A university course on preventing hearing loss

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INTRODUCTION

Noise is a well documented health hazard and has negative effects on student learning, work productivity, family/social relationships, participation in recreational activities, and the general health and well being of children, youth, and adults. Recently Griest et al. (2007) reported on the positive increases in knowledge about hearing loss and noise for students in grades 4 through 7 using "Dangerous Decibels," a school-based hearing loss prevention program. Unfortunately, the authors concluded that “while fourth-grade students retained their improved attitudes at least 3 months after the presentation, seventh-grade students did not. The greatest challenge in health education for adolescents is changing their high-risk behaviors.” (p. 173). Educating individuals about healthy lifestyles, choices and maintaining their general well being across the lifespan, especially with regard to hearing and noise, should be part of general education for all life-long learners. This becomes more critical as adolescents and young adults are reportedly increasing their exposure to dangerously high levels of noise through music (e.g. iPods, MP3 players, personal listening devices, etc.), work (e.g. construction, highways, transportation, etc.), recreation (e.g. snowmobiles, hunting, etc.), and social situations (e.g. concerts, clubs, sporting events, etc.).

Although programs are desperately needed at the elementary and high school levels, recent studies suggest that lasting attitude changes and resulting behavior changes may not occur during the middle school years. More than 5.2 million (12.5 %) individuals in the United States ages 6 to 19 years old are predicted to have noise-induced threshold shift in one or both ears (Niskar et al. 2001). Music-induced hearing loss is predicted to develop into a significant social and public health problem with the increases in the daily use of iPods, MP3 players, and personal listening devices for hours at a time (Crandell et al. 2004; Chung et al. 2005; Vogel et al. 2007). Holmes et al. (2007) concluded that hearing protection use was reported as limited for all college student participants in their study, with the majority reporting never having used hearing protection. In fact, 20 % of the respondents reported temporary threshold shifts after noise exposure “at least sometimes”, ear pain, and/or tinnitus.

The Problem

Increased exposure to high levels of noise in adolescents and young adults may result in severe adverse long-term effects on quality of life. University students need to be made aware of the dangers of noise. They need to learn about environmental noise as a cause of hearing loss, safe levels and the Occupational Safety and Health Administration (OSHA) guidelines, the effects of medications on hearing, effects of loud music, excessive noise from recreational activities, work related noise issues, how to protect themselves from noise induced hearing loss (NIHL), hearing loss symptoms, and how noise damages the hearing mechanism. We decided to develop a university course on the prevention of hearing loss, especially hearing loss caused by the adverse effects of noise.

METHOD

The Penn State University is a large, research university with an enrollment of more than 80,000 students in central Pennsylvania. It has a long-standing tradition of General Education requirements which supports one of the missions of the University that students' programs of study include a wide range of skills and knowledge bases for life-long learning. One of the General Education requirements is a Health Science and/or Physical Activity requirement. Courses in this requirement area focus on a diversity of topics ranging from theories and practices of wellness and fitness activities to knowledge, perceptions and skills needed to live satisfying, high quality, and healthy lives. Courses include such topics as use of leisure time, sports activities, alcohol and drug abuse, obesity and eating disorders, safety education, etc.

In order to reach the broadest group of students at the University, we decided to submit CSD 101: Preventing Hearing Loss for approval as one of 80+ University courses fulfilling the General Education requirement. The supporting materials described the critical nature of hearing across the lifespan, the influence of noise on the quality of life, problems with noise in communities, schools and social environments, the relationship between hearing loss and noise, and the potential for changing the adverse effects of noise through knowledge and skills acquisition. The request for course approval was routed through departmental, college and university Committees. Approval was based on the rationale that noise was a major health threat. As outlined, the best way to influence behavior was to increase students' knowledge about the susceptibility and vulnerability to noise induced hearing loss and actions they could take to protect their hearing across the lifespan.

