

On Academics

TEACHING EMERGENCY PREPAREDNESS TO PUBLIC HEALTH WORKERS: USE OF BLENDED LEARNING IN WEB-BASED TRAINING

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This article presents the development of a program and results of a study to evaluate an online distance-based learning (DBL) program for competency-based, basic emergency preparedness training for employees of local health departments nationwide. The program was developed and implemented beginning in May 2003 by Columbia University's Center for Public Health Preparedness (CU-CPHP), and was designed to be delivered in two parts. The first part was an online training program, providing the basic knowledge required for public health preparedness. The second part was a downloadable template, which the student could use to guide learning and subsequent demonstration of the core emergency preparedness competencies to his or her supervisor. The student could return this documentation to the CU-CPHP to receive a certificate of completion, which would be e-mailed to the recipient. Evaluation findings indicate that this course resulted in a high degree of participant satisfaction along with an increased level of participant understanding of the basic emergency preparedness core competencies.

INTRODUCTION

The public health workforce plays a key role in ensuring the safety of all Americans. By providing a first line of defense against infectious diseases, and a key component of response to bioterrorism and other emergencies, state and local health agencies perform an invaluable function. The expectations of the entire public health system have been expanding for the last decade, a process accelerated by 9/11, anthrax exposures, and the weather challenges posed by Hurricanes Katrina, Rita, and others. Because of these rising demands, the commitment to assuring that all public health employees are competent in emergency preparedness and response has been emphasized.

As noted by a recent study from the Institute of Medicine, effective public health preparedness requires a workforce with both knowledge and skills required for full engagement in planning, response, and evaluation activities for disasters. However, most public health leaders report that the public health workforce is not fully prepared in this regard.¹ Therefore, strategies are needed that will facilitate competency-based emergency preparedness training that is effective, efficient, and economical. Use of DBL methodology has been suggested as a method to achieve this goal. Yet, while DBL has proven to be an effective tool for imparting knowledge and for assessing some competencies, it has been used less for education in competencies that involve physical tasks.²

Competencies are statements of expected performance of some combination of knowledge, skill, and attitude, and can be measured in small increments for educational purposes (i.e., competencies gained in a single classroom setting) or in larger units in the workplace (i.e., job performance over the course of a year). Competency-based learning is often visualized within a four-level pyramid, with the behaviors and qualities that help explicate learning styles and learning achievement variations placed at the foundation. At the next level are the skills, abilities, and knowledge that are generally comprehended, either through documented or experiential learning. Competencies are the third level and result from being able to merge skills, knowledge, and abilities into meaningful tasks. At the top of the pyramid is assessment of the competency through demonstration. Within this framework, competency-based learning is aimed at defining, teaching, and assessing competencies.^{3,4}

Numerous authors have indicated that face-to-face competency-based training efforts often result in improved learning outcomes, such as higher levels of work performance.³⁻⁵ In particular, for public health agencies, the Centers for Disease Control and Prevention Strategic Plan for Workforce Development Task Force has contended that the incorporation of well-planned competency-based activities can benefit staff by enabling them to successfully fulfill their functional roles. The authors have asserted that involvement in public health learning experiences must be motivated by a broad set of competency certifications in which workers can gain a basic understanding of "what public health is, what it does, and how it accomplishes its mission to promote physical and mental health and prevent disease, injury, and disability."⁶

Yet, while a significant amount of research has cited the benefits of competency-based training in face-to-face public health learning environments, there has

been less examination of the most effective ways in which it can be fostered online, particularly for meeting the needs of public health workers.⁷ As noted by Bershin, such courses are usually first conceived as being online Powerpoint® presentations, in which participants merely read a series of slides.¹ While this type of activity can certainly be of value, the extent of actual understanding is often quite limited. Furthermore, there has been a considerable amount of criticism of this passive learning approach. For example, Aragon asserts that learners are usually dissatisfied with most online courses because they struggle with the lack of social presence.⁸ Boettcher further suggests that apathy toward instructional goals could also be exacerbated in online environments, due to the difficulty of providing the emotional dynamics deemed to be so critical in the learning process.⁹ A substantial amount of research also indicates that one reason staff may feel more comfortable with online environments is that they do not feel the added pressure of demonstrating how to perform various tasks.¹⁰

Because of these criticisms, it is necessary to question whether the pedagogical approaches and course designs most commonly implemented for competency-based online initiatives actually enhance the learning process. To address such concerns, a new trend in instructional design has been to consider blended learning solutions in which online course content is mixed with traditional face-to-face instruction, with the intention of providing a richer learning experience. Such strategies often involve a combination of approaches, such as participation in interactive online classes; coaching by a supervisor in face-to-face environments; access to downloadable manuals; and participation in hands-on seminars and workshops located at the learner's work environment. Research is beginning to suggest that such an approach can add value in public health environments, primarily because it enables participants to receive the same and elaborated messages from several sources in various formats over time. An evaluative study by Covich et al. bears this out, indicating that the provision of several online options for learners, in addition to classroom training, can increase public health workers' understanding of their role within the agency.¹¹

