

ABSTRACT

In response to several initiatives from national agricultural leadership to review and modify curriculum, a national curriculum for forage instruction is being developed. Through funding from the USDA Challenge Grants Program, the National Forage and Grassland Curriculum (NF&GC) is presented on the World Wide Web (WWW) to provide instructors of forage production and related courses a scope and sequence, content materials, WWW links, and teaching methodology and strategies. The NF&GC is unique in two ways: (i) it utilizes a number of nationally known topic matter experts working collaboratively with educational designers and technology specialists to present current scientific material in an educationally sound form, and (ii) it utilizes the best traits of WWW format while presenting more than just any W W W class. Although interested learners can take the course on the WWW, it is designed to help science instructors become more proficient as teachers by providing educational methodologies and strategies, an abundance of materials and resources, and connections to national experts. The objective of supplying content and teacher training is ambitious. Obstacles were expected but have been overshadowed by benefits. The purpose of this article is to share our experiences in the design and implementation of a collaborative WWW development project.

Modifications in college curriculum occur for several reasons: the need to add new subject matter, revised college requirements, new social concerns, and personnel changes. The need to create a National Forage and Grasslands Curriculum (NF&GC) was revealed by deficiencies in teaching materials and techniques discovered when personnel changes meant the second author, a forage research scientist, was assigned to teach a course covering basic forage production and management. The previous instructor had 40 yr of practical experience to guide his course design, content, and lab activities; however, he had not developed instructional materials. This left the new instructor in need of concrete materials to cover an expansive topic. Fortunately, the dilemma came at an excellent time. The National Agriculture and National Resources Curriculum Project had recently identified 12 course areas not adequately represented in agriculture curriculum. The introductory forage course was tailor-made to address 9 of the 12 concerns: computer use; systems approach; ethics; problem solving; cultural and social aspects of domestic and international agricultural systems; energy use; man and his food—biological and consumer aspects; systems of integrated pest management; and internships and cooperative education. The other three course areas (leadership development, student projects, and integrated reproduction management) could be considered in designing a well-constructed class. Funds were made available through the USDA Challenge Grants Program for curriculum changes in colleges offering agriculture and natural resource programs (USDA, 1992, p. 11–18).

The most widely used textbook available covering the topic of forages was the fifth edition of Forages, Volume 1, An Introduction to Grassland Agriculture (Barnes et al., 1995). It was reviewed as a “good reference” but several of the chapters are “a bit tedious to read” (Behnken, 1997a, 1997b). Volumes 1 and 2 provide basic forage information on many topics. Teaching techniques, learning strategies, related resources, and lab activities, however, are not provided. In addition, the cost for both volumes (approximately $120) generally precludes requiring both volumes for an introductory undergraduate class. To address the need for forage teaching materials, forage and teaching specialists were recruited to develop a broad-based curriculum linked to the WWW.

PROCESS

A soft system analysis process described by Wilson and Morren (1990), and previously used in agricultural educational review and reform, was utilized to design this Web-based introductory forage course.

Stage 1—Divergent Phase. Information (e.g., course syllabi) was gathered from instructors of introductory forage courses offered at institutions around the nation. Forage scientists were asked what information should be included in the study of forage production. Industry leaders were asked what skills were sought in new employees. High school and undergraduate science classes were interviewed to determine what information was common to earth and animal science units and therefore reasonable to expect as foundational for potential students. Extension agents were contacted to determine what skills needed to be strengthened in communities involved in forage production. Students from forage-related classes were pre- and posttested to determine what information was mastered or still lacking.

Stage 2—Assimilative Phase. The information gathered was summarized, analyzed, discussed, and pondered. Most forages courses examined contained units on species identification, establishment, hay, silage, weed control, animal requirements, grazing, fertilization, and forage quality


testing. Few courses offered well-developed units on environmental concerns or ethics. Most courses emphasized developing a knowledge base instead of developing student skills in problem solving or leadership. Since forages are a natural part of the plant-animal-soil continuum, forage classes usually pay some attention to a systems approach. Most forage classes had other crop science course prerequisites, but students often had a wide variety of academic and practical backgrounds.

Stage 3—Convergent Phase. Ideas regarding content in a basic forage course were listed. The subject, which may seem very specific to some, proved to be very broad and cumbersome. Forages are directly connected to environmental concerns, animal welfare issues, air and water pollution, food production, domestic and international policies, and trade wars. A list of over 20 key topics was constructed. Major themes were noted. Plans were made to seek resources for teaching each topic. Nationally known experts were obtained for each topic area. Ideas for connecting the content with desired skill development were recorded.

