associated social, legal, and ethical implications. Inclass debates and article discussions required reading and research into opposing views of drug misuse and addiction issues (ie, needle exchange, legalization, drug-classification policy, and pharmacotherapy interventions to name a few). University of Toronto faculty members presented lectures on specific topics from the course curriculum and then moderated a class discussion on their presentation. Student writing, in the form of 3 reflective writing assignments throughout the course and a reflection exercise included in the final examination, was examined for evidence of learning, attitudinal changes, and content acquisition. A participation score was given to students based on group work, peer evaluation, and instructor evaluation of engagement in class discussions. Students were assessed on their understanding of course material and its integration with their community placement experiences through a final oral presentation of a group project that aligned with their community placement, an individually written final paper on this project and a traditional final written examination which evaluated scientific knowledge, written communication and integration of social and health policy.

In addition to class time, students engaged directly, for a minimum of 20 hours, with a community harmreduction service or agency to which they were matched based on their ranking of preferred placements. These harm reduction groups included outreach arms of community health centres, policy advocacy groups or outreach initiatives funded through private or public funds. They focused on one particular at-risk population (streetinvolved youth, methadone treatment, etc) or on the broader population of individuals whose physical and mental health were affected by illicit drug use or drug laws and policies. Student projects were initiated at the partners request and were wide-ranging and included, but were not limited to, the creation of educational materials regarding non-palatable alcohol use to the creation of safe-injection kits (Table 1). Participating community partners were initially approached by staff members at the University of Toronto's Centre for Community Partnership and interested partners provided a description of the student placement or involvement. Every student enrolled in the course was required to participate in the community placement; therefore, ensuring availability of an adequate number of community placements and projects was imperative.

Ongoing support was available for students by the course teaching team (course instructor and teaching assistant) and students were invited to share experiences from their placement with their classmates on a weekly basis. The course was coordinated by a faculty member, with grading support provided by a graduate student teaching assistant. The projects completed by student for the partners, which were shared publicly through oral or poster presentations or educational pamphlets were previewed regarding their educational content by the course coordinator.

EVALUATION AND ASSESSMENT

This sequential mixed methods study²⁷ used a preand post-course attitudinal survey instrument and student reflective writing to assess changes in attitude and perspective throughout the course. Consent to participate was obtained from all students. The study was conducted in accordance with the University of Toronto Office of Research Ethics guidelines.

Survey Design

Pre- and post-course survey instruments were designed to probe the background of the student population and examine their preferences in learning modalities, as well as their attitudes towards drug users and addiction and their knowledge of harm reduction. Students were provided 20 minutes during the first class (prior to introduction of course material) to complete the pre-course survey instrument and 20 minutes during the last class to complete the post-course survey instrument. Pre- and post-course questions regarding preferences toward learning and drug use and addiction were aligned. Following background questions, students were asked to indicate how strongly they agreed or disagreed with a statement on a 5-point Likert scale ranging from strongly disagree to strongly agree. There were 14 questions specific to learning (ie, "I learn effectively by working in groups."), 5 questions on academic service learning, and 24 questions probing student perception on their discipline and

