INSTRUCTIONAL DESIGN AND ASSESSMENT

An Elective Course to Engage Student Pharmacists in Elementary School Science Education

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Submitted May 16, 2011; accepted July 27, 2011; published December 15, 2011.

Objective. To develop and assess the impact of an elective course (HealthWISE) on student pharmacists' skills in communication and health promotion and elementary school students' knowledge of and attitudes toward science.

Design. Three colleges and schools of pharmacy collaborated to develop a 1-credit elective course that used online and classroom teaching and learning techniques to prepare student pharmacists to teach science in elementary school classrooms. Student pharmacists delivered 6 science lessons to elementary students over the course of 2 months.

Assessment. In weekly journal reflections and a final paper, student pharmacists reported improved communication and health promotion skills. Elementary teachers reported they were satisfied with student pharmacists' performance in the classroom. On pretest and posttest evaluations, elementary students demonstrated increased science knowledge and enhanced enthusiasm for science following the lessons taught by student pharmacists.

Conclusions. The HealthWISE elective course provided positive benefit for student pharmacists, elementary school teachers, and elementary students.

Keywords: service-learning, communication skills, health promotion, STEM education

INTRODUCTION

Service-learning and community service experiences have become a regular part of pharmacy curricula.¹ Student pharmacists are involved in many efforts that impact the overall health of the community including community-based health education programs, emergency preparedness planning, and screening programs for chronic diseases like hypertension and diabetes.²⁻⁵ Service-learning is beneficial for both student pharmacists and the target audiences of effective, well-designed interventions.^{2-4,6-10} Service-learning helps student pharmacists to understand the future patients they will assist, recognize the importance of community service, and become aware of patients' needs for social support.⁷ Through the activities, the

health and wellness of the general public are positively impacted and the communication abilities, problem-solving skills, and social responsibility of student pharmacists are improved.

The US Department of Education's official Web site for No Child Left Behind identifies that America's schools are not producing students with the science excellence required for global economic leadership and homeland security in the 21st century.¹¹ The national report "Rising Above the Gathering Storm" proposes recommendations for strengthening US scientific and technological capacity, including steps to improve K-12 science education.¹² A report commissioned by President Obama entitled "Prepare and Inspire: K-12 Education in Science, Technology, Engineering and Math (STEM) for America's Future" cites both a lack of *proficiency* among America's youth in STEM fields and a lack of *interest* in science.¹³ Elementary school teachers are not prepared to meet the challenges on their own. According to a study of 6,000 elementary (K-5) teachers on the status of elementary

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science teaching, over 40% received 4 or fewer semesters of college-level science coursework, suggesting they do not have an adequate background in science.¹⁴ In addition, fewer than 3 in 10 teachers in the study reported feeling well prepared for teaching the sciences.

Student pharmacists who engage in service-learning as volunteers in elementary classrooms can be a solution for both the lack of proficiency among teachers and the lack of interest among students. Student pharmacist volunteers are enthusiastic and can inspire students to attain advanced degrees and enter science fields. They can be powerful career role models who accelerate the frequency and quality of science instruction as they share their knowledge with elementary school students and teachers. They also can be instrumental in raising the level of achievement of minority youths who want to pursue careers in science. The future of the US economy is dependent on all students receiving an education that prepares them to enter a competitive workforce. A quality math and science education also can help to alleviate economic and health disparities.¹⁵

Service-learning is an important approach to use in implementing the Accreditation Standards and Guidelines of the Accreditation Council for Pharmacy Education (ACPE).¹⁶ The ACPE Guidelines define service-learning as “a structured learning experience with clearly defined objectives that combine performing service in the community with preparation, reflection, and discussion.” These service-learning activities should meet community needs, enhance relationships between community and academia, foster civic and professional responsibility, provide structured reflections, and extend student learning into the community. The ACPE Standards and Guidelines are clear in their call for pharmacy graduates to be able to “communicate and collaborate” with patients and a broad audience that includes members of the community. Student pharmacists also should be prepared to “promote health improvement, wellness, and disease prevention.” Teaching elementary students offers student pharmacists a challenge to improve their communication skills and practice them with an audience that is diverse in terms of age, setting, language, and culture. Science lessons, with opportunities for discussion, vocabulary building, and hands-on activities, are believed to be a critical pathway to language development and help English language learners, (students who speak English as a second language, ELL) to improve their language skills as well as to learn science.¹⁷

