Extension Education Methods

Exploring Hybrid Teaching Methods for Hispanic Agricultural Workers

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SUMMARY. Growing demand for appropriate training opportunities for Oregon's increasingly scarce agricultural workers continues to outpace extension's available time and resources. New, more efficient, and innovative ways of reaching this audience must be explored to better fill the need and demand. Hybrid teaching, which refers to course delivery through a blend of traditional, face-to-face teaching, along with online instruction outside of the classroom, is being implemented in some English-language extension programs. A hybrid pesticide training course was designed and delivered in Spanish over the course of 4 weeks to nursery and landscape workers in Oregon to assess their reception of hybrid teaching. The delivery method was very well received and the students showed interest in taking more courses offered in a hybrid format. Initial and final practice exams included in the course were used to assess student performance and showed significant improvement from the students who completed the course. One student became certified and licensed to apply pesticides in the Oregon.

Hybrid teaching refers to course delivery through a blend of traditional, face-to-face teaching, along with online instruction outside of the classroom (Hino and Kahn, 2016). Incorporating online components can allow educators to reach a greater number of people and

increase the amount of material their audience can access. It also allows for greater scheduling flexibility, which is often the biggest issue when the target audience is comprised of working adults. The role online tools play can range from partial, supplementary, online material, to courses that are delivered completely online.

The hybrid teaching approach has been on the rise on college and university campuses, and it is slowly beginning to be adopted in extension education programs (Durden et al., 2013; Francis, 2014; Friedl et al., 2015; Hino and Kahn, 2016; Norman, 2013; Schneider et al., 2011). However, Spanish-language opportunities delivered in a hybrid format are still rare or nonexistent, especially those appropriate for agricultural workers. This is despite the 63.5% increase in Oregon's Hispanic population from 2000 to

2010 (U.S. Census Bureau, 2011). Previous extension work has demonstrated that reaching out to the Hispanic population often requires different approaches, even when reaching out in a traditional, face-to-face manner (Bauske et al., 2013; Delgadillo, 2003; Farner et al., 2005; Francis et al., 2014; Hobbs, 2004; Robinson et al., 2003; Warrix and Bocanegra, 1998; Woodson and Sgamma, 1997).

As part of our extension and outreach program, we offer workshops in Spanish to agricultural communities throughout the year on various plant health topics. A popular series of workshops among nursery and landscape members is offered annually every Thursday in October at the North Willamette Research and Extension Center. During Fall 2014, three traditional face-to-face workshops were offered in Spanish to support agriculture workers interested in obtaining the Oregon private pesticide applicator certification. The three pesticide training workshops filled quickly, registration closed early, and people were turned away, attesting to the high degree of industry demand for this type of training. This situation exemplifies the scarcity of appropriate learning opportunities for Hispanic agricultural workers.

Simultaneously, the demand for labor in Oregon nurseries continues to grow (Ruttan, 2016; Stone, 2016), including the demand for licensed pesticide applicators. However, low pass rates among the workforce continue to deprive the industry of an adequate pool of licensed workers. This results in a large demand for training opportunities to help workers prepare for the exam. With the continuing growth of the Hispanic population in Oregon, and their major contribution to the agricultural workforce, the need for efficient and flexible training opportunities becomes more acute. Trainings must be tailored to their needs and circumstances not only in the areas of technical, pesticide training but for other extension programs trying to reach a Hispanic audience.

The primary objective of this pilot, Private Pesticide Applicator Exam Preparation course was to assess whether delivery of educational material via a hybrid class would be a viable option for reaching Hispanic audiences by gauging participant

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ability to access online materials as well as their reception and acceptance of the course at its conclusion. Despite the challenge, it has historically posed, pesticide applicator training was chosen as the topic for this pilot program because of high demand. However, the principal interest was to assess reception of a hybrid course by Hispanic agricultural workers.