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Community Partner Placement	Activity or Project	
Toronto Harm Reduction Task Force	Facilitate focus group interviews and draft report regarding peer-driven project; Assist in the design and creation of opioid overdose prevention information package; Develop and create Web page on naloxone use; Review and create information package on nutritional deficiencies associated with street drug use; Assist in the facilitation of a discussion for front line workers around CNS effects of drugs "Bevel Up" as a discussion tool; Research, prepare and staff a display related to pharmacology and harm reduction at the bi-annual Harm Reduction Health Fair	
Canadian Harm Reduction Network	Develop and write a position paper on the ethical justification for harm-reduction	
Eva's Satellite Emergency Youth Shelter Shout Clinic Health Service	Joint Project: Develop an educational resource for homeless and street-involved youth who have been prescribed psychiatric medications and are using illicit/licit substances, including harm reduction and self-care strategies, as well as info on relevant community resources	
Regent Park Community Health Centre	Conduct a needs assessment on substance use issues in the community and help facilitate a review for Community Based Research on substance use.	
Breakaway Satellite Program- Breakaway Opiate Addiction Treatment Centre	Research and create pamphlet for users and first line worker on polydrug use (eg: methadone and marijuana)	
Operation Springboard	Research and write reference paper pertaining to the addictive potential of common drugs misused by children and youth.	
Seaton House Annex	Create pamphlets regarding non-palatable alcohol use and associated toxicities; review client drug lists and look for potential drug-drug interactions	
Street Health Community Nursing Foundation and Health Centre	Harm reduction kit creation; Assist front line workers with drop-in and outreach programs to area residents and street-involved individuals	

Table 1. Overview of Community Placement and Activities Aligned With the Academic Service-Learning Course

their attitudes towards drug use and harm reduction (ie, "Harm reduction programs are effective ways to help drug users") and whether exposure to this academic servicelearning course format was a potential source of these changes. The questions within the survey instrument were designed and fine-tuned by the authors to identify potential shifts through subjective reporting from students on the opinions detailed above. To fine-tune clarity and student comprehension, questions were reviewed by students who were not involved in the course, as well as educational consultants at the University of Toronto's Centre for Teaching Support & Innovation. Such cognitive interviewing techniques and expert review are recommended for creating valid survey instruments able to measure change.²⁸ (The survey instrument is available from the corresponding author.)

Of the 22 students who completed the intake survey instrument, 15 also completed the exit survey instrument; thus, data analysis was completed on the 15 paired survey instruments. Survey data were compiled and analyzed using GraphPad Prism 3.01 for Windows (GraphPad Software, La Jolla, CA). Factor analysis was undertaken to see if individual items measuring harm reduction perceptions were correlated to approximate an underlying construct using SPSS statistical software (New York, NY). Because the distribution of responses failed to meet the assumption of normality, paired non-parametric Wilcoxon t tests were used to examine significant differences between the pre- and post-course outcome measures.²⁹ Students' reflective writing assignments were reviewed in light of course objectives.

Factor analysis on the 27 items that comprised the survey instrument revealed no factors with an Eigenvalue greater than 1. As a result, data analysis was completed by examining responses to individual questions addressing specific attitudes and ideas regarding student learning and student attitudes.

Students reported their top motivation for enrolling in the course was to learn about partner organizations in the field of drug addiction and to help people. A majority of students (87%) had previous volunteer experience and their top-ranked reasons for volunteering were to help people, learn about themselves, learn about the organizations and develop their résumé. Overall, students previous volunteerism was in the health and education sectors. A comparison of students who completed the course with those who did not revealed substantial differences. The pre-course survey responses of the 5 students who dropped the course for unknown reasons revealed stronger negative opinions regarding individuals who misuse/abuse drugs.

Prior to this course, students reported that the skills essential for the majority of their university courses in decreasing order of importance were: memorization, analysis, application, judgement, and reflection. However, in the post-course survey, students reported that because of the service-learning format of the course, making judgements, applying their knowledge, and reflecting on information were most relevant to their learning, with memorization ranked as least relevant.

On the pre-course survey instrument, students reported that they learned most effectively by relating to the educational content, discussing the material, and attending lectures (Table 2). Following course completion, there was a significant shift towards students identifying effective learning through writing. There was also a trend towards identifying more strongly with learning through group work.