To address these needs, a 1-credit elective course (HealthWISE) was developed to provide the opportunity for student pharmacists to integrate academic and clinical skills with principles of community health promotion and

prevention, while strengthening science education in elementary schools. The goals of HealthWISE are to (1) prepare student pharmacists to develop skills to communicate and collaborate with others; (2) prepare student pharmacists to promote health improvement, wellness, and disease prevention; and (3) to improve health science education for elementary students. HealthWISE is an intensive intervention by student pharmacists over the course of 1 semester during which they develop relationships with teachers and students, making it much more than an episodic way for student pharmacists to perform community service-learning in schools. It is a viable way to reach out to communities and bring the expertise of student pharmacists into elementary school education. The purpose of this study was to assess the impact of this course on development of student pharmacist communication and health promotion skills, and elementary student knowledge of and attitudes toward science.

DESIGN

The HealthWISE elective course was originally pilot tested at the Thomas J. Long School of Pharmacy at the University of the Pacific in 2007.¹⁸ Feedback was solicited from student pharmacists and pharmacy faculty members as well as elementary school teachers and their respective administrators. Following the pilot, the University of the Pacific collaborated with 2 additional colleges: Washington State University College of Pharmacy in Spokane and the University of Arizona College of Pharmacy in Tucson, to develop the service-learning elective course for student pharmacists that was delivered and evaluated during the 2008-2009 academic year. All 3 institutions partnered with local school districts that served a large proportion of ELL students. The Institutional Review Boards at the University of the Pacific, Washington State University, and the University of Arizona determined that this study was exempt from review.

Using Bloom's Taxonomy,²⁰ curricular outcomes and learning objectives for the elective course were focused in the areas of communication, professionalism, and health promotion. Specific outcomes for the HealthWISE program were:

- (1) Effectively use principles of communication for quality presentation.
- (2) Demonstrate comprehension of cultural competence principles.
- (3) Provide leadership/mentorship to help individuals improve the profession and participate in influencing, training, and developing the next generation of pharmacists.
- (4) Promote health awareness and disease prevention.

In order to achieve the above global outcomes, the course included the following specific learning objectives identified for student pharmacist achievement:

- (1) Engage elementary school children in learning scientific information.
- (2) Guide elementary school students through hands-on laboratory exercises so that students understand more basic ideas of biology and science.
- (3) Apply their experience to manage a class of elementary school children.
- (4) Connect communication skills from the classroom to the healthcare environment.

The course content was divided into one-third student pharmacist preparation for teaching and two-thirds student pharmacist visits to elementary schools to teach the science curricula. Partnering teachers and school principals were invited to the last preparation class to introduce the student pharmacists to their sponsoring teachers. A final, culminating celebration that included both student pharmacists and teachers was held at the end of the semester after all the classroom visits were completed. Faculty materials (sample syllabus, class presentations, specific agendas for each class, handouts, and supporting materials) and student materials (online homework modules of additional instruction, curricula and lessons for the classroom teaching activities, student handouts, and a list of materials needed) were posted online (materials are available online for use by other institutions¹⁹). The topics of the 4 homework modules that provided additional training for student pharmacists were: (1) volunteering in schools; (2) good teaching practice for teaching science in schools; (3) dealing with challenging learning situations, including ELL students; and (4) family events for science.

HealthWISE curricula were inquiry-based and taught basic science through attention to health concepts appropriate to elementary grades. The curriculum for grades 4 through 6, called "Immunization Plus," targeted medicine, public health, and immunology. It advanced learning about infectious diseases, transmission, and herd immunity (epidemiology), population-based rates, the immune system, and vaccine research and production. The "Using Live Insects for Early Lessons in Life" curriculum for primary grades (1-3) capitalized on children's fascination with insects to teach basic health concepts. Students learned important biology and entomology knowledge and developed motivation to learn science at an early age. The curricula were chosen to engage and inform elementary students, and for their simple implementation with easy to gather materials. The curricula also were chosen because they integrate reading, math, and social studies while advancing science knowledge.

