An Evaluation of a Multidisciplinary Course Delivered at a Distance: Prescriptive Principles to Challenge our Profession

Kim E. Dooley
Texas A&M University
Bhimanagouda S. Patil
Texas A&M University-Kingsville
R. Daniel Lineberger
Texas A&M University

Abstract

Most of our universities are using, or exploring the use of, distance education as a delivery system for courses, degrees and continuing education. Texas A&M University-Kingville Citrus Center was awarded a USDA Challenge Grant to develop a new course: *Phytochemicals in Fruits and Vegetables to Improve Human Health*. This course, delivered in spring, 1999, was the first in the nation to combine experts from chemistry, plant physiology, horticulture, plant breeding, food science, plant pathology, biochemistry, postharvest physiology, and the medical sciences in the discussion of phytochemicals. Distance learning technology provided the conduit for interaction between 18 faculty/researchers across the nation and a diverse group of learners in 10 videoconferencing sites. Weekly topics and discussion were delivered via the Trans-Texas Videoconference Network (TTVN) with course handouts and PowerPoint slides available on a course Web site. The primary objective of the course was to provide opportunities for students to acquire interdisciplinary knowledge related to the effect of fruits and vegetables on human health. A second objective was to make students aware of careers in health-related interdisciplinary fields, and increase their knowledge and understanding of the relationships between research findings and the practical use of phytochemicals. The purpose of this evaluative research study was to analyze how well the course, as designed and delivered, met the course objectives. What were the student perceptions of this multi-teacher, multi-location (distance education) approach? Could prescriptive principles for effective use of distance education be developed to serve as an instructional model for the delivery of agricultural science courses? Formative and summative evaluations were collected on-line and stored in a database. An external evaluator observed the course and kept a field journal, compiled numerical ratings and completed the constant comparative method to integrate categories on all open-ended responses. The most beneficial component of the course was access to national experts/presentations and the relevancy of research applications to a geographically dispersed audience. Only through distance education was this approach possible. The initial evaluative results were useful for the future revision of this course and can be applied to other courses and programs. This evaluative study highlights numerous challenges facing our profession. Agricultural educators can become the leaders in methodologies for the effective and efficient design, delivery, and evaluation of distance education as a conduit for agricultural and life sciences content.

Introduction and Theoretical Framework

The study presented here pertains to lessons learned from organizing and teaching one multidisciplinary course delivered at a distance. It is an initial effort to provide "food for thought" as we conduct further research on the effectiveness of different approaches to distance education.

Why Distance Learning?

Most of our universities are using, or exploring the use of, distance education as a delivery system. "Major organizational changes and new developments in higher education are being accelerated by dynamic advances in global digital communications and increasingly sophisticated learning technologies….Barriers to accessing higher education learning opportunities are being reduced globally because of improved learning technologies" (Hanna, 1999, p. 19). The movement of higher education institutions to utilize technology to deliver education is often the result of administrative decisions to reach a broader audience in an efficient manner. Resources have been and are continuing to be put in place for high-speed Internet connections and interactive videoconferencing. Specifically, continuing education, academic courses, and full degree programs are being developed to meet demands from individuals seeking non-traditional access.

Many institutions question the "quality" and rigor of distance education programs and courses and compare "traditional" classrooms to technology-mediated delivery. Many researchers argue that these comparative studies are of little or no value. The predominance of "no significant difference" findings has led them to conclude that delivery systems do not matter (Russell, 1996). "Comparative studies of mediated education do not address the question of quality of learning and teaching in the right frame. These studies are grounded in the mechanical view of mediated communication and the physical science paradigm of educational technology" (Saba, 1999, p. 29). Clark (1983) argued that media were mere vehicles used to deliver instruction and that it is the method rather than the media that affects learning. Research that considers the use of "systems approaches" to describe distance education and define a set of prescriptive principles for its effective use are necessary (Saba, 1999; Smith & Dillon, 1999a). "A systems theory of distance education helps us understand that 'distance' is not a product of geography, but rather it is a function of the relationship between structure and dialogue" (Smith & Dillon, 1999b).

Why a Phytochemicals Course?