Course Development

We developed the course using a theoretical foundation based on Bloom's (1984) taxonomy for learning and Becker's Health Belief Model (Becker 1974). Bloom (1984) developed a classification of 6 major levels of intellectual behavior critical to effective learning. Using these 6 levels we created modules that included: 1) knowledge (e.g. recognizing, locating and recalling facts about hearing and noise; defining noise terms, listing parts of the auditory pathways); 2) comprehension (e.g. identifying hazardous noise levels, summarizing information from journal articles, describing information from streaming videos); 3) application (e.g. how does this information translate or apply to the learners' life and health choices, demonstrate how to use on-line audiometer); 4) analysis (e.g. differentiating types of noise, hearing losses, calculating noise levels); 5) synthesis (e.g. designing plans for companies to assist workers with NIHL, composing advocacy papers, predicting the possibility of hearing loss); and 6) evaluation (e.g. making decisions about the use of earplugs and assistive devices, the value of hearing across the lifespan, estimating the likelihood of noise induced hearing damage).

We combined these categories with the underlying principles of the Health Belief Model (Becker 1974; Glantz et al. 1990) of changing lifestyle behaviors. This model proposes that changes in individuals' health-related behaviors are dependent on their beliefs in their ability to change, knowledge about themselves, and their confidence in changing the behavior. The model stresses an individual's perception of four concepts for effective change to take place: a) the perceived severity of the problem (e.g. noise pollution), b) the perceived susceptibility to the negative effects or risk of the problem (e.g. adverse physical and psychological effects of noise), c) perceived benefits to reducing the problem using self-protective actions (e.g. the benefits of hearing protections, noise control, etc.), and d) the perceived barriers and negative con-

sequences in taking self-protective activities (e.g. peer pressure, wearing earplugs to a concert, etc). Using the underlying principles of Bloom (1984) and Becker (1974) we designed a semester-long, online, web-based course offered through the Department of Communication Sciences and Disorders for undergraduates entitled, CSD 101: Preventing Hearing Loss.

Online Course Development

Grabowski & Small (1997) suggest that basic to effective online instruction and the development of successful learning environments are the principles of information, instruction, and learning. Koszalka & Ganesan (2004) in discussing taxonomies for online course development defined information as "the basic unit of facts or data that can be used to present a flow of messages," instruction as "specifically selected, organized, and sequenced data with the deliberate intent of directing procedures or learning activities", and learning as "specifically engage participants in active cognitive processing to support the development of knowledge." (p. 245).

Developing and teaching effective online courses is not just simply translating traditional courses/lectures into web materials (Bude 2005; Chou & Tsai 2002; Mupinga et al. 2006). Online instruction utilizes listserves, web pages, streaming videos, making personal short videos, functional Power Point presentations, articles, pod casts and responding to hundreds of individual e-mails. These courses make use of other experts in the field who allow free access to websites, videos and lessons, sites and information in the public domain, and teaching learners how to search and surf the internet. These skills are necessary for informed consumers and life-long learners in the 21st century. Student learning is also evaluated differently through quizzes and assignments which assess abilities to retrieve, comprehend, synthesize information, and share results through both formative and summative assessments.

The advantages of online learning are numerous. Asynchronous learning, greater flexibility, greater likelihood for students from multiple continents and cultures in one course, self-paced tutorials and immediate feedback when assignments are submitted are a few of the strengths and additional benefits of online learning. In addition, faculty can access immediate tracking of student progress and online activity, interactive simulations, and diverse websites to develop the optimal educational experience for responsible and independent undergraduate learners (Chou & Tsai 2002; Pomales-Garcia & Liu 2006; Sinn 2004). However, there are also a number of challenges to online learning. Faculty need to deal with the lack of face-to-face contact, difficulties in building rapport and learning communities, absence of social interaction and discussions, and even simple questions answered in a few words in a traditional class often require multiple e-mails and explanations. Other problems include breakdowns in technology, servers and websites inaccessible due to repairs or maintenance. Students also need to have appropriate software available to access the materials to successfully complete the course (Chou & Tsai 2002; Mupinga & Maughan 2008; Sinn 2004).

Procedures

The online course was offered in multiple sections of 40 learners. An introductory 2-minute video welcoming students to the course and explaining the format, the need for responsibility, accountability, self-pacing, and independence was provided for review. We monitored online activity and time spent by the authors/professors and students for this 1.5 credit course.

The course requires students to have state-of-the-art computer systems, software programs and either personal internet use or University internet access. There were no required course books and all materials were online. Students needed to complete all 11 assignments and could complete a maximum of three assignments per week. All contact with the authors/professors was through the university course management system (ANGEL), and e-mail correspondence. Frequent e-mail contact was encouraged and contact with students was made through messages sent a minimum of four times per week. The purpose was to encourage community building, discuss course requirements, answer questions addressed by some students to all learners and keep the lines of communication open and positive. We also encouraged telephone and mail contact if necessary.