The initial student pharmacist preparation phase consisted of 6 hours of classroom instruction and 6 hours of online self-directed learning. The classroom instruction included lecture, discussion, and active learning with student pharmacists practicing lesson delivery and applying knowledge gained through online learning. Student pharmacists delivered 6 science lessons in the elementary schools, which also served as active-learning sessions for them as they learned from the teaching experiences. Student pharmacists wrote about their experiences in a journal and a final paper, focusing on lessons learned from teaching sessions and how they would modify future sessions to incorporate those lessons.

EVALUATION AND ASSESSMENT

Elementary School Students

For the 2008-2009 academic year, a quasi-experimental pretest/posttest research design was used to assess whether elementary school students' science knowledge and attitudes changed as a result of the intervention (Table 1). The 2 curricula, Immunization Plus and Using Live Insects were implemented in 16 classrooms (4 elementary schools) per study site (California, Washington, and Arizona).

The pretest and posttest were intended to gather data to answer the following questions: (1) To what extent did knowledge and attitudes change as a result of the program? (2) Did the effectiveness of the intervention vary by who presented the educational material (teacher only vs. student pharmacist only vs. teacher + student pharmacist)? (3) To what extent did gender, ethnicity, and language mediate treatment impact? (Questionnaires are available from the author upon request.) Pretest questionnaires were administered to all elementary student participants (intervention and control groups) prior to the first teaching session by the student pharmacists. Six weekly 1-hour curriculum sessions for elementary students in the intervention group followed. One week after the curriculum

Table 1. Study Design Used to Implement the HealthWISE Program^a in Elementary Schools

Group (2 nd /5 th graders)	Intervention	Design ^b
4 classrooms (school 1)	Teacher only	O1 X O2
4 classrooms (school 2)	Student pharmacist only	O1 X O2
4 classrooms (school 3)	Teacher + student pharmacist	O1 X O2
4 classrooms (school 4)	No intervention (control group)	O1 O2

^a The Using Live Insects curriculum was implemented in the second-grade classrooms and the Immunization Plus curriculum was implemented in the fifth-grade classrooms.

^b O1 = pretest, X = curriculum, O2 = posttest

sessions were completed, a posttest questionnaire was administered to all elementary school students in the intervention and control groups. In addition to the same knowledge and attitude questions asked in the pretest, the posttest included questions on satisfaction with the intervention curriculum. Unique identifiers were assigned to each student to allow for matching of baseline and follow-up data.

Demographic data were collected from students at the time the pretest questionnaire was administered. All analyses were conducted using STATA 10.0 (Stata Corporation, College Station, TX). Due to missing data, the Arizona site was not included in the analyses or results presented here.

Second-grade students and the Using Live Insects curriculum. Forty-eight percent (48%) of the second-grade students were male and 52% were female. The mean age of the students was 7.4 years. Over half of the students were white (56%), with other key racial/ethnic groups including Latino (20%) and American Indian (12%). English was the predominant language read and spoken at school (90%) and in the home (82%) (Table 2).

While second-grade students' knowledge increased significantly from pretest to posttest for each of the intervention conditions, attitude towards science increased significantly only in the teacher only group (Table 3). Among intervention groups, no significant differences in mean scores from pretest to posttest were found (Table 4). After adjusting for pretest knowledge scores, intervention conditions, and demographic characteristics; pretest knowledge scores ($p < 0.01$), and the teacher only, student pharmacist only, and teacher + student pharmacist intervention conditions remained significant predictors of posttest knowledge ($p < 0.001$, $p < 0.05$, and $p < 0.01$, respectively). Demographic characteristics were not significant predictors of posttest knowledge.

Fifth-grade students and the Immunization Plus Curriculum. Forty-seven percent (47%) of fifth-grade students were male and 53% were female. The mean age of students was 10.4 years. Less than half of the students were white (41%), with other key racial/ethnic groups including Latino (22%), Asian/Pacific Islander (10%), and American Indian (9%). While English was the predominate language read and spoken at school (84%) and in the home (78%), 14% of students reported speaking both English and Spanish in school and 15% reported speaking both English and Spanish or just Spanish in the home (Table 2).

