NUTRITION SCIENCE ONLINE: PROFESSIONAL DEVELOPMENT OF SECONDARY SCHOOL TEACHERS USING THE INTERNET

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Nutrition Science Online, an Internet course, was designed for secondary teachers to increase knowledge of nutrition science and comfort in using computers and the Internet, and to readily apply information learned in their classrooms. Participants= nutrition knowledge, self-perceived competence, and comfort using the Internet increased significantly as a result of the course. Those teaching the course identified several suggestions for use of the Internet for nutrition education.

The Internet is rapidly expanding as a tool for education and information. The increasing access to the Internet by children, parents, teachers and school personnel allows for numerous uses of this technology in the field of Family and Consumer Sciences (FCS). FCS teachers can utilize the Internet to communicate with students and colleagues, encourage student collaboration, keep current on research and professional development, and teach others at a distance (Kato & Hackman, 1997). Using the World Wide Web (Web) allows teachers and students to access content not available elsewhere, and, conversely, to share their own work with the world (Hackbarth, 1997). Use of the Internet by FCS teachers for professional development requires access to a computer, modem and phone line; an Internet Service Provider; and training in how to use this technology. Use of the Internet with students also requires classroom access to the Internet and ideas on how to guide students through the Web for learning in the family and consumer sciences.

One approach to increasing familiarity and use of the Internet by teachers is to offer a professional development course using distance education. Among the many advantages, distance education enables the students to learn without needing to travel great distances or arrange for logistical support such as child or elder care; to take advantage of educational offerings while maintaining full-time professional employment; and to access postbaccalaureate studies throughout the world (Cohen, Parnell & Amick, 1994; Laughlin, 1997). A computer-based approach to teaching nutrition would be of particular use for FCS teachers, as they would have the opportunity to learn the technical along with the subject matter skills that are needed in classroom applications. As teachers who are trained in nutrition are more likely to incorporate nutrition into classroom teaching than those who do not receive training (Stang, Story & Kalina, 1998), opportunities for accessible professional development courses in nutrition are needed. Teaching nutrition or foods as a science course offers additional advantages for students, such as

providing science credits for high school graduation (Miller, 1997). However, there are few published examples of nutrition science or other FCS courses taught primarily through the Internet (Achterberg, 1996; Cohen et al., 1997; Hayden & Ley, 1997), and limited availability of courses for non-university students. The purpose of this paper is to describe an Internet-based professional development course for secondary teachers and to provide recommendations for future courses of this type. Nutrition Science Online (NSOL) was designed for secondary teachers to increase nutrition science knowledge and applications, increase teachers' experiences with the Internet and increase integration of nutrition science and experimentation into the classroom.

Program Development

NSOL was developed by an interdisciplinary team of university faculty and staff with expertise in nutrition and in computer technology. A small grant (<$14,000) enabled the funding of course instructional and technical staff to develop and teach the course. University faculty incorporated the work into their university teaching responsibilities. The resultant non-degree course was designed to provide Professional Development Points (PDPs) for teachers upon course completion.

NSOL was designed using the WebBBS software, which allowed access in text or graphics modes (http://awsd.com/scripts/webbbs/). Registered participants could access the course through the Web using their local Internet Service Provider or the UMassK12 Internet server, an Internet host service designed especially for Massachusetts K-12 teachers and students. Participants were required to have access to any type of computer that had a modem and communications software.

Program Implementation

Training. Thirty-one teachers attended an introductory day-long workshop at the beginning of the course. Two Cooperative Extension agents in the midwest also participated in the course, but did not attend the workshop. The purpose of the workshop was to orient the teachers to the course structure, provide hands-on computer training, and allow for face-to-face interaction with staff and participants. A computerized dietary analysis program was distributed, and participants were trained in using this program off-line (Total Diet Assessment, Esha Corp., 1997). Also distributed were an introductory nutrition textbook (Smolin & Grosvenor, 1997), a food experiment manual (Cobb, 1994), and a course workbook developed for NSOL with syllabus and detailed weekly instructions for performing on-line and off-line activities. Included in the training were reviews of the principles of nutrition science and the importance of critical thinking about resources on the Internet.