Historically, consumption of certain fruits and vegetables was thought to prevent or cure ailments ranging from headaches to heart diseases. In fact, early medicine revolved largely around the prescription of specific plant food concoctions for certain health disorders (Darby, Ghalioungi & Grivetti, 1977; Kohman, 1947). In the history of mankind, there has always been the awareness that the composition and quality of the diet have a strong impact on maintaining good health. Parents encourage children to eat fruits and vegetables because they help the children "grow big and strong." However, only one percent of children from two to 19 years old meet the U.S. Department of Agriculture's dietary guidelines (Munoz, Krebs-Smith, Ballard-

Barbash & Cleveland, 1997).

Until relatively recently, these attributes of fruits and vegetables were based more on metaphysical beliefs than on scientific evidence, but during the past decade many studies examined the relationship between the consumption of fruits and vegetables and human health. Besides being the main source of dietary fiber and vitamins, fruits and vegetables contain more useful compounds, including a myriad of phytochemicals or bioactive compounds shown to have anti-inflammatory, antioxidant, and healing effects. These include carotenoids, flavonols, flavones, tocopherol, selenium, phenols, protease inhibitors, organosulphur compounds, limonoids, and plant sterols (Potter & Steinmetz, 1996; Fahey, Zhang & Talalay, 1997).

The National Academy of Science released an important report on *Diet, Nutrition and Cancer* (Commission of Life Sciences, 1982). This report emphasized the relationship between diet and cancer and offered specific dietary suggestions. The Surgeon General's Report on Nutrition and Health in 1988 revealed that five of every 10 deaths in the U.S. were attributed to diet-related diseases. The strategy in the war against human diseases needs to be revised. A major emphasis on prevention rather than cure needs to be implemented through education in agriculture and food science curricula. Even though we have evidence suggesting the importance of fruits and vegetables, there were no specific courses designed to teach students about the phytochemicals contained in fruits and vegetables.

Background, Course Objectives, and Purpose of the Evaluative Study

In the fall of 1998, Texas A&M University-Kingville Citrus Center was awarded a USDA Challenge Grant to develop a new course: *Phytochemicals in Fruits and Vegetables to Improve Human Health*. This course, delivered in spring, 1999, was the first in the nation to combine experts from chemistry, plant physiology, horticulture, plant breeding, food science, plant pathology, biochemistry, postharvest physiology, and the medical sciences in the discussion of phytochemicals. Although it was designed as a graduate-level course, upper-level undergraduates and professionals in the field seeking continuing education credit also participated. Interaction among 18 instructors and 32 students at 10 videoconference locations (within three university systems) was accomplished via an interactive video network. Phytochemical information was delivered through PowerPoint® presentations, slides, demonstrations, video clips, and discussion. Course handouts and PowerPoint slides were provided to learners on a course Web site (http://phytochemicals.tamu.edu). A basic premise of the course design was to shift significantly away from the traditional lecture style by one instructor to a learning environment enhanced by distance education with several instructors. As described in *Everybody Counts*, the teacher's role should shift to that of consultant, moderator, and interlocutor, not just presenter and authority (National Research Council, 1989).

Course Objectives

The primary objective of the course evaluated was to provide opportunities for students to acquire interdisciplinary knowledge related to the effect of fruits and vegetables on human health. A second objective was to make students aware of careers in health-related interdisciplinary fields, and increase their knowledge and understanding of the relationships between research findings and the practical use of phytochemicals.

Study Purpose

The purpose of this evaluative research study was to analyze how well the course, as designed and delivered, met the course objectives. What were the student perceptions of this multi-teacher, multi-location (distance education) approach? Could prescriptive principles for effective use of distance education be developed to serve as an instructional model for the delivery of agricultural science courses?

Methods

Because of the unique challenges of a multidisciplinary approach coupled with the use of distance-learning technologies, educational evaluation (with both numerical and open-ended responses) was the method employed (Borg & Gall, 1989). A formative evaluation was administered to determine 1) the effectiveness of the presenters, 2) students' understanding of content presented, 3) usefulness of supplemental materials, 4) the quality of the videoconference transmission, and 5) whether students perceived the "right mix" of interaction between the lecture and discussion components of the course. These data were collected voluntarily through the course Web site and stored in a database; therefore, the number of responses for each topic varied. One "field" in the database collected the location of the learner to determine if there were differences based upon site (although there was no "local" site as presenters were also physically dispersed). The means for the numerical ratings were calculated for each question. Students were also asked for "responsive evaluation" (Stake, 1967) on the most and least beneficial aspects of each session.