Materials and methods

COURSE DESIGN. Before starting the course, we participated in a unique, 8-week-long, OR State University Extension, hybrid training, study group that provided background on the pedagogy, tools, and techniques for creating hybrid programs (Hino and Kahn, 2016). The Private Pesticide Applicator Exam Preparation course was designed to take place over 4 weeks, with a face-to-face meeting to start the course and another at the end. The online, public version of Canvas (Instructure, Salt Lake City, UT) was chosen as the learning management software (LMS) for the course because it is the software used by official, university-level courses at Oregon State University. The public version of the LMS was free to use and allows instructors the flexibility to manage and monitor many important aspects of the course and student activity, with additional features such as the ability to switch to a Spanish-language version of the LMS with a single click of a button. The LMS also offered a mobile application that facilitated access to video lessons and other materials via smartphone, which added even more flexibility to the course.

The three major topics covered in the course were pesticide math, label comprehension, and laws and regulations. We determined that math would require the greatest amount of review and practice, so the topic was covered over a 2-week period. As students progressed through the course, they encountered several quizzes with no time limit. They were allowed to take these quizzes to review and practice the material as often as they wanted. At the end of weeks 1, 2, and 4, they had a longer, timed practice quiz to help them practice time management during an exam and to be exposed to the added anxiety of having a time limit.

During the face-to-face meetings, students were given access to portable

computers using the Chrome operating system (Chrome OS; Google, Mountain View, CA), an educational tool selected for affordability and portability. Students were also free to bring their personal laptops, and those with smartphones were encouraged to bring them to receive assistance with mobile installation and access to the LMS.

MATERIAL DEVELOPMENT. Most of the course instruction took place through the use of videos we created. The videos had to be concise and start at a level that was appropriate for our students. Initial topics included the various ways in which multiplication and division operations can be presented, exponents and their relationship to units of area and volume, and order of operations; these topics led up to the more common calculations used in pesticide math: area, volume, percentages, and unit conversions. Most of the math videos developed for this class consisted of narrated footage, created using screen-capture software (Camtasia:mac; TechSmith, Okemos, MI), of sample problems being worked out through an electronic writing tablet (Intuos; Wacom, Kazo, Japan). Many math instructional videos are available online in Spanish, but they are mostly geared toward high school and college-level students. In total, we created 20 videos that averaged 5 min in length.

The students also received a take-home activity packet for the label comprehension portion of the course. This packet consisted of seven pesticide labels, along with generic questions about the different sections and information they should be able to quickly identify within each label, such as type of pesticide, registration status, active ingredients, etc. A second set of questions, specific to each pesticide label, was also included. Many of these questions posed hypothetical scenarios that would require close scrutiny of the label and also require calculations based on label information, similar to the questions found on the official Oregon private pesticide applicator exam. Sheets with basic formulas, conversion factors, and English-Spanish translations of common label terms were also included. The answers, along with step-by-step solutions to math problems, were posted online at the end of that course section.

COURSE REGISTRATION. Students were required to register for the hybrid course online, so participants who at least had the ability to access the registration form and provide the necessary information would be most likely to register for the course. The participant registration form also included questions about prospective participants' access to computers and the internet, as well as their level of comfort, familiarity, and ability with computers and web browsing (Table 1).

LMS ENROLLMENT. Enrollment in the LMS was free but required a valid e-mail address to create a user account. Participants without e-mail addresses were guided through the process of creating a new e-mail address before enrollment. Some students already had an e-mail address but did not use it on a regular basis, so guidance through password resets or creating new e-mail accounts was provided.

STUDENT EVALUATION. Student performance evaluations took place in the form of computer-based practice exams during the initial and final face-to-face meetings. The initial and final practice exams consisted of 50 questions covering pesticide math, laws and regulations, and label interpretation. The initial exam also included several basic mathematical operations, which were not included in the final exam. Student results were used to assess their abilities at the start of the course, as well as to provide a point for comparison at the end of the course. For both practice exams, students had a total of 60 min to complete the questions.

STUDENT FEEDBACK. At the end of the course, students completed an online questionnaire (Qualtrics, Provo, UT) we created, in which their views and opinions about the course were collected (Table 2). The goals of the questions were to assess whether they liked the teaching methods and whether they would be willing to take another hybrid course with a similar design.

Results

STUDENT REGISTRATION AND PERFORMANCE. A total of 18 students registered for the course, attended the first face-to-face session, and completed the initial evaluation. Of those students, 12 attended the last face-to-face session, and 11 completed the final practice exam. One student was unable to complete the

Table 1. Participant responses to background questions collected during the registration process, before the start of the 4-week, hybrid Private Pesticide Applicator Exam Preparation course. The responses were used to gauge participant familiarity with computer use and web browsing.