The course included many of the features of recommended Web-based instructional models, such as use of a syllabus, Web-links, threaded discussions, e-mail, a resource page, and on-line submission of work (Estabrooke, 1999). With this format, we were able to take advantage of the strengths of distance education by encouraging working at one's own pace and time while maintaining the importance of group identity as provided by face-to-face learning. Group identity at a distance was maximized by dividing participants into three groups and assigning them to work predominantly with one of three instructors throughout the ten-week course. Groups were further divided into "pods" of four to six people for some activities and assignments to facilitate interaction among participants. Guidelines for facilitating on-line

courses, as described by Harasim et al. (1995), were used to improve clarity and communication within the course.

Weekly Flow of Events

The course was divided into five units, each taking approximately two weeks to complete. The five areas of emphasis included carbohydrates, lipids, proteins, energy balance and exercise, and the role of vitamins and minerals in health and disease. Each unit focused on the basic science of the topic while exploring its personal application. Course assignments included suggested experiments to be completed in the classroom, opportunities to explore the Web, and ideas for using the computer as a resource.

During the course the participants, working on computers in their homes or schools, performed required activities guided by the workbook. Interaction in the course was primarily on-line. Participants used the WebBBS System to find answers to research questions with the aid of links in the NSOL Web page "Library"; performed on-line self-assessment quizzes in "Testing 1, 2, 3"; and posted evaluations of experiments carried out at home or in the classroom in "Dr. Jekyll's Lab" bulletin board. They also posted and read messages from their pod members, either in the "pod" or "Recipes Page" bulletin boards as directed by the workbook, or in the "Virtual Cafe". Participants also posted messages about controversial issues in "The Great Debates" area. In addition, messages could be publicly or privately (confidentially) posted to and from the instructors. An "Administration" Web page was developed for participants to check for updates or changes in the course assignments, and to serve as a way to contact the nutrition or technical staff. Off-line, the participants completed activities from the text book and analyzed their food intake using the diet analysis program.

Active learning was particularly encouraged in the final unit, which was a project based on cooperative learning, with participants taking ownership of the project and the instructor serving as a guide (Bostock, 1997). Participants worked in their pods to develop a lesson plan about calcium, iron, or vitamin A or C. Participants communicated by e-mail to determine important objectives and concepts for the lesson, develop appropriate classroom activities, find Internet-based resources that students could access to learn more about the topic, and develop ways to evaluate how well the objectives were met. One pod member, serving as the "facilitator" for the project, compiled each pod member's contributions to the lesson, posted drafts of the lesson plan for pod members to edit, and posted the final lesson in the NSOL main menu.

Final Meeting

A final half-day workshop was held at the end of the ten-week course, at which time participants made final preparations and shared their lesson plans. Focus group discussions were also conducted so the participants could share their NSOL experience with the staff and each other. Attendance at both workshops and completion of all required activities were necessary to receive the 30 PDPs for the course. However, due to travel limitations, some teachers were excused from the final workshop.

Methods

All 33 participants completed a pre-test, either at the initial workshop or via mail before the course began. Nutrition knowledge of material covered by the course was assessed using 20 multiple-choice questions. The questions were reviewed by the instructional team for clarity and coverage of the nutrition content expected in the course. Split-half reliability was computed

using the Spearman-Brown formula (Nachmias and Nachmias, 1987), with r = 0.60. Ratings of comfort teaching nutrition and familiarity with computers and the Internet were determined using 3-point Likert scales. The nutrition knowledge test and computer and nutrition comfort ratings were administered again at the final workshop for 21 participants or via mail for an additional 5 participants. Course evaluations, including ratings of satisfaction with the course and method of instruction, were also obtained at this time. Pre- and post-test scores were matched for each individual and paired t-tests were performed to evaluate changes in participants' nutrition knowledge and comfort in using various Internet services.