At the conclusion of the course, an open-ended, on-line evaluation was collected and standard course evaluation forms were administered at the Texas A&M University System sites (College Station and Weslaco). These data were not available for those enrolled in other university systems or for continuing education credit.

An external evaluator observed the course and kept a field journal about the learning environment, compiled numerical ratings, and used the constant comparative method to 1) compare incidents applicable to each category and 2) integrate categories on all open-ended responses (Lincoln & Guba, 1985; Glasser & Strauss, 1967). All on-line responses were coded to ensure confidentiality and stored in a database on the server of the external evaluator.

One of the limitations of this study was the difference in purpose or distinction between "research versus evaluation" (Coldeway, 1988).

> Evaluation, as described in the evaluation literature, is an attempt to determine the worth, quality, or value of something. It can be done for the purposes of improvement or to describe the final outcome. It is not typically concerned with prediction or control of variables that generalize beyond the primary setting….Evaluation can be quantitative or qualitative and need not be overly concerned with issues typically important in research approaches that are designed to test hypotheses of theoretical constructs. Evaluation must be built into the distance education development process in almost every case and should not be viewed as an extra cost or activity that serves little purpose" (Coldeway, 1988, p. 49).

Therefore, this study provides a "lessons learned" framework for sharing the results of a multi-disciplinary approach to distance education. "Using a systematic approach to instructional design and delivery will naturally lead to evaluation and should raise questions about overall effectiveness" (Coldeway, p. 51).

Findings

The findings are divided into four sections: 1) *Formative Data* with numerical averages for each topic and integrated categories for all open-ended responses, 2) *Summative Data* of open-ended responses collected on-line at the completion of the course, 3*) Standard Course Evaluation* forms administered through The Texas A&M University System only, and 4) *Discussions of Results* drawn from the data analysis.

Formative Evaluation Numerical Ratings and Discussion of Open-Ended Responses

For each topic throughout the semester, students were asked to complete an on-line evaluation instrument (with 1 being the lowest and 5 the highest) for the following questions: 1) How would you rate this presenter (preparedness, enthusiasm, delivery techniques)?; 2) How well did you understand the content?; 3) Did the supplemental materials help (PowerPoint slides, other visuals, handouts)?; and 4) How would you rate the videoconference transmissions (audio, video, interaction with other sites, etc.)? The students were also asked, "Did the session have the right mix of lecture and discussion/interaction" and this could be indicated by a "yes" or "no" answer (see Table 1). Following these five questions were three open-ended questions: 1) What was the most beneficial part of the presentation? 2) What was the least beneficial part of the presentation? and 3) Other comments or recommendations.

In addition to the numerical ratings, the open-ended responses were analyzed and integrated into the following six categories: 1) presenter qualities, 2) student understanding, 3) effectiveness of supplemental materials, 4) quality of videoconference transmission, 5) most beneficial, and 6) least beneficial aspects of the course. Student responses on *presenter qualities* included: clear pronunciation, detailed presentations, good discussion of complex subject matter, thorough coverage of content, interesting content, scientific application, outstanding preparation, excellent overview, willingness to answer questions, knowledgeable about subject matter, genuine interest, enthusiasm, humor, and using real research data to demonstrate principles. *Student understanding* was enhanced when presentations integrated discussion and "real-world" applications according to respondents. The *supplemental materials* considered useful were 35mm slides, handouts, bar graphs, visual aids of actual objects, lecture notes/PowerPoint slides and video segments.