Upon course completion, all students reported that they agreed (43%) or strongly agreed (57%) that their view on drug misuse programs had changed as a result of this course, with a significant shift in student awareness of harm reduction programs within the city (from 2.4 \pm 0.3 prior to course to 4.0 \pm 0.2 at end of course, p=0.001) and a realization that harm reduction strategies are an effective way to help drug users (3.1 \pm 0.3 prior to course to 4.1 \pm 0.2 at end of course, p=0.007). Students demonstrated a change in their attitudes towards "media/ Hollywood portrayal of drug use" (ie, what is seen on TV or in movies), shifting from agreeing it was acceptable prior to the course (3.7 \pm 0.3) to no longer agreeing that this portrayal of drug use was acceptable (2.9 \pm 0.3, p=0.007) following their interactions with harm reduction groups and improved awareness and knowledge. Following the course, 85.7% of students also reported they agreed or strongly agreed that this course changed their view on service, and 71.4% agreed or strongly agreed they had a desire to continue to be involved in service, and 92.1% would seek out service opportunities. All students reported a greater understanding of the social impact of pharmacology and toxicology in society (57% strongly agreed and 43% agreed).

Reflective Writing Assignments

A series of prompted reflective writing assignments, focusing on students' belief systems, perceptions, and the assumptions on which the latter are based, provided a triangulation of our findings and contributed to the validity of the evidence. Each reflective assignment had 2 submission dates, which allowed formative instructor feedback following the first draft and prior to grading the final submission. Using the Describe, Examine, and Articulate Learning (DEAL) model,³⁰ students were asked to reflect on and integrate their understanding of issues from the course in light of their community placement experience while drawing from their personal understanding of social norms and attitudes. Reflective writing essays were limited to 400 words and were graded on evidence-based observation, logic, clarity, integration, critical evaluation, depth, and significance, as well as writing ability. The initial prompt was provided to students at the onset of the course and prior to meeting their respective community partner: (1) Provide an example of when you have seen an individual under the influence of drugs or alcohol. Describe your perceptions or assumptions that you made about the individual and the situation.

The second and third reflective writing prompts were provided sequentially as the course progressed and students became involved in their service placement:

	Pre-Course, Mean (SD)	Post-Course, Mean (SD)	Р
Learn effectively through lectures	4.1 (0.1)	4.1 (0.3)	0.81
Learn effectively through reading textbooks	2.9 (0.3)	3.3 (0.3)	0.16
Learn effectively by discussing issues	4.2 (0.2)	4.1 (0.3)	1.00
Learn effectively by relating ideas to everyday experiences	4.4 (0.3)	4.2 (0.3)	0.43
Learn effectively by writing ideas and opinions	3.4 (0.2)	3.9 (0.2)	0.03 ^a
Learn effectively by working in groups	3.4 (0.3)	3.9 (0.2)	0.09
Learn effectively by working alone	3.9 (0.3)	4.1 (0.2)	0.3
Had to take responsibility for own learning in this course		3.9 (0.2)	
more than usual			

Table 2. Subjective Student Ranking of Effective Learning Techniques

A 5-point Likert scale with response choices ranging from strongly disagree (1) to strongly agree (5) was used to assess student attitudes.

^a Data from students who completed both pre- and post-survey instrument (n=15) was analyzed for significance with the Wilcoxon t test.

(2) How have your assumptions/perceptions of drugs (or alcohol) addiction and/or abuse been reinforced or challenged by the community organization you are working with and their philosophy of harm reduction. Please explain; and (3) How has what you have learned in class been confirmed or challenged by your work and interactions in the Harm Reduction community? How has this experience (course material and community partnership) affected your thinking of pharmacology and/or toxicology?

The findings from the student writing assignments were intended to complement the data gathered in the survey instruments with the student writing detailing the process by which the students experienced changes in their attitudes and perceptions.³¹ Prominent themes were identified in the reflective papers written in response to the second and third prompts. These themes included the students' personal perceptions of drug users, harm reduction strategies, and associated social issues with which students had begun to identify and connect to their discipline. Although attitudinal changes were observed in nearly all of the students' reflective essays, for brevity, only exemplars that illustrate shifts in student attitude were included. Students' reflections in response to the initial writing prompt provided a baseline measure of students' attitudes and perceptions of individuals they had observed under the influence of drugs or alcohol. The examples from the onset of the course show that students distanced themselves from marginalized individuals who used/misused drugs. Students could not comprehend the rationale for taking drugs and placed blame on drug users. Students' writing from the beginning of the course suggest that our cohort entered the course with a number of assumptions about drug misuse that were reinforced by their social milieu.

