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RESEARCH AND PRACTICE

Public Health Emergency Preparedness Terminology: Using an Interactive Game to Introduce Complex Words and Definitions.

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Key Words
Public health emergency preparedness, public health terminology, public health education, instructional games.

Abstract
Objectives. An educational reinforcement exercise, using a bingo game, introduced students to challenging public health emergency preparedness terminology in order to pilot test the use of a game as an efficient method of learning a new vocabulary and definitions. Knowledge of the language of emergency preparedness and a fast and fun way to stay current could contribute to better coordination among public health personnel and their community partners.
Methods. A bingo game, developed using Macromedia Flash and XML files, and delivered within the Blackboard™ Course Management System was tested with first year medical students in a library orientation, and graduate public health students in an introductory class (Groups 1 and 2 respectively). Pre- and post-tests were embedded in the game so that participants received their results at the conclusion of each to reinforce learning.
Results. Both groups showed a statistically significant improvement in their knowledge of terms.
Conclusions. The results suggested that the web-based educational reinforcement in bingo game format was an effective method for learning difficult terminology. Anecdotal data from verbal feedback after each group showed favorable reactions to the learning approach. The flexibility and customizability of the bingo activity makes replication in other academic and public health applications possible.

INTRODUCTION

Public health has been increasingly recognized in recent years because of its critical role in emergency preparedness for epidemics, bioterrorism and natural disasters. Local public health agencies are often charged with managing these complex shared community responsibilities (Asch et al., 2005; Quiram et al., 2005) and must coordinate across the spectrum of public health communities and disciplines (Markenson et al., 2005; Covich et al., 2005). Diverse social, economic and biological factors necessitate partnerships between governmental agencies and private entities. Sharing a common language is a central component of effective coordination. A review of the literature shows little research has been conducted in academic settings using web-based terminology to introduce Public Health Emergency Preparedness (PHEP) terminology.

"Public Health Emergency Preparedness: Matching Fact to Function" was designed as a minimalist educational model to efficiently disseminate public health emergency preparedness (PHEP) terminology. The model was tested in a medical school with a public health program, diverse student population and urban

international border location. The primary activity was a Web-based educational reinforcement exercise in bingo game format, developed in Macromedia Flash. The BlackBoard ™ course management system enhanced the model with a pretest and posttest. The literature suggests a game format would be effective with this population (Gee, 2003; Beck & Wade, 2004) and for this content (Thiagarajan, 2003; Quinn, 2005).

The model used is based on the "knowledge proficiency" level, or ability to define and match terms and definitions (Bloom, 1956), a narrower focus than many online programs which include full curricula and exercises (Baldwin et al., 2005; Parker et al., 2005; Terndrup et al., 2005). While traditional emergency preparedness and response (EP&R) terminology and public health (PH) terminology share a common foundation, important terms/concepts are continuously being added; moreover, there are some terms with different connotations for the respective fields. Key terms were chosen from the Centers for Disease Control and Prevention's (CDC) Emergency Preparedness & Response (EP&R) Web site, a Critical Incident Protocol glossary, and graduate public health lectures (CDC, 2005; Jones, 2004; Bhalla & Warheit, 2004). Although it was not possible for the activity to be inclusive of all appropriate terminology, a reasonable effort was made to select representative vocabulary. Examples of important terms for EP&R which may not be traditionally used in PH are "Unified Command Center" and "Incident Commander." Important terminology in PH that may not be as familiar in EP&R is disease "incidence" and "prevalence." Examples of terms familiar to both traditional public health and emergency preparedness, but with potentially different connotations, include "domestic violence," "recovery" and "exercise."

METHODS

The learning technique was tested in two sample groups. All participants were members of a larger group who were attending either an orientation meeting or an introductory class. In the first group, 208 first year medical students attending a scheduled medical library orientation were offered the opportunity to participate. Of these 195 (93.7%) participated in the learning exercise. In the second group, 21 of 31 Masters of Public Health first year graduate students attending the introduction to public health class were given the opportunity to participate, yielding a response rate of 68%. The two activities were done about a month apart.

Procedures

The learning activity was conducted in medical library computer classrooms so each participant could have their own computer. The Blackboard course management software was used to present the pretest and posttest and provided automatic scoring and immediate feedback. The activity was a sanctioned addition to end of the orientation or class. Students received a recruitment script which explained the voluntary nature of their participation. If they chose to participate, they subsequently received an information sheet explaining that only aggregate data would be reported and published. Participants were enrolled in the activity using BlackBoard and an instruction sheet led them to the locations of the pretest, the bingo game and the posttest. Although participants completed the three components at their own pace on individual computers, the total time allotted for the game and activity was 30 minutes.

The bingo format offered rapid reinforcement of correct or incorrect answers. Terms and definitions in XML file format consisted of 42 paired terms and definitions. Each participant received randomly selected definitions which they had to match to terms. For example, the definition "Location senior public officials assemble to resolve critical incidents" would match with the term "Emergency Operations Center." With only 24 squares on the "bingo card", not all terms were on the board at all times. If the student determined that no term matched an available definition, s/he proceeded to the next definition. If the term was on the board and was accurately selected, a "piece" appeared on the appropriate bingo square. If the student completed an entire row horizontally, vertically or diagonally, s/he was alerted to the successful completion of the exercise. Figure 1 is illustrative of the matching definitions to terms format.