Table 1
Numerical Averages on Formative Evaluation (Scale: 1=lowest - 5=highest)

Topic	*Presenter Rating*	*Student Understanding*	*Supplemental Materials*	*Videoconference Transmission*	*Right Mix % "yes"*	*Number of Respondents (n)*
antioxidants	3.9	4.1	3.4	3.9	86%	7
beta-carotene	4.3	4.2	4.2	4.5	100%	11
cancer chemo-prevention	4.0	3.5	3.8	2.5	50%	4
carotenoids	4.6	4.2	4.5	3.8	100%	14
citrus limonoids	3.8	2.9	2.8	3.1	60%	15
community-based programs	3.8	4.3	3.3	3.4	88%	16
crucifers	3.8	3.8	3.4	2.4	82%	17
designer fruits	4.2	4.1	4.2	4.4	100%	9
diet & prostate	3.9	3.2	3.3	3.1	60%	10
flavonoids	4.4	4.0	4.2	3.8	80%	5
isoflavones	3.8	4.0	3.8	3.3	100%	8
myristicin	3.6	3.6	3.8	3.2	80%	5
nutrition & cancer	3.8	3.5	4.0	3.2	55%	28
onion & antiplatelet	4.7	4.5	4.4	4.1	100%	10
wine & health	4.4	4.4	4.5	4.3	91%	11
AVE	**4.1**	**3.9**	**3.8**	**3.5**	**82%**	**11**

It was important in this context to separate *videoconference transmission* from content presentation. Most of the time, the interactive video provided an appropriate conduit for the course delivery, but there were some sites that were not connected the entire time of a session. There were frequent audio difficulties, often caused by connection problems, a lack of facilitation/technician assistance at distance sites, misunderstandings about muting functions, and by some speakers who did not speak directly into the microphones. Visuals were often hard to read on the TV monitors and students wanted to see the speaker more often than the visuals during the presentations.

Overall, the *most beneficial* component of the course was the diversity of speakers/presentations and the relevancy of research applications. The *least beneficial* aspects primarily stemmed from the nature of the seminar format. Some students commented that there was too much detailed information (especially chemistry). Many of the presenters were from international origin and on occasion were difficult to understand. PowerPoint slides downloaded from the course website were not in the same order as given in the presentation because of intellectual property concerns, causing some student confusion. Some presentations were

perceived to lack clear organization and appeared rushed, especially when there were two speakers for one class session. Speakers often prepared so much material that there was no time for breaks or class discussion, thus causing frustration and information overload.

Summative Evaluation Based upon Open-Ended Responses

At the conclusion of the course, students were asked to complete an on-line, open-ended, evaluation instrument. This summative evaluation included eight questions and the opportunity to add additional comments and suggestions. Eight respondents completed the summative evaluation. These questions and a summary of comments are documented in this section.

1) In your opinion, was distance education an effective way to deliver this course? Although students mentioned some obstacles to the videoconference delivery (especially audio as mentioned previously), students felt that it was interesting to have speakers from all over the nation and to be able to reach a diverse audience of learners. The interaction with multiple sites and diverse speakers and students was unique and a strength of the course. One student commented, "With the speakers being dispersed, this was the only way to offer a course of this type."
2) Should this type of technology be used in the future? Every respondent agreed—this technology allowed more speakers to come together and offer their knowledge and expertise to a wider audience.
3) If you took this course with an instructor in the traditional classroom, do you think you would have gained more knowledge? This question had a mixed response. Those who said, "yes" felt the course was too intense, especially in a three-hour, once-a-week format. They suggested a shorter time frame with more frequent meetings. The issue of "accents" of the speakers was mentioned as a barrier to learning, this being intensified by the audio difficulties experienced with videoconferencing. Those who answered, "no" once again emphasized the ability to garner knowledge from instructors all over the US with diverse research backgrounds compared to the knowledge base of one instructor in the traditional classroom.
4) Did the topics enhance your understanding of phytochemicals in fruits and vegetables? The answer unequivocally was "yes."
5) Were there topics needing to be covered that were not? Answers varied based upon the diverse nature of the student backgrounds. Topics mentioned were processing effects on each of the chemicals' dietary aspects, ethnobotanical or historical aspects, and less on specific foods and more on phytochemicals *per se*.
6) Were there any topics covered in too much detail? Many students mentioned that the course included too much chemistry and biochemical structures. Some felt there was a bias toward citrus and others felt there was too much information on growing crops and plant diseases rather than the aspects of phytochemicals in relation to health issues.
7) Would you recommend this course to others? Once again every respondent said "yes" but they did mention that perhaps it should be limited to graduate students or those who have a pre-requisite of biochemistry/chemistry.
8) What suggestions for improvement would you make? Answers varied and many have been mentioned previously: course was too intense in a 3-hour block; need to have local

facilitators; implement more written assignments and fewer exams; make sure speaker slides are in the order they will present and formatted for TV monitor display; provide technical support for correcting transmission difficulties; create a manual that lists foods and phytochemicals as a course reference; if the course continues to have a broad audience, then have less detailed content; provide streaming video of lectures over the Internet; and provide review questions before or right after the lectures.