The course objectives included: 1) Demonstrate knowledge of hearing and hearing disorders, including etiologies, characteristics, assessment, and prevention. 2) Demonstrate knowledge of noise, noise levels, types, measurements and adverse biological and psychological effects. 3) Demonstrate prevention methods and rehabilitation strategies for hearing loss. 4) Demonstrate knowledge about the susceptibility, vulnerability to NIHL, the benefits of changing current behaviors and the barriers to making those changes. Table 1 presents an outline and brief overview of the course assignments and testing.

Table 1: Course outline and content for CSD 101: Preventing hearing loss

Lessons	**Assignments**
Online welcome and review of syllabus, course policies, requirements, and independence/responsibility needed to successfully complete online courses.	
Plagiarism quiz as a useful reminder and review of independent work requirements and academic honesty	Plagiarism on-line
Test quiz: How to access and use ANGEL Course Management System	Test Quiz
Lesson #1: Noise, hearing, basics, some facts. Videos from NIH, Power Point presentations on loud noise, misconceptions about noise and hearing, pamphlets, noise measurement devices, online hearing quiz and information about potential sports/recreational noise problems	Quiz # 1: Introduction, Noise, Facts 40 questions for this assignment.
Lesson #2: Definitions: Terms to increase your basic knowledge and understanding about hearing and noise	Quiz # 2: Definitions 40 questions for this assignment.
Lesson #3: Basic acoustics principles and a little dose of human ear anatomy and physiology	Quiz # 3: Acoustics 40 questions for this assignment.
Lesson #4: Introductory information about hearing anatomy and physiology of the hearing mechanism and terminology; basics for understanding hearing and hearing loss; PowerPoint's and streaming videos	Quiz # 4: Anatomy and Physiology 40 questions for this assignment.
Lesson #5: Noise pollution, facts and types of pollution. Information on noise levels, noise control, permanent and temporary hearing loss, papers from Pediatrics, brochures from National Hearing Conservation Association, information on MP3 players, iPODs, personal hearing devices, etc.	Quiz # 5: Noise Pollution 40 questions for this assignment.
Lesson #6: Hearing loss and hearing assessment. Information about hearing testing, types of losses and configurations of audiograms, otitis media, JAMA pamphlets, hearing loss simulations, effects of ototoxic medications	Quiz # 6: Hearing Loss and Testing 40 questions for this assignment.
Lesson #7: Causes of hearing loss in adults. Hearing in young adults through the lifespan, aging and hearing process, complications of NIHL and the aging process, social stigma, screening in medical fields, schools, industry, tinnitus videos, websites on infectious diseases	Quiz # 7: Etiology of Hearing Loss: Adults. 40 questions for this assignment.

Lesson #8: Hearing loss and prevention in children. Videos, readings from journals, Power Point presentations, classroom acoustics, universal infant screening	Quiz # 8: Etiology of Hearing Loss: Children. 40 questions for this assignment.
Lesson #9: Hearing conservation. Hearing conservation programs, ear protectors, noise abatement methods, hearing aids, assistive listening devices, gene therapy, stem cell research, classroom acoustics	Quiz # 9: Hearing Conservation 40 questions for this assignment.
Lesson #10: Hearing loss rehabilitation. Videos on hearing aid fittings and other assistive listening devices, articles from the popular press, child and adult hearing rehabilitation programs, readings from journals, NIH, NIOSH, Boys Town, OSHA, ASHA, ASA, ADA, and other websites	Quiz # 10: Hearing Loss Rehabilitation 40 questions for this assignment.
Lesson #11: The final assignment is a synthesis paper. Students are provided with a case study of an individual with a noise-induced hearing loss. Background information and work related issues on job performance are provided. Students are required to present the most logical cause of the hearing loss, explain the path of sound, explain 3 possible environmental factors that could have contributed to the hearing loss/problem, why the individual responds better to his male coworkers, and 3 things the company can do for the individual.	A Drop-Box is provided for online submission of the advocacy paper.
Student Rating of Teaching Effectiveness completed after final grade assigned.	Online survey

RESULTS

Time spent online by students

Time spent online by students was measured by the ANGEL course management system. This metric is only an approximation of time spent on the course as learners were able to download articles, readings, and Power Point presentations for later study and review. Of the 1,937 students who completed the course since 2003, the average amount of time spent in online activities ranged from 12.4 hours a semester to 85.2 hours a semester (mean time 29.3 hours a semester). In a traditional classroom, this 1.5 credit course met for 17.5 hours in class with additional time for quizzes, exams, outside readings and independent studying.