While fifth-grade students' knowledge increased significantly from pretest to posttest for each of the intervention conditions, attitude towards science did not (Table 5). In comparing differences in mean scores from

Table 2. Demographic Characteristics of Elementary School Students Who Participated in the HealthWISE Programs Administered by the University of Pacific and Washington State University^a

Characteristics	Second Grade Students (N = 281), ^b No. (%)	Fifth Grade Students (N = 264), ^b No. (%)
Gender		
Male	135 (48)	124 (47)
Female	146 (52)	140 (53)
Mean age, years	7.43	10.4
Race/ethnicity		
White	158 (56)	108 (41)
African American	15 (5)	16 (6)
Latino	55 (20)	56 (22)
Asian/Pacific Islander	0	26 (10)
American Indian	33 (12)	23 (9)
Other	20 (7)	32 (12)
Languages read and spoken		
English	247 (90)	221 (84)
Spanish	0	0
English and Spanish	25 (9)	37 (14)
Other	5 (1)	6 (2)
Languages read and spoken at home		
English	229 (82)	207 (78)
Spanish	25 (9)	19 (7)
English and Spanish	17 (6)	20 (8)
Other	9 (3)	18 (7)

^a Demographics include all intervention and control groups. For subgroup analysis, the demographics were broken out for the specific groups. Due to a significant amount of missing data, data from the University of Arizona's HealthWISE program was not included in the analysis.

^b Due to missing data, not all variables sum to total N's.

pretest to posttest among intervention groups, all interventions had an impact when compared to scores of students in the control group, with the teacher + student pharmacist group demonstrating the greatest impact (Table 6). Each of the intervention groups had significant improvement between pre-test and post-test scores when compared to the control group. The elementary students taught by the classroom teacher and student pharmacist together had the greatest improvement. After adjusting for pretest scores, intervention conditions and demographic characteristics; the pretest knowledge scores ($p < 0.001$), and the pharmacy only and the teacher + student pharmacist conditions remained significant predictors of posttest knowledge ($p < 0.001$ and $p < 0.001$ respectively). Demographic characteristics were not significant predictors of posttest knowledge scores.

Table 3. Second-Grade Students' Knowledge and Attitude Towards Science Before and After Completing the Live Insects Curriculum (N = 280)

	No.	Pretest, Mean (SD)	No.	Posttest, Mean (SD)
Knowledge ^a				
Teacher only	72	6.6 (1.7)	70	9.1 (1.5) ^b
Student pharmacist only	65	6.5 (1.7)	61	7.9 (1.8) ^b
Teacher + student pharmacist	72	6.4 (1.8)	69	8.3 (1.5) ^b
Control	71	5.7 (1.9)	65	6.3 (1.9) ^c
Attitude towards science ^d				
Teacher only	66	2.8 (1.2)	67	3.1 (1.1) ^c
Student pharmacist only	65	3.3 (0.9)	59	3.5 (0.8)
Teacher + student pharmacist	70	3.6 (0.8)	66	3.6 (0.8)
Control	69	3.0 (1.2)	61	3.2 (1.0)

^a A total of 11 knowledge questions; scale range (0-11; low of 0 questions correct to high of 11 questions correct).

^b $p < 0.001$ (based on paired t test).

^c $p < 0.05$ (based on paired t test).

^d Attitude scale range (1-4; low to high).

Classroom Teacher Satisfaction with the Curriculum

Elementary school teacher satisfaction with the curricula was assessed using post-intervention questionnaires. Teachers were asked to evaluate the following 4 components of the curricula: ease of use; grade appropriateness for your class; elementary student interest in subject matter; and your interest in the subject matter. A 5-point Likert-type scale was used that ranged from 1 = poor to 5 = outstanding. Each of the 4 questions was worth a maximum of 5 points for a potential cumulative score of 20 points.

Using Live Insects curriculum. Eleven of 12 second-grade teachers completed the evaluation. The mean cumulative rating was 18 out of 20. In response to an open-ended question of the features of the curriculum they liked *best*, 4 teachers responded the hands-on activities, 3 responded

enthusiasm of the student pharmacists, 4 responded literature/children's books, and 1 responded lessons plans. In response to an open-ended question of the features they liked *least*, 2 teachers responded that the lessons were sometimes confusing or not easy to follow, 2 responded the songs did not always match the CD, 1 responded the handouts were sometimes lacking information, and 1 responded the handouts were not always engaging. Although teachers did provide recommendations for improving the curriculum, 100% of the respondents indicated they would choose to implement this curriculum again in their classrooms.