Stage 4—Accommodative Phase. Consideration was given to (i) determining how much content could be reasonably covered in an introductory course; (ii) expectations of the institution and department for a researcher with limited teaching duties since many forage instructors also have research and/or extension responsibilities; (iii) readily available resources; and (iv) feasible accomplishments. Tough questions were asked about placing the preparation of a forage course into the mix of research, extension, and departmental responsibilities. Many forage instructors felt that teaching was not recognized and rewarded in promotion and tenure policies; therefore, they felt efforts were better spent on research publications or grass roots support for extension activities (Davis and Beyrouty, 1995).

Stage 5—Implementation Phase. Analysis of the previous stages led to several conclusions:

1. Few teaching materials were available, although extensive resource materials were available.
2. Many scientists, though proficient in their subject matter, had no preparation for teaching and did not feel adequately equipped.
3. The content deemed necessary for a basic course required several areas of expertise (soil, animal and plant sciences, economics, production, industry).
4. Extensive effort would be required to provide content in conjunction with student skill development in writing, calculating, problem solving, and communicating.

These conclusions led to the decision to seek funding from the USDA Challenge Grant Program to develop a NF&GC with (i) content input of 20 to 30 national experts, (ii) an educational format developed by an instructional designer, and (iii) accessibility to all interested via the WWW developed by technology specialists. The proposal was funded for 3 yr (1996–1998).

RESULTS

The proposal defined four objectives leading to the creation of a scientifically current, academically sound, and technologically dynamic undergraduate college course covering the basic concepts of forage production and grassland management.

Objective 1. The first objective of the project was to utilize a core-development team to determine the overall structure of the course. The seven-member team brought together the science, technology, and education expertise needed to develop the course. Eight regional advisors were designated to provide a national perspective. Experts were identified to develop content for the major topics.

Objective 2. During the 1996–1998 Spring term the instructional designer assisted in the junior-level Forage Production and Management class offered at Oregon State University. The task was to assess the skills and needs of students for development of the NF&GC. Involvement in the class demonstrated the need to address student writing and test-taking skills, text readability, and suitable lab applications. This involvement also made it clear that calculation skills (herbicide application, yield determination, silo capacity, seeding rates) were essential for students to apply forage concepts to real farm situations.

Objective 3. With input from multiple disciplines, the course organization, assessment tools, model-lesson template, content topics, and plans for evaluation and revision were determined and presented on the WWW for comment and review. General skills needed by all students—including reading, writing, problem solving, and calculating—were integrated into the overall course design and applied specifically to forage production. Self-assessments were provided. Ample provisions also were available for practice to ensure continued progress.

Most cross-links deal with related science sites but some links connect users with industry (farm equipment is a major link in the hay and silage harvesting module), literature (pastoral themes in literary works), and basic skills (math, writing). These links connect instructors to even more resources.

Objective 4. Experts from each of the 20 forage topics were identified for lesson development. To assist cooperating topic experts and provide for consistent educational design and approach, an introductory module was developed by the core team and presented on the WWW.

Information from topic experts came in many forms: lectures, notes, taped classroom instruction, lesson reviews, visits/discussions, and articles. This project was universally well received and subject matter experts expressed willingness to be contributors; however, obtaining responses in a timely fashion was a challenge. As a result, expecting subject matter experts to develop a first draft of their respective instructional module proved unrealistic. Instead, the project director and the instructional design specialist drafted modules from the variety of raw materials provided by the subject matter experts, and experts were asked to revise, correct, and improve the lessons.

Thus, the core team established the overall structure of the course, student needs were assessed, initial course structure was placed on the WWW, and experts contributed materials for each module.

The course was presented on the WWW and provided access to forage instructors nationwide. The Web design
placed emphasis on how students learn, easy navigation, and links to provide instructors with valuable resources and suggestions for their best use. The topic modules were placed on the WWW as they neared completion. Text, visuals, questions, pre- and posttests, and activities were added and revised as more topics were presented to provide better transitions and less repetition. The NF&GC is a part of the Forage Information System (FIS) with the NF&GC URL http://www.forages.css.orst.edu/Classes/NFC/index.html (see Fig. 1 for a screen capture of a portion of the NF&GC). The FIS has been available on the WWW since November of 1994 and currently receives from 1000 to 10 000 contacts each day from the USA and scores of countries around the world. Linkage of the NF&GC to FIS will greatly expand its outreach potential. Since the FIS contains extension, research, teaching, and international projects, this project also will help provide linkage across USDA agencies and programs.

