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Evaluation Summary:

Epiville

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Evaluation summary: http://ccnmtl.columbia.edu/projects/evaluations/epiville.pdf

Project Description: Background & Purpose

Epidemiology is the study of the distribution and determinants of disease in human populations. It is regarded as the basic science of public health, and is also considered an important part of training in other health professions such as medicine, dentistry, and nursing. Columbia University's Mailman School of Public Health's (MSPH) core course in Epidemiology has been highlighted both within and outside the school as a "best practice example" of rigorous curriculum enhancement and innovative use of new educational technologies (Lapp and Herman 2002, Oblinger, 2003). The basic design of the course is a series of weekly lectures on key content areas, delivered by senior faculty. After each lecture, students meet in small group seminar sections that are led by junior faculty and advanced doctoral students.

The course presents a number of significant educational challenges. First, it has a large enrollment, approximately 260 students per semester. Second, as with all professional educational programs, the student body is extremely diverse, both in the level of prior exposure to Epidemiology and in the level of interest and motivation in this area, since many students will continue further coursework in the field, although most will not. Finally, because Epidemiology is an applied discipline, it is crucial that students learn to integrate the conceptual and theoretical material with practical knowledge.

The course developers from the Department of Epidemiology of MSPH teamed with educational technologists from the Columbia Center for New Media Teaching and Learning (CCNMTL) to create Epiville. Our primary focus was to enhance outside-of-class learning through the development of case-based homework exercises utilizing innovative Internet and media technologies.

In order to overcome the limitations we encountered with traditional paper-based homework and lecture-based

learning, we developed a set of exercises using interactive tools that provide students with an enhanced web-based learning environment, namely instantaneous answers to multiple-choice questions, innovative use of interactive maps and visuals, a self-assessment tool allowing instructors to tailor their class plans to more effectively address critical misconceptions, and a tiered approach to content. We believed that these tools would improve learning by allowing students to receive immediate feedback on self-assessed exercises, learn how to collect and analyze the data, and help them to identify learning needs by communicating directly with instructors. Several studies suggest that using an authentic case-based learning approach in medical education could help students to learn not only the content knowledge but also required real-world problem-solving skills simultaneously (Williams, 1992; Hmelo, 1998). In addition, research suggests that this approach also increases active engagement in learning and facilitates class discussion (Williams, 1992; Hmelo, 1995; & Hmelo & Day, 1999).

At present, the project has evolved into a set of related interactive web-based exercises that students are required to complete as homework assignments. In these exercises, students investigate a series of public health problems by assuming the role of an intern at the Department of Health in the fictional town of Epiville. Students gather relevant information (via audio, video, and on-line text) from various linked web-pages including: simulated TV news reports, public radio announcements, material supplied by the Epiville Department of Health, and interviews with local residents, officials, managers and other figures. Students then use the data they have collected to address key analytic and theoretical questions. Each week during the semester, students are assigned a different research task relevant to epidemiological concepts as they are being covered in course lectures.

Each exercise can be used as a stand-alone module. The order of exercises and modules can be changed according to curriculum needs without sacrificing educational impact. Exercises are highly structured so as to provide students with the predictable pattern of learning of new concepts. Each exercise opens with a set of explicit learning objectives, clearly defined teaching goals that guide students through the exercise. These learning objectives are also emphasized in the classroom lectures that coincide with the week's exercise.

In the course of each module, students answer multiple-choice questions that are complemented by detailed explanations of both the correct and incorrect answers. This provides immediate feedback to students, which has been recognized as adding a significant value to improving the learning and assessment of competencies (Van Der Vleuten 1996). Yet another example of a built-in educational tool is the interactive device that allows students to manipulate the data in order to understand the intricacies of data analysis. This was accomplished by developing interactive maps and graphs to provide visual illustrations of the often abstract concepts of Epidemiology.