Immunization Plus Curriculum. Ten of twelve fifth-grade teachers completed the evaluation (n = the number of teachers providing the indicated response). The mean cumulative rating was 19 out of 20. In response to an open-ended question of the features of the curriculum they liked *best*, 6 teachers responded hands-on activities, 4 responded student pharmacist enthusiasm, and 2 responded high level of student interest. In response to an open-ended question of the features they liked *least*, 2 teachers responded too short, 1 responded some difficult vocabulary, 1 responded that some lessons were vague/time expectations were off, and 1 was confused with KWL charts (KWL is an active participation technique that stands for what I Know, what I Want to know, what I Learned). Although teachers provided recommendations for improving the curriculum, 100% of the respondents indicated that they would choose to implement this curriculum again in their classrooms.

Comments from the teachers were positive overall and showed great enthusiasm for the program. Teachers in the program expressed that the curricula were excellent and appreciated that they focused on science but included attention

Table 4. Differences in Mean Scores from Pretest to Posttest Within Groups for the Using Live Insects Second-Grade Intervention Conditions

Intervention Groups	Group Means	Mean Difference ^a
Teacher vs. student pharmacist	2.2 vs. 1.9	0.3
Teacher vs. teacher/ student pharmacist	2.2 vs. 1.9	0.3
Teacher vs. control	2.2 vs. 1.8	1.0
Student pharmacist vs. teacher/student pharmacist	1.9 vs. 1.9	0.02
Student pharmacist vs. control	1.9 vs. 1.2	0.7
Teacher/student pharmacist vs. control	1.9 vs. 1.2	0.7

Significance based on Tukey HSD pairwise comparisons for variable intervention studentized range critical value = 3.6879869. Significant if above the critical value of 3.69.

^a None of the comparisons were significant.

Table 5. Fifth-Grade Students' Knowledge and Attitude Towards Science Before and After Completing the Immunization Plus Curriculum (N = 264)

		Pretest,		Posttest,	
	No.	Mean (SD)	No.	Mean (SD)	
Knowledge ^a					
Teacher only	40	6.5 (1.7)	40	7.9 (2.5) ^b	
Student pharmacist only	75	6.8 (2.2)	71	8.2 (2.3) ^b	
Teacher + Student pharmacist	100	8.0 (2.5)	96	10.4 (2.7) ^b	
Control	49	5.5 (2.2)	48	5.8 (2.2)	
Attitude towards science ^c					
Teacher only	39	8.3 (2.7)	40	8.5 (2.5)	
Student pharmacist only	74	8.6 (2.4)	69	8.4 (2.2)	
Teacher + Student pharmacist	99	8.2 (2.7)	95	8.4 (2.1)	
Control	44	8.7 (1.8)	46	8.4 (2.5)	

^a Fifteen knowledge questions; scale range (0-15; low of 0 questions correct to high of 15 questions correct).

^b $p < 0.001$ (based on paired t-test).

^c Attitude scale range: 0-12 (low to high).

to both literacy and math skills. Teacher comments emphasized that the curricula were engaging and interactive and appreciated that the student pharmacists arrived with hand-outs, games, and experiments. Lessons for the younger students also involved children's literature and student pharmacists read quality trade books to the children.

Classroom Teacher Evaluation of Student Pharmacist

For the 2008-2009 and 2009-2010 academic years, classroom teachers at the Washington site completed 17 assessments of 16 student pharmacists. Four student pharmacists were evaluated by 2 different teachers as they delivered the curriculum in 2 different classrooms.