Student Feedback

Students rated the overall quality of the course instruction very high in all 49 sections of CSD 101 taught between 2003 and 2008. Using a 7-point rating scale where 1 = the lowest rating and 7 = the highest rating, 88 % of all students rated the overall quality of the course as a 6 or 7. Using the same 7-point scale, 91 % rated the organization of the course materials, 83 % rated the extent to which interest in the subject matter was generated by this course, and 74 % rated the fairness of exams in terms of difficulty with either a 6 or 7. Qualitative, constructive student comments were incorporated into each revision of the course.

Of the thousands of comments, 91 % were positive and grouped into seven categories. This first category was labeled Format Using Multiple Learning Strategies and included items such as: “Course materials were well prepared and carefully explained.” “Online courses are so much better for visual learners like me.” “I liked that everything was written out or I could go back and re-read or listen to the videos a second time.” I liked I could listen to the videos, read the Power Points over two and three times and still e-mail you with tons of questions.”

The second category was labeled Flexibility and 24/7 Access and comments included: “I thought the convenience was really good.” “I was able to schedule a class

when it suited my work schedule." "This was great. I met all the course requirements just about anywhere I found a computer." "Doing all the work online, at 2:00 am was great."

The third category was labeled Encouragement of Active, Independent Learning and included statements such as: "I learn better when I manage the time." "I learned something in this class every time I went online that changed my ideas about noise and hearing." "I changed my lifestyle and actually went to my children's school and asked about classroom acoustics and learning."

The fourth category was labeled Immediate and Prompt Feedback including: "I really liked all the immediate feedback on the quizzes when we submitted them." "Thanks for the daily reminders and updates." "Online feedback was great and all the detailed explanations helped me understand my mistakes."

The fifth overall category was labeled Communication of High Expectations. Comments included: "This class was intellectually challenging and stimulating, thanks." "The expectations were high but appropriate even for a 100 level course." "Material, expectations and explanations were clear."

The sixth category, Satisfaction with Learning Activities included comments such as: "I was in Pakistan taking this course on an internship and really got a great deal out of it. I am already telling other people to protect their hearing." "The readings and web sites were valuable and added to my understanding of the noise and hearing." "My paper was really well thought out because I wasn't rushed to hurry and finish something in a few hours." "I plan on using the information learned in this class on a daily basis."

The final category of responses was labeled Overall Evaluation of the Course and included: "This was a really great class!" "This is one of the best courses I took." "I found this type of class reduced my testing anxiety. It wasn't just memorizing facts to spit it back."

Of the 9 % of comments that were deemed negative, comments were grouped into three categories. The first category was labeled Workload Issues. Comments included: "This was a ridiculous amount of material for a 1.5 credit course. Cut it down by at least 50 %." "I couldn't keep up with all the work and lessons and you should send more reminders when assignments were due." "The final assignment was too difficult and required too much time to complete."

The second category was labeled Technology Problems. This category included comments such as: "Way too many (technical) problems with ANGEL (course management system)." "I really hated the computer meltdowns." Computer glitches were terrible."

The third category of negative responses was labeled Lack of Faculty/Student Contact. Qualitative comments included: "I did not feel as I was part of the class." "I didn't like the lack of one-on-one and personal attention I would like to get." "It takes too much time to e-mail and wait for a response."

CONCLUSIONS

CSD 101: Preventing Hearing Loss is an online course designed for undergraduate students at a major university to meet their General Education requirements. It provides University students with exposure to important information about their hearing and the dangerous effects of noise. The course has generated positive student

comments and feedback suggesting learners acquire knowledge about their susceptibility, vulnerability, possible changes to prevent hearing damage and NIHL, and barriers to making those lifestyle changes. This course can serve as a model for other universities in providing students with information about hearing, hearing disorders in children and adults, the adverse effects of noise, and conservation programs.

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