As the course progressed and students interacted with their community partners, there was a shift in perception and attitude that corroborated the survey results. Student writing from the second and third writing prompts demonstrated changes in their attitudes towards harm reduction as a pragmatic strategy for addressing drug addiction and misuse. Students who had once narrowly articulated pharmacological questions within a purely scientific framework were able to apply and understand the implications of science in a social context in their reflective writing.

DISCUSSION

The goals of this course were to demonstrate the applicability of students' pharmacology-specific knowledge and to impart an appreciation for the human dimension of scientific theory and educational content while improving students' learning capacity. We examined the extent to which academic service-learning pedagogy is related to changes in students' learning modalities and attitudes towards the harm reduction approach of managing drug misuse or addiction. Overall, our findings support the hypothesis that students in an academic service-learning course shift their learning modalities towards improved learning by writing and group work as indicated in the survey instruments, and can be sensitized to the interdisciplinary nature of drug misuse issues and harm reduction concepts. Reflective writing demonstrated students' ability to situate their discipline-specific knowledge within a wider societal context. Thus, academic service-learning within a pharmacology course appears an effective method of teaching and engaging students with their community.

This study was designed to measure students' perceptions of their skill sets rather than their competence within those skill sets. Of great interest were the changes in learning perceptions resulting from academic servicelearning pedagogy. Data from student feedback (surveys and writing) reflected a shift from lower-order learning (memorizing) to more higher-order thinking (applying, analyzing, evaluating).²⁶ After this experience, students reported significant shifts in subjective learning modalities toward effective learning through writing and group work. The formative feedback mode of assessing reflections may have contributed to these improved learning outcomes. Although the importance of grammar, spelling, logic, and clarity in the writing samples was highlighted, the instructors emphasized a non-judgemental attitude with regards to any views, values, or opinions expressed. Students were coached to critically evaluate and integrate the educational content with their "real world" experience, without being bounded by the anxiety of grades on the initial draft, thus removing creative inhibitions and allowing students to be innovative in the connections they drew. In addition, students showed a trend toward recognizing effective learning through group work. This may be the result of the opportunities for teamwork within the class, on debates, oral and written presentations, and as part of their community placements, which may have sensitized students to the values and rewards of collaborative work. The instructor and visiting speakers noted the quality of classroom discussions following lectures, presentations, or debates as exemplifying a more comprehensive understanding and critical thinking characteristic of knowledge integration, application, analysis, and evaluation.

Altogether, these changes in subjective learning modalities suggest that students are adaptable learners poised to internalize knowledge using a variety of approaches that are not limited to lectures and textbook reading. Despite being taught and examined on rigorous physiological and pharmacological concepts and theories, students identified memorization as the least relevant to their learning by the end of the course. Higher-order thinking was also illustrated in reflective writing where students incorporated educational content and placement experience to suggest a new framework for addressing drug misuse and addiction issues. We found reflective writing assignments provided an opportunity to challenge students' biases, perceptions, and stereotypes, as a consequence of their interactions with marginalized communities.³² The reflective writing process presented an opportunity for students to make explicit connections between course educational content, placement experiences, and their own belief and value system. Through formative feedback, we challenged and helped students to uncover their assumptions and to explore the basis on which these assumptions were formed. As such, the reflections served to improve students' awareness and their ability to relate to and integrate with issues and communities with which they may not have related or integrated in the absence of this course. This is a key goal of academic service-learning.