Table 6. Differences in Mean Scores from Pretest to Posttest Within Groups for the Immunization Plus Curriculum

Intervention Groups	Group Means	Mean Difference ^a
Teacher vs. student pharmacist	1.4 vs. 1.4	0.02
Teacher vs. teacher + student pharmacist	1.4 vs. 2.4	1.0
Teacher vs. control ^a	1.4 vs. 0.3	1.1
Student pharmacist vs. teacher + student pharmacist	1.4 vs. 2.4	1.0
Student pharmacist vs. control ^a	1.4 vs. 0.3	1.1
Teacher + student pharmacist vs. control ^a	2.4 vs. 0.4	2.1

^a Significance based on Tukey HSD pairwise comparisons for variable intervention studentized range critical value = 3.6910882. Significant if above the critical value of 3.66

Evaluations were not available for 3 student pharmacists. Teachers were asked to rate the student pharmacists on the following performance criteria using a 5-point Likert-type scale: (1) communication; (2) professionalism; and (3) teaching skills. Response categories ranged from 1 = does not meet expectations to 5 = exceeds expectations. The mean rating for all questions combined was 4.8. In response to an open-ended question regarding student pharmacist performance, 6 teachers commented that the students communicated well 7 were impressed with white coats/professionalism, 4 responded enthusiastic, 5 responded well-prepared/confident, 2 responded good role models, and 1 responded that the student pharmacists talked (at the appropriate) level of the students.

Anecdotal responses from the teachers who welcomed the student pharmacists into their classes with the California program were positive. Teachers also claimed the student pharmacists were well prepared for the experience, and that their elementary students responded well to both the curricula and the students.

Student Pharmacist Satisfaction with Classroom Teacher and Site

For the 2008-2009 and 2009-2010 academic years, 14 of 16 student pharmacists at the Washington site completed assessments of the classroom teacher and site. Students were asked to evaluate the teachers and sites on a 3-point Likert-type scale. They were first asked to rate the classroom teacher on helpfulness in orienting them to the school, assisting in classroom management, and scheduling teaching sessions. The response categories ranged from 1 = not helpful to 3 = very helpful. The mean rating was 8 out of a possible 9 points.

Student pharmacists were asked to rate the classroom teachers and sites as future HealthWISE partners, using a 3-point Likert-type scale on which 1 = not recommend and 3 = highly recommend. The mean rating was 5 out of a possible 6 points.

End-of-course papers at the California site gave information about student pharmacists' reactions to their experience. Student pharmacists met the challenge of teaching with enthusiasm and gained a new found knowledge of the challenges of dealing with young children, schools, and the obstacles that teachers face in their daily work.

Student Pharmacist Reflection on Learning

For the 2008-2009 and 2009-2010 academic years, student pharmacists at the Washington state site were asked to identify a learning outcome from the course syllabus that they felt they achieved in the course. They were then asked to reflect upon their experiences and identify

how this experience helped them to achieve the outcome. All 16 student pharmacists completed the paper. The outcomes the student pharmacists identified that they felt they had achieved included: 9 indicated improved communication skills ($n = 9$), promoting health and wellness ($n = 8$), and professional mentorship ($n = 1$), (2 student pharmacists identified 2 outcomes they had achieved). Student pharmacists were able to positively relate their teaching experiences to impact their future effectiveness as pharmacists. Many elementary schools in the program at the California site had high percentages of ELL students and student pharmacists responded to this challenge by incorporating strategies that were taught in their training. The student pharmacists were surprised by the number off ELL students in the elementary schools and the experience reminded them of the importance of effective communication in educating and caring for their patients.

DISCUSSION

The HealthWISE course provided a successful learning opportunity for student pharmacists. Student pharmacists identified how the course helped them to develop communication, health promotion, and professionalism skills in a nontraditional setting. The HealthWISE course provided them with the opportunity to work with elementary school students from diverse backgrounds and cultures in a classroom setting. The student pharmacists agreed that this experience would improve their ability to better care for diverse patients as a pharmacist.

The HealthWISE course inspires student pharmacists to pursue a life of service. This long-term benefit of the HealthWISE experience was envisioned as this study was conceived, and came up throughout discussions with student pharmacists and teachers. As student pharmacists from this program enter practice, they will find themselves in communities and neighborhoods where they may be one of the few persons trained in the sciences. This program provides experience to these future practitioners in an elementary school classroom environment and shows them that they can have a positive influence on science education in their communities. They identify their desire to continue serving elementary school students as teachers of science as they graduate and move on in their professional lives. At the Washington site, 1 student pharmacist scheduled her academic practice experience during the HealthWISE elective course so that she could return to campus to help prepare the next class of student pharmacists for their experience in the elementary school sites. Another student pharmacist returned as a volunteer during his advanced pharmacy practice experience (APPE) year because he did not want to miss another opportunity to serve. This required him to work with his APPE sites to

carve out the time to spend at the elementary school. In Arizona, the student pharmacists developed a Children's Health Fair model, which is shared with elementary schools throughout the Tucson area each semester. As students finish the course, many of them express a desire to continue this classroom science education experience on their own. The HealthWISE course is arming a cache of future pharmacists prepared to continue service in the community to positively impact STEM education. This could be the most significant, long-term benefit of this program, ie, providing elementary school students and teachers with local professionals who can provide science expertise and stimulate interest in science in their classrooms.