Standard Course Evaluation Results

Standard course evaluation forms were administered for The Texas A&M University System with 14 respondents -- Kingsville (Table 2) and College Station (Table 3). The instruments had different questions and will be discussed separately. Both forms used a 1-5 scale with 5 being the "best" or "strongly agree."

At Texas A&M University – Kingsville, the seven respondents were all graduate students with three indicating that this course would be used in their "major." The others listed it as an "elective" course.

There was also an open-ended question on the Texas A&M University - Kingsville form, "Please give your views on the quality of the learning experience in this course. In your comments, please include both strengths and weaknesses." Student responses were overwhelmingly positive. "There should be more courses like this! Not only the subject matter, but the format (teleconferencing links to multi-educational sites, with the experts in their fields)." "This course was very informative. The material taught was very new…a new concept in the way scientists are approaching killer diseases. This is very exciting because scientists are starting to look around at our environment and are going back to plants for cures."

Several students mentioned the technical difficulties with the videoconferencing, but did not imply that it was a hindrance to learning. "There are still some technical problems regarding [interactive video]; if we can resolve that in the future it would be much better." "Once technical problems are worked out, there shouldn't be any more problems!"

At Texas A&M University in College Station, the seven respondents were also all graduate students with a mix of those who took the course because it was required and those who chose it as an elective. Students at Texas A&M University – College Station also had the option to provide additional comments. On the "most positive aspects of this course" several students commented on the ability to "know the newest knowledge and to know what the scientists are doing!" "Speakers shared the most updated information—I feel very informed." "The different instructors with different backgrounds made the course very interesting." On "how you would improve this course," students mentioned the need for a textbook or another reference and again mentioned some frustration with the videoconference delivery.

Table 2
Texas A&M University – Kingsville Student Evaluation Results

Question	*Rating*
This course promotes a challenging learning environment for students.	4.86
This course inspires high academic standards and goals in students.	4.71
An atmosphere of mutual respect and civility is encouraged in this course.	4.86
The subject matter in this course is presented in a clear and organized manner.	4.71
Tests and other requirements cover the course material as stated in the syllabus.	4.86
The grading system outlined in the syllabus is followed.	4.71
The instructor is accessible outside of class.	4.86
Lectures and discussions focus on the material outlined in the syllabus.	4.86
The results of tests and assignments are returned in a reasonable time.	4.86
The textbook(s) and/or other required materials contribute to my understanding of the subject.	4.86
Students are offered help and encouragement in this course.	4.71
A student's ability to think (analytically, critically, creatively, etc.) is enhanced by the experience of this course.	4.86

Discussion of Results

Evaluation data are commonly used in the constant revision, refinement, and improvement of courses. Embracing Farhad Saba's view of a "systems theory of distance education," researchers should consider the complexity of educational research and the use of a variety of data sources. In order to capture the effectiveness of distance education as a delivery system when teaching complex content to a diverse audience, a variety of formative and summative data collection procedures were used. Although the overall student response rate was low with weekly collection, the researchers needed to "snapshot" individual speakers/topics for course evaluation. We also needed to separate ineffective teaching techniques from the technology delivery system and determine if there were differences in these perceptions based upon locations.

Based upon the course objectives, students acquired interdisciplinary knowledge related to the effect of fruits and vegetables on human health, interdisciplinary career choices, and the relationships between research findings and the practical use of phytochemicals. Distance education served as an effective dissemination tool for the course content. Student numerical ratings and comments support these findings. In comparing data at different site locations and standard course evaluation for this course compared to other horticulture graduate courses delivered in a "traditional format," there was no difference in student outcomes and attitudes about the course. Although there were some technical difficulties, distance education was not a barrier to learning.