Figure 1: The PHEP Bingo Board: An Educational Reinforcement Exercise
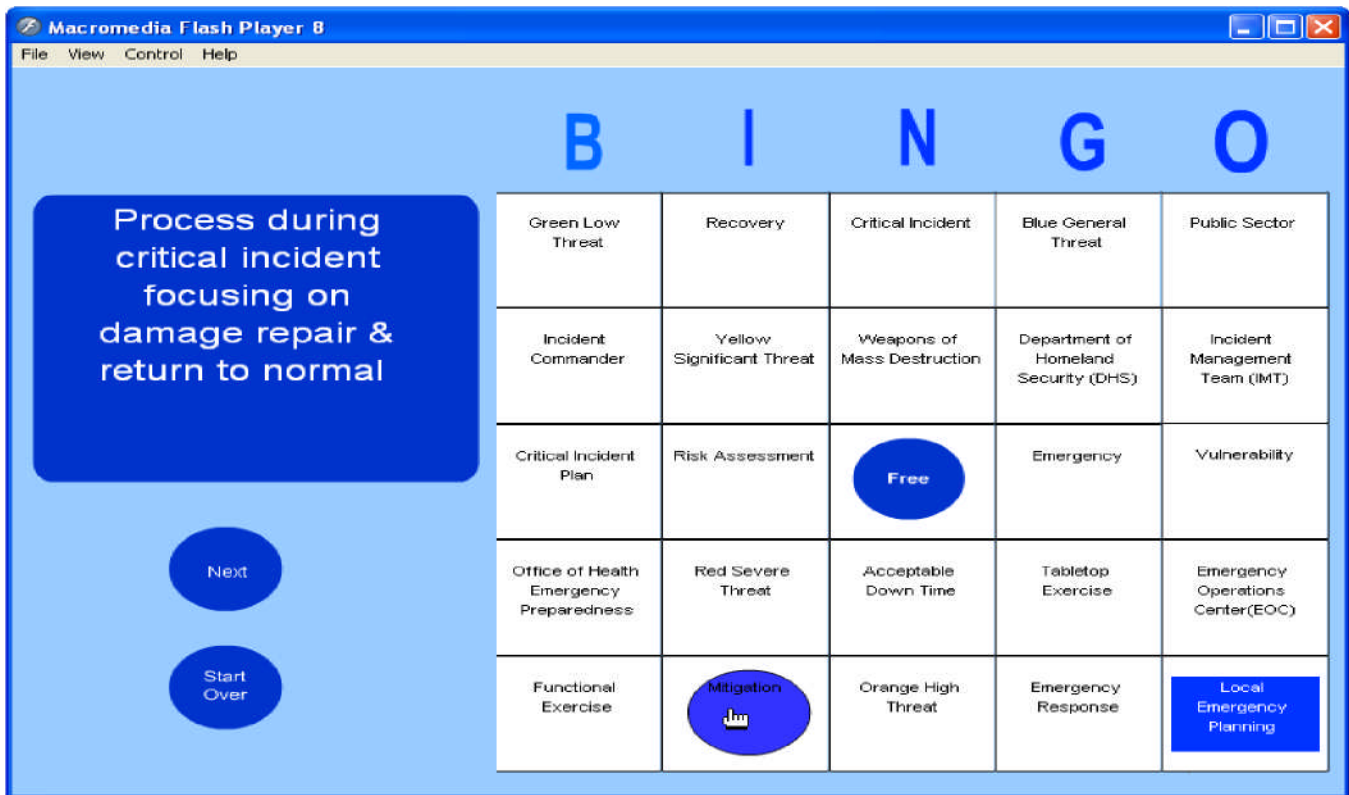
The pretest and posttest each had six questions; some questions were worth ten points and others were worth five. The questions were presented in three formats: multiple choice, sequential ranking or fill-in-the blanks. Examples included:

- An exercise with limited field operations, simulation testing, preparedness and resources deployment is:

    a)   Full scale

    b)   Functional

    c)   Tabletop

- Place emergency threat levels in their proper sequence from low to severe:

    Orange, red, yellow, green, blue

- Identify the federal agency responsible for safety of the food supply and biologic efficacy.

(Type in answer)

Both groups received a five minute introduction to the topic of PHEP. However, there were some differences between the groups in the sequence of activities. Participants in the first group were immediately asked to complete the pretest, the bingo activity, and the posttest. In contrast, the participants in the second group first heard an hour lecture by an urban health coordinator on PHEP implementation and its relevance to Public Health core competencies prior to completing the pretest. This lecture was not intended as an enhancement to the learning activity protocol; it was the regularly scheduled topic for the class.