Pre-course registration questions	Responses (no.)	Responses (%)
Do you have regular access to the internet?		
Yes	16	89.0
No	2	11.0
Sometimes	0	0.0
Total	18	100.0
How do you typically access the internet? (Choose all that apply)		
Computer	10	52.0
Tablet	2	11.0
Smartphone	5	26.0
I don't have access	2	11.0
Total	19	100.0
How confident do you feel surfing the web?		
Very confident	5	27.8
Somewhat confident	10	55.6
Not confident/I feel intimidated	3	16.7
Total	18	100.0
How much skill do you feel you have when surfing the web?		
A lot of skill	3	16.7
A little skill	13	72.2
No skill - I don't want to learn	0	0.0
No skill - I want to learn	2	11.1
Total	18	100.0

Table 2. Participant responses to evaluation questions used to gauge participant reception of the 4-week, hybrid Private Pesticide Applicator Exam Preparation course in Spanish. The evaluation was completed at the end of the course, during the last face-to-face meeting.

Course evaluation question	Responses (no.)	Responses	
		Rating (1 to 5 scale) ^a	(%)
Did you like the hybrid format of the course?	7	4.57	—
Would you take another hybrid class?			
Yes	11	—	100
No	0	—	0
Not Sure	0	—	0
Total	11	—	100
Did you find it difficult to use the learning management software?			
Yes	0	—	0
No	11	—	100
Not Sure	0	—	0
Total	11	—	100
Would you have liked to have had more face-to-face meetings?			
Yes	11	—	100
No	0	—	0
Total	11	—	100

^a1 = not at all; 5 = yes, very much.

final exam under the same conditions as the other students and was excluded from final analyses.

Comparison of the scores between the initial practice exam and the final practice exam showed significant ($P = 0.048$) improvement in student subject matter knowledge.

The mean scores of the initial evaluation, between students who completed the course and students who did not, was not significantly different ($P = 0.276$). All comparisons were analyzed using the Kruskal–Wallis test by ranks using the publicly available R package (R Core Team, 2015).

STUDENT FEEDBACK. Eleven students completed the course evaluation during the final face-to-face meeting (Table 2). All responded that they would take another hybrid class, did not find it difficult to use the LMS, but would have liked more face-to-face meetings.

OFFICIAL EXAM. An attempt was made to schedule the official Oregon pesticide certification exam for all interested participants on the same day at one of the official testing centers. Because of scheduling conflicts, the students were not able to take the test until ≈ 10 weeks after the course concluded. We accompanied the students to the testing center to show support. Ten of our participants took the Oregon private pesticide applicator exam: 10% earned above the required 70 points to pass and another 60% earned over 60 points.

Discussion

One of the outcomes of this project was the development of a hybrid class with modules that covered the topics of most difficulty for our target audience: math, label comprehension, and laws and regulations. The educational material used was developed for our audience because of the specificity of their needs and current lack of other suitable materials. The LMS offered a good platform on which to present the educational material and provided a way to present the content in a manner that was easy for our participants to access. The overall simplicity and ease of navigation of the course material was highly valued by participants (Table 2). The LMS mobile application made it easy for the participants to watch videos on their smartphones, which, for some, was their primary source of internet connection outside of the face-to-face meetings.

Pesticide applicator training is important for all agriculture commodities that strive to follow the law and implement practices that minimize safety hazards to their employees, the public, and the environment. However, it has historically been a difficult topic to teach. Passing the pesticide applicator certification exam is a challenge, not only for agricultural workers who primarily speak Spanish, but even for native English-speakers. Even though a Spanish-language version of the exam is available, the pesticide

labels in the label interpretation section of the exam are all in English. Traditionally, agricultural workers prepare for the exam by attending a course in which all the necessary material is covered in one or two back-to-back class sessions. The exam is administered at the end of the day. Through our interactions with agricultural workers who have participated in these events, many have expressed that it is simply too much information to retain in one or two sittings.

Although not all of our students completed the course, student performance on the initial evaluation exam was not indicative of a student's likelihood to finish the course, because the mean scores of students who did not complete the course was not significantly different from the mean for students who did complete the course (Fig. 1). Two students indicated they were unable to attend the final meeting because of timing conflicts at work.