Table 3
Texas A&M University – College Station Student Evaluation Results

Question	*Rating*
I would take another course from this professor.	4.14
The instructor was consistently well prepared and well organized for class.	4.00
The exams/projects were presented and graded fairly.	4.71
Help was readily available for questions and/or homework outside of class.	4.29
The instructor stimulated my interest in the subject.	4.14
The instructor had a thorough knowledge of the subject.	4.29
The instructor kept students informed of their progress	4.43
The instructor treats students with respect.	4.57
Reading assignments and homework contributed positively to the learning experience.	4.57
I learned to apply principles from this course to new situations.	4.57

Implications & Recommendations

While this project was funded through a USDA Challenge Grant, what elements can be transferred to other courses delivered via distance education? One part of evaluation is sharing "lessons learned" and developing strategies to solve, or resolve, these issues.

Even with all the training and logistical planning provided to develop and deliver this course, reliance on presenters to provide appropriate visuals for videoconferencing was a problem. Because of copyright/intellectual property issues with "cutting edge" research, the presenters were concerned about including all the data slides on the course Web site. The team decided to exclude certain slides and this caused greater frustration and confusion for the students because the slides were not "in order." Now that we have the "content" collected and permission granted on course materials, we plan to re-format for distance education delivery and develop more Web-based/CD-ROM components to the course. This should help correct many of the transmission difficulties due to videoconferencing to multiple locations. We also plan to include fewer speakers and less didactic instruction, to allow more time for discussion and application/synthesis of the content.

The data-gathering procedures on-line worked well. In the future, we will not need weekly formative evaluation (perhaps only once or twice during the semester) and that should improve the number (and consistency) of responses. Having undergraduate, graduate, and continuing education students together was a challenge, but also provided a unique perspective to course content. We intend to continue to advertise the course to a diverse audience, but will require some pre-requisites or background reading and/or textbook to help provide a context for the course.

Regardless of the content being delivered, can agricultural educators help define the "prescriptive principles" for effective use of distance education? Here are some recommendations based upon our course evaluation to start this dialogue:

1. METHODS: It is not the *media* that makes the difference, it is the *methods* employed. "Students learning at a distance have the potential to learn just as much and as well as students taught traditionally" (Schlosser & Anderson, 1994). The students enrolled in *Phytochemcials* learned the course material and met the course objectives. Because of the nature of the content and guest speaker approach, this course primarily used lectures with supplemental visuals. Our profession needs to determine the *most effective* instructional methods for teaching agricultural content at a distance.
2. INSTRUCTIONAL DESIGN: This course used a multi-instructor, multi-site, multi-media format. Agricultural educators can help other content areas within our colleges and universities to design distance learning experiences that will maximize learning. We know that *interactive* environments improve retention and transfer. Our profession can be the leader in the design and adoption of student-centered instructional design models appropriate for distance education and other forms of experiential learning.
3. ASSESSMENT STRATEGIES: The educational evaluation technique, with both numerical means and open-ended responses, provided appropriate feedback for the revision and improvement of this course. By collecting data throughout the course or program, and asking questions that were content specific as well as "technology" specific, the researchers were able to separate knowledge/skills acquisition from the distance education delivery system. Our profession needs to develop appropriate evaluation and outcome assessment mechanisms to determine "effectiveness" of delivery strategies.
4. TEAM APPROACHES: Teaching at a distance takes more preparation/development time and expertise. Our team included the logistical leader (planning the content and speakers), a dissemination specialist (designing the course Web site), and an evaluation specialist (designing and collecting the on-line data). Our profession needs to continue to embrace team approaches and help to design distance education "templates" that improve effectiveness and *efficiency*.

In conclusion, the most beneficial component of the course was the diversity of speakers/presentations and the relevancy of research applications to undergraduate, graduate, and continuing education students. Only through distance education was this approach possible. The initial evaluative results were useful for the future revision of this course and can be applied to other courses and programs.

This evaluative study highlights numerous challenges facing our profession. Agricultural educators can become the leaders in methodologies for the effective and efficient design, delivery, and evaluation of distance education as a conduit for agricultural and life sciences content.

References

Borg, W. R. & Gall, M. D. (1989). Educational research. New York: Longman.

Clark, R. E. (1983). Reconsidering research on learning from media. Review of Educational Research, *53*(4), 445-459.