Results

Over half of the participants (53%) were family and consumer science teachers and 16% were science teachers; the other participants taught health, physical education, or other disciplines. Fifty-seven percent of participants taught at the high school level, 23% taught at the middle school/junior high level, and the remainder taught at the elementary level or worked outside of the K-12 classroom. Most participants were women (81%) with at least some Internet experience (71%).

Participants' nutrition knowledge test scores significantly improved from start to end of the course , but comfort in teaching nutrition remained the same (Table 1). A significant number of the participants felt more comfortable using search engines to search for Internet resources, using e-mail, and downloading and printing files after completing the course. Comfort in using Web browsers did not change significantly as a result of course participation.

Most participants reported that they spent between 1 to 4 hours each week performing off-line assignments, such as textbook reading, analyzing diets, and completing assigned activities. There was wide variation in the number of hours they spent on-line completing activities such as Web research, or communicating with participants and instructors; nearly half spent 1-4 hours weekly, while most others spent 4-6 hours each week on-line.

Table 2 lists how participants, on average, perceived the adequacy of the course in various respects. On a 5-point scale, time allotted to complete activities, ability to get questions answered, and amount of participant-instructor interaction were rated very highly (4 or above). Participants had slightly lower, yet positive ratings (3.8) for the amount of time allotted to complete assigned readings, ability to get problems solved, and amount of participant-participant interaction. Overall ratings of course value, amount learned, self-reported increase in competency in nutrition and computers, and effort expended on the course were very high.

In response to open-ended questions of behavior change, 21 respondents reported making or planning to make nutrition or health-related changes, including exercising more (52%) or changing some aspect of their diet (57%), such as lowering fat intake or increasing fruit and vegetable consumption. When asked how they plan to use the Internet for personal or professional purposes, 86 percent of the 21 respondents said that they wanted to use the Internet to find resources for the classroom. Participant plans included developing a nutrition and health course using the Internet as a kind of on-line textbook for students, making a Home Page for their classes, and teaching their students to use the Internet. In evaluating changes that they had made or planned to make in their classroom teaching as a result of taking the course, 40 percent of the 20 who wrote responses stated that they wanted to use computers more with their students. Thirty-five percent were using or planned to use more hands-on activities and experiments in the classroom, while 35 percent planned to update nutrition curricula or add a nutrition unit to their present lesson plans.

When asked what they found most difficult about the course, 44 percent of the 23 respondents who answered this question pointed most frequently to technical problems they had with their hardware or Internet server, which made it impossible for them to connect to the course Website. Thirty percent of the 23 respondents found it difficult to make time at home for the course. In contrast, few participants found any aspect of the course to be "too easy".

Participants recommended several changes for future computer-based courses. Eleven percent of the 18 respondents who offered suggestions felt there should be more computer training before the class began and that Internet access from home should be a prerequisite. This was further supported by comments participants made in focus group evaluations. Eleven percent stated that more time should be allowed to complete the program; another 11% suggesting reducing the course workload. Seventeen percent felt more participant-participant communication should be built into the course, allowing the entire class to communicate with each other. Four respondents liked the hands-on aspect of the course and recommended incorporating more experiments and laboratory exercises into future courses.

Discussion

NSOL was developed to provide an accessible method of continuing education for secondary school teachers of family and consumer sciences, health, and science. As a result, nutrition knowledge and computer competency increased in participants. Many of the participating teachers were planning to incorporate the nutrition or technologies they had learned into their classroom teaching, supporting the work of Stang et al. (1998), who found that teacher training is associated with use of nutrition in the classroom. It is interesting to note that comfort teaching nutrition in the scale used here was not significantly changed by the course. As most participants were somewhat or very comfortable teaching nutrition at both pretest and posttest, it is possible that there was a ceiling to this response. In addition, the 10 weeks of the course was a relatively short time for teachers to be able to try any new nutrition activities with their students. Follow-up studies are needed to determine if actual use of nutrition in the classroom occurs in those intending to increase nutrition teaching.