Since this project is a cooperative venture utilizing the expertise of educational, technological, and scientific specialists, its development is building a small community of instructors interested in improving teaching skills and materials. The program is being introduced and demonstrated at various professional meetings and workshops. As more modules are completed, revised, and adopted by instructors, the community will continue to grow. In 1997 the project was presented at the Society of Applied Learning Technologies Conference and the American Forage & Grassland Council Conference and discussed at the International Grasslands Congress, Grazing Lands Forum, Pacific Northwest Forage Workers’ Conference, and the American Society of Agronomy annual meetings.

In addition to the 20 forage topic modules, their related links, questions, and activities, a glossary and image library are provided to aid in forage and grassland instruction. The glossary should prove helpful in a science field burdened with inconsistent terminology. The image library should enhance more broad-based instruction in programs around the nation. For example, instructors at northern colleges and universities often did not have adequate live plants or color images of warm-season forage species without extensive greenhouse work. Common grasses studied in most forage courses do not grow everywhere throughout the year, so the image library is an economical way to provide species examples.

**SUCCESSES**

Collaborative work from topic experts was used to meet an academic need. Science instructors now have a resource to disseminate accurate information from nationally known scientists from a variety of geographical, climatic, and vegetative areas, while using the most current, instructionally sound techniques through the most interactive method available. Much of the content has proven to be well presented with the visual capacities of WWW technology. Forage Production and Management can now be a course presented with excellent supplemental materials from subject matter experts, appropriate text, instructor guidelines, and a logical, comprehensive topic scope and sequence.

**CHALLENGES**

Several obstacles emerged during this project that utilized the talents of so many experts. Although this project was welcomed by the many subject matter experts involved, obtaining materials in a timely fashion continues to be a challenge. As a result, instead of having subject matter experts develop the first draft of the instructional module, the project director and the instructional design specialists are drafting modules from raw materials provided by the subject matter experts. Subject matter experts are then encouraged to revise, edit, and make additional suggestions. In addition, the raw materials submitted for draft development required substantial revision by the instructional designer and teaching experts to improve appropriateness.

The NF&GC has a greater capacity to present current material in a vivid format and with convenient, automated links to related material than any text book. The NF&GC also presents laboratory, discussion, and classroom activities and provides teaching strategies and methodologies for specific skills needed in a forages course.

One segment of the NF&GC is species identification, a skill required in most introductory forage classes, and a stumbling block for many students. Strategies from other science disciplines, such as medicine, have been studied to determine the best ways to teach topics containing massive vocabulary and requiring strong memorization skills. These strategies have been applied to forage identification. This has included developing a WWW-aware CD-ROM for species identification and linking it to the NF&GC. Funding for the CD-ROM prototype was provided from Oregon State University’s Instructional Development and Technology Committee grant program. The result is color pictures of many forage species in various developmental stages organized for self-directed student practice. Other segments of the NF&GC will be enriched in similar ways as instructors identify resources and tools that they can link for the benefit of all.

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and clarity for undergraduate (novice) learners. Perhaps this should have been anticipated, since one reason this project was developed was the realization that many scientists are well trained in science but have little background in educational methodology or instructional design. Since many of the subject matter experts are research or extension scientists, there is little time or administrative encouragement for developing skills in instruction. The slow submission of materials needing substantial review and revision has increased the time commitment by the project director and instructional designer. However, this additional revision provides more consistent design, better transition from topic to topic, uniform terminology, and a better final product.

Another difficulty in developing a curriculum for an introductory class like forage and grassland production is that each subtopic could be a class by itself. Units on environmental issues can include many concepts and require considerable time if pursued in depth in a classroom. Providing content and materials for such a broad unit requires much time, space, and research since management implications of environmental issues differ greatly from location to location, i.e., field burning is a major issue in the Northwest, irrigation is controversial in the Southwest, and erosion is a major concern in the central states. Providing a wealth of materials is a priority for this NF&GC project, but it has been a more time consuming project than originally anticipated.

CURRENT STATUS

At the beginning of the final year of development, 20 of the NF&GC topics have been written, illustrated, and linked to related resources. Many special features are well developed including the glossary, image library, learner survey, pretests, and plant identification supplements. New topics and additional teaching methodology materials continue to be included. Suggestions, contributions, and ideas are encouraged. The URL is http://www.forages.css.orst.edu/Classes/NFC/index.html. Contact the developer at the following email: david@forages.css.orst.edu.

REFERENCES