THE COURSE

A guiding assumption in the development of the DBL material discussed in this article was that generic, Web-based training would not be fully useful to public health workers who also need to know the specifics of applying target competencies in the workplace, and have

an opportunity to practice applications in an everyday setting.⁴ After considering the options discussed in the blended learning literature, the CU-CPHP's curriculum development team concluded that it would be most advantageous to combine online and face-to-face training efforts into one course that could be delivered in two parts. To provide wide accessibility, the online material required no plug-ins to view, and was designed for users with little familiarity with computers.

The competencies to be covered in the course were the Core Emergency Preparedness Competencies for All Public Health Workers, the most general statement of expected public health worker performance during an emergency event.⁶ The first, online portion would provide the knowledge required for response to acts of terror, disasters, and public health emergencies, and the generic framework for response within a public health agency. (The current version of the course can be viewed online at: <http://www.ncdp.mailman.columbia.edu/bep>.)

The second, on-the-job portion would provide the student with a downloadable template that could be used to guide agency-specific learning and subsequent demonstration of the emergency preparedness core competencies. The incorporation of face-to-face activities such as the inclusion of a downloadable homework assignment as the second portion of the course was a particular feature of this course and, to the best of our knowledge, is rare in Web-based learning geared toward public health. The Competency Checklist (available from: URL: <http://www.columbia.edu/~tec11/phr/checklist.htm>) was designed to be completed at the participant's public health agency, in collaboration with a supervisor. After watching the participant demonstrate competency, the supervisor could verify satisfactory performance. It is this interaction that translates a generic course into one that can serve a range of potential emergency roles and work situations, which often vary by agency and regions of the U.S. If desired, the learner or his/her agency could send the documentation to the CU-CPHP to receive a certificate of completion.

All evaluation associated with this effort was approved by the Columbia University Institutional Review Board for Human Subjects Research before the project was begun.

EVALUATION METHODS AND RESULTS

Since the course's inception in 2003, a major objective has been to assess effectiveness and usability. A first area of interest was how public health workers perceived such an online competency-based course on

basic emergency preparedness, and the second area of interest was the actual outcome of the training; that is, performance on Parts I and II of the course. We therefore focused on the following research questions:

1. What are public health workers' perceived learning outcomes while participating in the online course?
2. What are public health workers' documented learning outcomes while participating in Parts I and II of the online course?

Perceived learning outcomes

Perceived learning was assessed through online user surveys from every student and from individual comments submitted by users. User evaluations from public health employees who had completed the course were strongly positive. The 764 survey responses collected between May 2003 and March 2004 are summarized in Table 1 and indicate a high level of perceived knowledge gained, with "strongly agree" representing the largest response to each question. A total of 656 respondents (85.8%) either strongly agreed or agreed that they felt more knowledgeable about the basic emergency preparedness core competencies as a result of taking the course, 628 (82.2%) either strongly agreed or agreed that they were more knowledgeable about their agency's chain of command during emergency response, and 608 (79.6%) either strongly agreed or agreed that they were more knowledgeable about their own functional roles during emergency response.

Perceived learning was also determined by comments from users. Many participants, for example, indicated that the online course helped them to better understand their potential functional role during an emergency. One public health employee stated, "This course has me thinking about what my professional role as well as my personal role is in case of a disaster, etc. I have many questions for my agency at this point now so that I'm sure to understand my role." Another employee emphasized the importance of hands-on practice, stating, "I liked that staff were prompted to

find key items, e.g., that we should 'know where the emergency plan is' or the chain of command. I also liked that we were encouraged to locate and review these items. This was extremely helpful, and not something I expected to get out of an online course. It will really help me remember what I need to do."

Questions pertaining to the course's usability also indicated a high level of satisfaction. One participant stated, "The course contained a great deal of general information and was very easy to follow. It allowed the user to proceed at his/her own pace or as time allowed. Questions arose to me regarding the role of my agency and myself."

Data collected during the online registration process also yielded some interesting findings. Overall, 39% of the respondents indicated that they were responsible for communicable disease-oriented work within their agency, while 28% said they were responsible for technical/support, 13% for clinical, 12% for laboratory, and 8% for environmental health work. Registration data also showed that learners tended to log in in clusters, located throughout the U.S. The largest number of registered learners (234) was in Wicomico County, Maryland.