As students progressed through the course and community placements, they reflected on the multi-faceted nature of disease/drug misuse and appeared to gain a broader understanding of the world by applying scientific knowledge on a social and political canvas. Student insights revealed a growing sense of their appreciation for the social role and public purpose of this academic discipline. The ideas presented in the student writing demonstrated some preconceived ideas that students associated with the drug misuse/addiction community and the practices used to address issues within this community. The experiences they had working in community organizations through academic service-learning increased their awareness, sensitivity, and empathy for this particular social issue and the people affected by it and students came to accept and/or understand a different perspective regarding these factors. Rather than an isolated theory of study, drug addiction had morphed into a social and health issue with genuine and significant complexities. Students' writing reflected a heightened awareness of their assumptions, perspectives, and biases. Students' realized that continued drug use, despite negative consequences, has a physiological basis and is not necessarily the result of an individual's unwillingness to quit. Furthermore, students recognized that scientific inquiry is not immune to personal biases and that these may hinder progress towards pragmatic approaches to managing particular health conditions. The ability of students to "humanize" the issue of drug misuse/addiction and comprehend the various issues that also play a role beyond the "changes in physiology" provided them insight into complexities and determinants of this "multifaceted disease." This theme was evident in students' writing. This quest to "humanize" science education was one of the key motivations of adopting academic servicelearning curricula.³ Student knowledge was applied and "translated into societal applications," with the overall beneficial ability to position and humanize this disciplinary knowledge and understanding within a wider societal context.

Consistent with other studies demonstrating that academic service-learning sensitizes participants to community needs, ^{12,13,18} these students became more compassionate, as measured through their reflective writing and the changes in attitudes measured across the pre- and post-course survey instruments. The framework of this academic service-learning course, in collaboration with community involvement provided students with a deeper understanding and a more compassionate view of how scientific concepts integrate with social issues that surround them. Student writing within this course exemplified what has been previously observed with academic service-learning;³³ this pedagogy assists students in adopting a complex view of social problems and allows them to consider the context of human behavior.

Although this initial study provided insight regarding interesting shifts in students' attitudes and preferred learning modalities that are worthy of further examination, this study is not without its limitations. We fully recognize that the survey data lacked statistical power because of the small sample size. Possibly as a result, the factor analysis was not able to identify conceptual clusters of related items. By examining data from a larger sample, important and significant shifts in attitudinal constructs may be observed more clearly. We also realize that the population of students enrolled may have been a selfselected group as the majority was already involved in outreach and volunteer work. The student demographic is comparable to previous studies that indicate that students who take academic service-learning are generally female and have prior volunteer experience.¹⁶ Moreover there are indications from previous work¹⁹ and from our own data that these participating students may be more liberal in their thinking and more open to changes in attitudes. Participating students were more moderate or liberal in their views of drug users initially than those who enrolled but dropped the course (data not shown); however, the time commitment associated with course-based service learning may also have been a deterrent for these students. These findings appear to be consistent with Sherman and MacDonald's ideas,¹⁹ who also note that students who may benefit the most do not generally engage in integrated learning experiences and are unaware of the need for different integrated learning experiences. In that particular study, more than 50% of the students did not enroll in the optional service-learning activity, citing risk and uncertainty about their impact among the deterrents for participation. The students who self-enrolled and completed the course described here may have had a predisposition to allow changes and challenges in their perception.

Recognizing these limitations yet encouraged by our pilot study results, we have begun a longitudinal study to address and clarify potential changes in learning and changes in student attitude and perceptions as a consequence of this service-learning course.

SUMMARY

Adopting an academic service-learning pedagogy in a pharmacology course was associated with students gaining a deeper understanding of the educational content and its integration within a societal context. Students' writing and classroom discussions reflected shifts toward higherorder thinking. In addition, student's reported their learning modalities shifted toward learning by writing and group work, suggesting that the service-learning pedagogy contributed to students developing into adaptable learners. Consistent with the documented role of academic service-learning in enlightening students to community needs, the students appeared to become more compassionate and pragmatic in addressing scientific and social questions relating to drug misuse/addiction.

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