With our participants, the practice exams showed a marked improvement in student computer use skills and subject matter knowledge from the beginning to the conclusion of

the course. However, in addition to the 10-week delay between course conclusion and official exam administration, factors such as lack of test taking skills, nervousness, and test anxiety very likely played a significant role in the performance of these students, who have little test-taking experience. Test anxiety has been shown to correlate negatively with exam scores in traditional school settings (Sarason, 1959, 1963). According to data from the U.S. Bureau of Labor Statistics, 65% of pesticide handlers, sprayers, and applicators have a high school degree or equivalent, compared with 44% of general farmworkers (U.S. Department of Labor, 2016). However, determining why there was a discrepancy between the student performance in the hybrid course and the official exam currently lies beyond the scope of this assessment. Hence, the pass rate for the official exam from our participants could be attributed to a myriad of other factors that do not necessarily reflect on the effectiveness of content delivery in a hybrid format and is independent of participant acceptance of the methods, which were very positive.

Extension and outreach programs that effectively train agricultural workers are important, as labor in agriculture is becoming a serious problem for growers. A recent series of articles in *Digger*, a popular trade magazine published by the Oregon Association of Nurseries, highlighted this problem with a series of articles: *Help Wanted* (Stone, 2016), *Battling a labor shortage* (Ruttan, 2016), *Striving for efficiency* (Miller, 2016), *Eliminating waste with Lean* (Peters and Peters, 2016), and *The rising cost of compensation* (Szymczak, 2016), in their May 2016 issue, as well as *Working smarter, not harder* (Santamaria and Uribe, 2017), in the Feb. 2017 issue. These articles focus on improving efficiency, motivated in large part by the scarcity of laborers. Alternative approaches to training have the potential to reach more people and help form a more qualified workforce. This is becoming a priority in our extension activities, and the development of this hybrid class has broadened our vision for new ways to reach the Hispanic agricultural workforce that plays an important role in so many of the agricultural commodities in the United States.

One of the benefits of hybrid teaching is its scalability (Hino and Kahn, 2016), so a next step is to expand the course material, placing more emphasis on the areas where participants were most deficient. However, hybrid or mostly online delivery methods may be more viable for delivery of less technically intensive materials than a pesticide math class. The detail necessary to effectively teach unit conversions, or solving for unknown values, to an audience with little to no prior knowledge of algebraic concepts may be better communicated with more face-to-face time. Regardless, this hybrid class has laid the foundation to continue to expand and improve our methods for future iterations of this course and to help guide the development of new courses covering different topics. The hybrid format will not appeal to everyone but the overall positive reception and eagerness to consider future coursework from our participants is promising.

Despite the increase in computer and smartphone affordability and availability, there are still several demographic groups that need to strengthen their skills using computers (File and

Fig. 1. Comparison between initial and final practice exam scores of students participating in the 4-week, hybrid Private Pesticide Applicator Exam Preparation course in Spanish. The initial and final practices exams consisted of 50 questions and were completed during the first and final face-to-face meetings, respectively. Initial practice exam means between “Incomplete” (students who did not complete the course, $n = 8$) vs. “Complete” (students who completed the course, $n = 11$) were not significantly different ($P = 0.276$, Kruskal–Wallis test). Mean scores for the final practice exam ($n = 11$) were significantly higher than the mean initial practice exam scores ($P = 0.048$, Kruskal–Wallis test) of all students ($N = 18$).

Ryan, 2014), including our target, agricultural workforce. They need support to improve knowledge and skills to get the most from the available, affordable technology. In general, a majority (about 80%) of our participants have smartphones, which they are eager to learn to use better. As extension educators identifying a need in our target audience, we have initiated a new workshop series called Tech-Friday in which agricultural workers are invited to join us in an informal setting to improve their skills using computers, tablets, and smartphones and in doing so, prepare them for future hybrid class offerings.

Conclusions

The pilot program has shown that overall, the method of delivery was very well received by the target audience, and it could be a viable method of content delivery for Spanish-speaking agricultural workers. The positive feedback to this methodology provides us great support for creating new classes that will help reach agricultural workers and the Hispanic community in general. However, the face-to-face components of the class are still an essential part of the learning process.

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