All participants received a summary score and feedback on their responses immediately upon completion of each assessment. Therefore, participants knew their pretest scores and the correct answers to the questions before engaging in the bingo game and completing the posttest. Participants from both groups received a Public Health Emergency Preparedness Common Terminology Study Guide for the terms used in the bingo activity after completing the learning exercise.

Investigators were available for technical assistance for Blackboard course enrollment and the game. This procedure enabled observation of the patterns of difficulties experienced by some of the participants to aid in future improvement of the game. Although a formal satisfaction survey was not used, verbal feedback was encouraged at the end of each group.

RESULTS

Identifiers were stripped from the pretest and posttest scores and downloaded into a SPSS database for analysis. The maximum number of points a participant could receive was 50 for the pretest and 50 for the posttest. Actual pretest scores ranged from 4-45 in Group One and from 2-45 in Group Two. Posttest scores ranged from 5-50 in Group One and 20-50 in Group Two.

Not all participants had both pretest and posttest scores. This may be due to problems with Blackboard registering the responses or participants choosing to skip either the pretest or the posttest assessments. In Group One there were 179 (92%) who completed both the pretest and the posttest assessment. In Group Two, there were only 16 (76%) who completed both assessments. Paired t-tests were conducted separately for each group based on the participants who completed both assessments. Table One displays the results.

Table One: T-test Comparison of Pretest and Posttest Mean Scores

	Pretest Scores	Posttest Scores	t-test	p
Group One n = 179	21.87 (8.4)	36.51 (9.9)	-15.834	<.00
Group Two n = 16	23.63 (10.4)	36.56 (8.3)	-4.189	.001

As can be seen in the table, both groups showed a statistically significant improvement in their knowledge of terms. The average increase for Group One was 14.6 points and for Group Two it was 12.9 points. Pretest means for Group 2 were slightly higher than Group 1; however, posttest scores were almost identical.

DISCUSSION

The significant increase in scores for both groups suggests that the pairing of the bingo game and technology was an effective learning mechanism for PHEP terminology. The slightly higher increase in scores found in Group One could be due to a variety of factors. The participants in the first group were first year medical students who may have been less likely to have prior knowledge of public health terminology than the MPH students. Also the addition of the one hour lecture could have impacted Group Two's pre-activity knowledge of the terminology, causing their pretest scores to be higher than Group One's.

The intervening lecture in Group Two was not intended as an enhancement to the intervention but rather was an artifact of the classroom environment. Because differences in the posttest scores between the two groups appear negligible, there is no evidence to suggest that the inclusion of the hour lecture had significant effect on the learning exercise.

The two samples were chosen to test the learning activity because of the introductory content of the respective group sessions and their relevance to public health. No effort was made to control for group size.

Limitations

No data were collected about the participants themselves nor of their interests or background in public health emergency preparedness. Therefore, it is impossible to determine if there was a response bias due to self-selection or to prior knowledge of the terminology. Also it is unclear if the results are generalizable to the general population. However, the replication of the findings in Group Two lends some support to the generalizability of the effectiveness of the teaching method to other populations.

CONCLUSIONS

Increases in knowledge in both participant groups suggest that the approach and technologies used warrant further investigation. Anecdotal data from verbal feedback after each group indicated that the general response was favorable. Overall the students enjoyed the activity although some of them expressed the desire for "more time" due to their lack of familiarity with the terms.

PHEP vocabulary is abundant in acronyms such as ICS (Incident Command System), EOC (Emergency Operations Center), and POD (Point of Dispensing). Acronyms for federal, state and local agencies such as the Department of Homeland Security (DHS) or Local Emergency Planning Committees (LEPC) are also used frequently. Participants recommended that special attention be paid to acronyms in the future, perhaps as a discrete game.

Future plans include availability of the web-based educational reinforcement activity for dissemination through public health courses. The application of interactive game-based learning as a component of an online, distance education course and/or professional continuing education will also be explored. Because of the dynamic nature of the field, the vocabulary continues to be expanded, a process made easier by the storage of terms and definitions in XML format. MPH students participated in terminology updates through their review of US Department of Health and Human Services National Institutes of Health (NIH), and Health Resources and Services Administration (HRSA) web sites and publications in class sessions after the bingo game activity. Department of Homeland Security and Department of Justice web sites will also be reviewed. PubMed Medline will be used to conduct searches of biomedical literature and other timely sources for ongoing activity enhancement.

As an adult learning methodology, the use of games as a training tool can build enthusiasm and increase positive interaction among individuals with diverse learning and communication styles (Barnett et al., 2005). From a practical perspective, it appears the bingo activity can be conducted in small or large groups, as long as individual computers are available. Because of strategic location and cultural diversity of the university, its neighboring communities and international border, multi-lingual approaches will be explored, as will "talking dictionary" techniques to support the region's common languages and the sight-impaired. Additional study

through a pretest-posttest model or focus groups could facilitate better understanding of the perceptions of students, public health professionals and community members about the use of interactive gaming technologies as a learning modality generally and for emergency preparedness learning specifically.

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Contributors

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Human Participants Protection
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