Despite being an out-of-classroom tool, Epiville is closely integrated into the everyday activities of the course. For example, each concept in Epiville is accompanied by the references to the course textbook. In order to better integrate students' experiences in these exercises with their classroom experiences, we included "Discussion Questions" at the end of each exercise which are then used by classroom instructors to further explore concepts and methods introduced in the exercises. We also provide an additional set of multiple-choice questions to assess student knowledge of the topic, the responses to which are submitted to seminar leaders via the Internet. Student responses are used by seminar section leaders to tailor their teaching to the specific needs of their students. Thus, the web-based activities provide a means of integrating the out-of-class exercise with in-class discussion. The tiered approach to content is promoted by including sections called "For the Intellectually Curious," which provide an opportunity for students to be introduced to material that extends well beyond the scope of this introductory class.

Overview of the Evaluation Process

Since its origins in 2001 as a "city blueprint" with many possibilities for improving learning in public health and other health professions, Epiville's foundation and its continued growth was built on theories of how people learn. Even with the best intentions of the development team to implement these theories in the construction of Epiville, the team thought it was essential to build into the development process an ongoing evaluation of the students' learning experience. Critically concerned with the question of whether implementing these web-based modules is an efficient and effective way for improving learning, we collected, over a three year period, data from student and

faculty surveys.

In addition, a cognitive psychologist conducted an external evaluation of the Epiville project from the perspective of cognitive psychology. This research was designed to highlight the use of cognitive principles known to facilitate the comprehension and retention of information presented to students.

Findings

Student and faculty surveys indicated that Epiville improved students' understanding of the main concepts and principles of Epidemiology, as well as increased their interest in learning. Overall, the data demonstrate that this initiative has been a significant success based on student perceptions of their learning experienced compared to traditional exercises used in this course and other public health courses. Detailed class evaluations for the past three years show that students prefer these interactive web-based exercises to the traditional paper-based ones, and that they appreciate the innovative use of internet-based technology.

In particular, four of Epiville's components proved to be invaluable to both the instructors and the students.

1. Instantaneous answers to multiple-choice questions guided students through the new material and supplemented the textbook and lecture materials.
2. Innovative use of interactive maps and visuals provided students an array of explanations of concepts that are simply not possible with paper-based exercises.
3. The assessment tool of the exercises provided teachers with valuable information about the level of understanding that students have for each of the topics. Thus, they were able to adjust the content of their classes to more effectively address misconceptions about the course material, which in turn helped students meet the learning goals for the class.
4. The tiered approach to content allowed us to offer optional material to advanced students who sought to learn beyond the requirements of the course.

From a the viewpoint of cognitive psychology,

1. By providing the students with the opportunity to solve problems that are relevant to what is taught in the course, the creators have given the information *meaning*. In working through these cases, the students invoke and activate prior information, which facilitates the processing, comprehension, and recall of the learned information.
2. The students are given the opportunity to *elaborate their knowledge*. The individual study modules in Epiville challenge the students to consider a piece of information in a richer, wider context than the classroom, and to use their acquired knowledge to understand new and different problems.
3. The concept of *encoding specificity* has been incorporated into Epiville. The learning environment is designed to be similar to the environment in which this knowledge will be applied.

Epiville has now become an integral part of the core course. Furthermore, its flexible design features have allowed it to be adapted for use in other basic Epidemiology classes. Several of its features, especially assessment tools that allow teachers to adjust course content to more effectively address critical areas of student educational need, have the potential for greater use in other graduate-level classes. The complete integration of Epiville into the core Epidemiology course is a model of how new media content, paper-based textbooks and assignments, and lectures can be used in professional education.

Recommendations

The data provides valuable insights into the strengths and weakness of various type of new media teaching tools for promoting learning for graduate students in professional education programs, as well as how a blended approach of using technology outside that classroom can improve face-to-face learning. Epiville has grown from one to seven modules and has been used by over 750 students at Columbia University's Mailman School of Public Health. The development team has attempted to redefine each year the limits of this simulated city to improve learning by building modules informed by the data collected from paper-based and web-based evaluations. The data from the

evaluation has informed decisions in a number of areas including the development of interactive modules, choices of streaming-media, and how Epiville is integrated into the face-to-face meeting of the class.

The incorporation of other important cognitive principles would further enhance the effectiveness of Epiville as a learning tool. Some of these principles are:

- Increasing students' practice in recalling the information rather than in recognizing the information from multiple-choice problems, and
- Increasing students' practice at recognizing when specific approaches and knowledge need to be applied to a problem.

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