The HealthWISE course also provides a successful model for using online teaching and learning materials in the pharmacy curriculum. Resource allocation in universities has challenged faculties to be creative in findings ways to prepare student pharmacists for their future roles while learning to manage with fewer faculty positions and student pharmacists attending classes at distant learning sites. The online component of the curriculum provides a resource for student pharmacists to complete the content component of the curriculum when and where they choose. They then come together in the classroom setting to practice the skills they will need to be successful in the elementary classroom. Student pharmacists learn through this practice and feedback from their peers. Before they head to the elementary setting, they are armed with the tools they need to be successful. The elementary school teachers report that the student pharmacists are well prepared to enter their classrooms and teach science.

The HealthWISE course is a successful partnership between colleges and schools of pharmacy and public schools. Teachers report satisfaction with the curriculum and student pharmacist performance in their classrooms. This is most clearly evidenced by their desire to continue participation in the program as they invite student pharmacists back to their classrooms each year. Elementary teachers report the positive impact the student pharmacists have on their elementary students and the sense of professionalism the student pharmacists convey as they arrive in the classroom each week in their white coats. Those student pharmacists who are female and/or persons of color also serve as role models and examples to the children that gender, ethnicity, and race are not barriers to becoming a health professional. Such role models are essential in promoting diversity in the profession.

For both curricula, there was a significant increase in knowledge scores from pretest to posttest for all 4 intervention conditions. This program was successful in improving science knowledge among students regardless of gender, age, ethnicity, or language. While attitude towards

science scores did not significantly increase, this may be due to the relatively high mean attitude scores on the pretest, thus resulting in a ceiling effect. The schools that participated in the intervention may have had a higher interest in improving the science curriculum for their schools. Additionally, teachers in these elementary schools may have been highly motivated, resulting in elementary students' attitude towards science being relatively high before the intervention, thus creating some selection bias.

The HealthWISE course provides a model that could be successfully developed as an interprofessional education course that includes students from multiple health professions. At the Washington site, 1 student nurse enrolled in the course and was well received by the student pharmacists, teachers, and children at the teaching site. As with the student pharmacists, he was able to make clear connections as to how he could apply the learning from the HealthWISE course to his patient care experiences.

Over 175 student pharmacists from the 3 colleges and schools have been recruited and trained, and have taught the HealthWISE curricula at targeted elementary schools. Thirty-eight schools from 17 school districts have benefitted from science education partnerships with the 3 colleges and schools of pharmacy and 194 elementary classrooms and over 2,000 elementary students have benefitted from the program since its inception.

Limitations of this study include location for implementation and recruitment of teachers. HealthWISE was implemented at elementary schools in public school districts in 3 states and each had its own policies and local educational agendas. Teachers in public schools have many constraints that may hinder their willingness or ability to participate in such a collaboration. HealthWISE was implemented at the University of Arizona at a particularly difficult time for educators and that was a factor in the incomplete data received from that site.

Results achieved by other universities implementing this course may vary as they would be working with different schools systems in different parts of the United States or in other countries. When implementing HealthWISE, it is important to develop relationships with local educators and adapt the program to meet the needs of both the elementary schools and the student pharmacists.

SUMMARY

The HealthWISE course is a service-learning elective course that provides the opportunity for student pharmacists to develop communication, health promotion, and professionalism skills while contributing to science education in the elementary school setting. Student pharmacists, elementary school teachers, and elementary students find value and benefit from this partnership. Future

opportunities exist to develop the course as an interprofessional elective, providing opportunity for future health professionals to learn with, from, and about each other while providing valuable service to the communities in which they live.

ACKNOWLEDGEMENTS

This work was funded through a National Institutes of Health/ National Commission on Research Resources, Science Education Partnership Award R25RR012319.

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