Documented learning outcomes

For Part 1 of the course, learning outcomes were determined by matched pre- and posttests, submitted between May 2003 and March 2004. Content of these pre- and posttests was designed as a part of the instructional development and included 15 questions, each related to a core competency presented in the material. (Test questions are available from: URL: <http://www.columbia.edu/~tec11/phr/test.htm>). On average, learners spent 10 minutes completing each test. A total of 817 matched tests were available for analysis from enrollees. As shown in Table 2, increases were observed between pre- and posttest scores. The differences were statistically significant ($p < 10^{-3}$) by a two-tailed *t*-test. An analysis of individual responses indicated that the course participants performed better on every posttest question, with the highest increase being on question

Table 1. Summary of user survey results (n=764)

As a result of taking this course, I am more knowledgeable about:	Strongly agree (percent)	Agree (percent)	Disagree (percent)	Strongly disagree (percent)
The basic emergency preparedness core competencies for public health workers	51.7	34.1	8.0	6.2
My agency's chain of command during emergency response	45.8	36.4	12.3	5.5
My functional role during emergency response	45.4	34.2	13.9	6.5

Table 2. Mean scores of pre- and posttests, May 2003 through March 2004 (n=817)^a

	Mean	SD
Pretest	72.1683	16.31200
Posttest	94.2544	8.07285

^aThe difference in mean scores between pre- and posttests is statistically significant ($p < 10^{-3}$) by a two-tailed t-test.

SD = standard deviation

2 (Table 3). Of the total participants for this question, only 34% selected the correct answer for the pretest, while 84.9% selected the correct answer for the posttest. It is also clear that question 2 posed a challenge for many participants and that an understanding of regional and state system capacity capabilities may need to be explored further in competency-based public health training environments.

The question of learning outcomes on Part 2 of the course was best assessed by analysis of supervisors' comments. From May 2003 until March 2004, 511 supervisors had personally signed and mailed in printed competency checklist forms, so that staff within their agencies could obtain certificates of completion. These supervisors also provided additional comments, suggesting that usage of the course was an effective means for improving work performance. For example, one supervisor stated, "I can see that staff within our agency are now obtaining a better understanding of the core competencies than could be achieved with face-to-face training alone. They are able to practice at their own pace, which is important to them and brings better results." Another said, "This will be great for in-lab teaching like we use it, and also for one person sitting at their computer. I'm going to go ahead and put this URL up on our training intranet site so that new employees can access it here."

The returned competency checklists also revealed various ways in which public health staff have gained competency in possible functional roles during emergency scenarios. As an example, when asked to "describe the chain of command during emergency

response," 652 participants chose to draw an additional flowchart depicting their agency's incident command system (ICS) tree, along with their own placement within their agency's ICS structure. On average, learners spent two days completing their competency checklist forms.

In addition, 63 public health trainers have indicated that this online course has become an essential component of their in-person sessions using Internet-based technology. Trainers report using the course as part of a lecture-based slide show, having participants access the online pre- and posttests and online competency checklist.

DISCUSSION

The blended DBL approach used for this study was well received by participants as well as their supervisors. In addition, there was measurable improvement in knowledge, as documented by comparing the scores on pre- and posttests, and reports from supervisors. We do recognize the limitations of this outcome measure, as a formal case-control study (DBL only vs. blended) was not conducted. Nevertheless, both the outcome measures and highly favorable user comments suggest that this approach offers many advantages over distance-only approaches. One indication is the number of health departments that have recommended this course to their employees; many heard of the course through word-of-mouth from colleagues in other jurisdictions.

From its inception in 2003 until July 2006, this course has been taken by 11,207 employees at 324 health departments representing all states, with many agencies adopting it as a requirement for emergency preparedness training. In addition, the course source code has been provided to a number of other training organizations, including Yale University, the Virginia State Department of Health, and the Hawaii Department of Health in Honolulu, which have then further customized the course content for their own targeted audiences. The National Association of County and City Health Officials lists this course as a resource under

Table 3. Percentage of pre- and posttest questions answered correctly (n=817)

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
Pretest percent correct	91.3	34.0	65.5	45.8	57.6	68.9	80.4	62.7	66.6	63.6	84.5	89.1	80.3	85.2	93.1
Posttest percent correct	98.5	84.9	96.3	87.6	95.3	90.1	96.8	97.4	90.6	95.8	96.0	94.0	92.5	97.9	98.7

Workforce Competency Development for agencies participating in Project Public Health Ready.⁷

CONCLUSION

We conclude that the blended approach is well received by participants and can offer significant enhancement to a DBL course, particularly when specific skills are required in addition to didactic information.

This research was supported by the Centers for Disease Control and Prevention through cooperative agreement A 1010-21/21 with the Association of Schools of Public Health.

The authors thank all who have taken the course and offered their constructive comments, and Genie Chia-wen Wu for her work on enhancing the course and keeping it updated, in collaboration with Thomas Chandler. (Current version available on the Mailman School of Public Health website at: <http://www.ncdp.mailman.columbia.edu/bep>.)

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