It should be noted that the changes observed in NSOL cannot be attributed solely to the on-line portion of the course; the two required in-person workshops may have facilitated the positive changes observed. While requiring face-to-face meetings may prevent some participants from joining the course due to travel constraints, it also helps to facilitate the participant-participant interaction and instructor interaction for the remainder of the course. In the case of NSOL, the hands-on training was required for learning the WebBBS interface. However, the two participants with Internet experience who were unable to attend the training were able to learn the system quickly. As the public increases their facility with the Internet, there may be no need for in-person training from a technology standpoint. Nevertheless, the advantages of on-site training for facilitating the interaction during the learning process may still lead one to utilize it despite the potential disadvantages. Achterberg (1996), in her e-mail course, did not require an initial in-person workshop, but cited this as a recommendation for future courses.

From a teaching standpoint, in addition to onsite training, NSOL had several features that enhanced learning and reduced the potential instructor burden that can occur when there are too many e-mail messages for the instructor to read. Using three instructors, each with a small section of students, helps keep both instructor and participant focused, while allowing the instructor to follow participants' progress and improvement. It is useful for both participants and

instructors to have a workbook with all assignments, instructions, and deadlines clearly stated at the beginning of the course. It is also helpful to use conferencing software that allows for threaded discussions and multiple areas on the Web for posting messages, so that pertinent information is categorized, organized, and easy for participants and instructors to find. In order for participants to have meaningful discussions, but not become overwhelmed with the volume of messages, dividing students into groups of 4-7 and allowing them access to reading only their group=s material for many, but not all, assignments is ideal.

One recommendation to allow for more time to complete the course, is to offer NSOL for graduate credit and use the entire 14-week semester for coursework. We are currently offering such a course, with greater emphasis on learning and behavior change theories and application, additional incorporation of group learning approaches, and added research assignments. With this approach, teachers will be able to increase in nutrition and technology knowledge and skills and extend them to the classroom with the convenience of learning from their own homes.

Applications

NSOL is an effective means of distance learning that allows participants to learn about nutrition and gain technological skills at the same time. A course at any level of nutrition could be offered to a wide range of professionals who require continuing education, as well as to members of the general public who simply desire to learn more about nutrition. The Internet can be used for communication via e-mail; newsgroups, conferencing and on-line chat sessions; and/or for access to the large base of nutrition and health information and resources available on the Web. Studies of cost-effectiveness are needed to determine the most feasible distance education approaches resulting in positive nutrition outcomes.

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Table 1.
Nutrition and computer competency ratings as a result of course participation

Competency Measure	Pretest	Post-test	Paired t	p value
Nutrition Competency				
Comfort teaching nutrition[a]	1.8	1.6	-1.32	0.200
Nutrition knowledge score[b]	10.9	12.3	2.18	0.040
Computer Competency[c]				
Using search engines	1.4	2.3	5.60	0.000
Downloading/capturing files	1.3	1.6	2.04	0.055
Using e-mail	2.0	2.3	2.32	0.031
Using Web browsers	1.7	2.1	1.90	0.072
Printing files	1.5	2.4	6.10	0.000

[a] Ratings of 1 = very comfortable, 2=somewhat comfortable, and 3=not comfortable.
[b] Potential scores range from 0 - 20.
[c] Ratings of 1= not comfortable, 2=somewhat comfortable, and 3=very comfortable

Table 2.
Participant ratings of course adequacy and overall value.

Course Measure	Mean Rating	Standard Deviation
Course Adequacy (n=25)[a]		
Time for completion of activities	4.1	0.8
Time for reading assignments	3.8	1.0
Response to questions	4.0	1.0
Problem solving	3.8	1.0
Participant-instructor interaction	4.6	0.7
Participant-participant interaction	3.8	0.8
Overall Rating (n=26)[b]		
Value to participant	4.7	0.6
How much learned	4.6	0.7
Increased competency in nutrition	4.2	0.7
Increased competency with computers	4.6	0.7
Effort expended on course	4.5	0.7

[a] Ratings on a 5-point Likert scale, with 1= Not at all; 5=Very sufficient
[b] Ratings on a 5-point Likert scale, with 1= Not at all; 5=A great deal

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