Coldeway, D. O. (1988). Methodological issues in distance educational research. The American Journal of Distance Education, *2*(3), 45-54.

Darby, W. J., Ghalioungi, P. & Grivetti, L. (1977). Food: The gift of Osiris. New York, NY: Academic Press.

Fahey, J. W., Zhang, Y. & Talalay, P. (1997). Broccoli sprouts: An exceptionally rich source of inducers of enzymes that protect against chemical carcinogens. Proceeding of Nationlal Academic Science 94, 10367-10372.

Glaser B. G. & Strauss, A. L (1967). The discovery of grounded theory. Chicago: Aldine.

Hanna, D. E. (1999). Higher education in an era of digital competition. Madison, WI: Atwood Publishing

Kohman, E. F. (1947). The chemical components of onion vapors responsible for wound healing qualities. Science, *106*, 625-627.

Lincoln, Y. S. & Guba, E. G. (1985). Naturalistic inquiry. Newbury Park: CA: Sage.

Munoz, K. A. Krebs-Smith, S. M., Ballard-Barbash, R. & Cleveland, L. E. (1997). Food intakes of US children and adolescents compared with recommendations. Pediatrics, *100*(3), 323-329.

National Research Council. (1989). Everybody counts. Washington, D.C. National Academy of Sciences.

Potter, J. D. & Steinmetz, K. (1996). Vegetables, fruit and phytoestrogens as preventive agents. IARC Sci Publication, *139*, 61-90.

Russell, T. L. (1996). The "no significant difference" phenomenon. Research Reports, Summaries, Papers. Raleigh, NC: Office of Telecommunications, North Carolina State University.

Saba, F. (1999). Toward a systems theory of distance education. The American Journal of Distance Education, *13*(2), 24-31.

Schlosser, C. A. & Anderson, M. L. (1994). Distance education: Review of the literature. Research Institute for Studies in Education. Ames: Iowa State University.

Smith, P. L. & Dillon, C. L (1999a). Comparing distance learning and classroom learning: Conceptual considerations. The American Journal of Distance Education, *13*(2), 6-23.

Smith, P. L & Dillon, C. L. (1999b). Toward a systems theory of distance education: A reaction. The American Journal of Distance Education, *13*(2), 32-36.

Stake, R. E. (1967). The countenance of educational evaluation. Teachers College Record 68, 523-540.

U.S. Department of Health and Human Services (1988). A report of the Surgeon General on health and nutrition. DHHS publication no. (PHS) 88-50210. Rockville, MD: U.S. Public Health Service.

Commission of Life Sciences (1982). Diet, nutrition and cancer. National Academy of Sciences, Washington, D.C.

An Evaluation of a Multidisciplinary Course Delivered at a Distance: Prescriptive Principles to Challenge our Profession

A Critique

Michael K. Swan
Washington State University

Contributions and Significance of Research

The results of this study give us the opportunity to ask some tough questions concerning the use of distance education or distance delivery in course delivery. Offering courses via distance delivery is not an inexpensive mode but a mode that takes time and resources away from other areas within the university. Another tough question is the "quality" issue as it relates to course content and structure. As pointed out in the research paper quality and rigor are often mentioned as factors as to why not to offer distance delivered courses.

Procedural Considerations

This evaluative research study was well designed and conducted in meeting the researchers purposes and objectives. It was evident from examining the related literature that a limited amount of research is available to adequately defend the use of distance education in many situations. Adequate evaluative methods utilized in the study were appropriate for this research study.

Questions for Consideration

Are faculty being offered training on how to properly and efficiently develop courses for distance delivery? If so, are administrators and students alike being instructed on how to properly access and utilize materials from a distance? Do students have access to additional resources when taking distance delivered courses at your university? If so, what are these and how often are they accessed?

In the three studies from Texas I have some questions that need to be answered concerning your infrastructure. As you are delivering the courses via distance delivery techniques has your university structure changed to accommodate the needs of distance delivery? Such things as personal communication tools and applications, network of networks for web based courses or web based campus, dedicated servers and software applications for distance delivery, and software applications and services for those away from your campus structure. Just how has the physical campus infrastructure changed to accommodate the use of distance delivery of courses?