Perceived Benefits and Response to Instructional Technologies Used in Agribusiness Courses at Arkansas State University.

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Abstract

This study evaluates various instructional technologies or teaching aides presented to Arkansas State University agribusiness students to determine which were perceived as most beneficial in learning materials in agribusiness courses. Student perceptions of effective learning – greater classroom experiential learning, easier understanding of teaching materials, and higher performance in examinations – was measured comparing test scores and students' evaluations of teaching (SET) data at the end of each semester from Spring 1998 through Fall 1999. Results show that instructional technology plays a positive role in facilitating student learning and academic performance.

Introduction

The way instructional material is delivered affects the way students deal with it. As active participants in the learning process, students must have a sense of ownership of the learning goals and be both willing and able to receive instructional messages (Savery and Duffy, 1995). The effort students will invest in this learning process depends on the relevance of both the medium and the content or material that it contains.

The use of instructional technologies as teaching aides in institutions of higher learning is regarded by many educational researchers as an effective method of increasing students classroom learning and academic performance (Cummings, 1995: DeSieno, 1995: Sargeant, 1997). Instructional technology is rapidly emerging as an important component of teaching and learning in Arkansas State University's College of Agriculture.

Like many researchers (DeSieno, 1995; Farrington, 1997), the College of Agriculture believes that instructional technologies will apply pedagogy more effectively, improve instructional delivery, reduce the time required for students to master new concepts, and improve student performance. In the Fall of 1998 the ASU college of Agriculture introduced instructional technologies to assist in delivering teaching materials- multimedia, internet, distance education, etc. and furnishing some classrooms with mobile instructional equipment (carts with computers, video cameras, projection equipment, VCRs and televisions). Since Spring 1999, these classrooms were equipped with permanent multimedia instructional stations. In spite of the placement of the teaching equipment, the Agribusiness Department did not know the extent to which these directly influencing students learning. A parallel question faced by the College as a whole was whether the use of instructional technology in agribusiness courses be a model for the College's other agricultural courses?

Various studies have examined the factors that influence students' stock of knowledge. Stock of knowledge refers to the amount of understanding at a specific point of time, whereas learning or improvement in knowledge represents the level of knowledge gained over a period of time (Siegfried, 1979). The measures used must relate to the expectations of the instructional technology. To evaluate the effect of these technologies on student performance or knowledge gained in agribusiness courses at ASU, the study compared students' classroom test scores and students' evaluation of teaching (SET) data taken at the end of each semesters from Spring 1998 through to Fall 1999.

Although it can be argued that the test scores and SETs do not accurately or fully explain what students learn, the reality is that these are the only evaluation measures available during the study period. Moreover, these measures can uncover useful results. Many studies on test format give conflicting results. Some studies indicate that men perform statistically better than women on multiple choice exams (Gohmann and Spector, 1989; Watts and

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Lynch, 1989), while on essay exams women outperform men (Ferber et al., 1983; Lumsden and Scott, 1987). Other studies (Rhine, 1989; Williams et al., 1992) showed no significant difference in exam performances due to gender. To overcome these conflicting results, the study used both multiple choice and essay questions in all the tests. SET instruments are commonly used in higher education to assess quality of instruction, including the delivery and understanding of teaching materials and other aspects of a course. SET reports can assist instructors adopt instructional technologies or other teaching methods to improve instruction (Worley and Casavant, 1995; Boice, 1991).

Materials and Methods

Study Period

To provide a context for assessing the impact of instructional technology on students learning improvement, two kinds of teaching were compared - conventional lecture method (Phase I) versus teaching with instructional technology (Phase II). Data were collected in Spring 1998 and Fall 1998 semesters (Phase I), and in Spring 1999 and Fall 1999 semesters (Phase II). These terms were targeted because all the selected courses in the study were taught in both periods. This arrangement allows some perspective on student improvements in knowledge or learning over these semester periods.

Courses and Instructor Selection

The agribusiness courses selected for this study were Agricultural Marketing (AGEC 3003), Agriculture Sales (AGEC 3063), International Commodity Marketing (AGEC 4023), and Marketing Specialty Agricultural Products (AGEC 3043).

The Agribusiness faculty agrees that instructor's personality does influence students learning and performance even when teaching materials are delivered through instructional technologies. To minimize this effect for this study, only one instructor teaching three or more of the targeted courses was selected. This instructor was also chosen because he uses all the instructional technologies available at the College, usually as presentation software (PowerPoint, the Internet and the Word Wide Web, videos, overhead projections, and other software, and audio-visuals).

A recent study to determine effective technology applications concludes that "any technology integration requires that teachers engage in rethinking, reshifting, and reshaping their curriculum" (Means, 1993). The instructor redesigned his teaching material to incorporate multiple technologies, and he incorporated as teaching aides hands-on activities utilizing community resources such as agribusiness firms. Invitations were extended to their representatives to teach in the classroom. In this way students were able to acquire experiential learning outside the class through direct contact with local agribusiness industry representatives, farmers and farmers associations, bankers, and student-student interaction in projects. These hands-on activities were utilized to a greater extent in Agricultural Sales and Marketing Specialty Agricultural Products than in the other two courses selected for this study.

Data and Evaluation Process

The study was a descriptive survey design, with a population of 317 students enrolled in AGEC 3003, AGEC 3043, AGEC 3063, and AGEC 4023 for four (4) semesters as shown in Table 1. About 53 percent of the students involved in this study took the agribusiness courses in both Phases I and II.

Evaluation measures of instructional technology might be found in student perception of the implementation, quality and benefits of the technology and in the student perceptions of their level of engagement and satisfaction. However, lack of systematic direct student engagement, satisfaction or performance measures is one of the study's major limitations. Instructional technology in agribusiness courses at ASU is fairly new. As a result, no performance-based standards of measure exist for assessing the effectiveness of student learning from instructional technologies. No other direct measures of student learning are presently available. To compensate for this limitation, the study used a triangulation process in which the effectiveness of the instructional technology is measured from multiple perspectives, particularly SET surveys, other surveys and interviews, comparisons of student performance in multiple choice and essay tests, and selected student work samples. Each individual data source would be limited, but collectively the evidence may be persuasive if they are consistent with one another.

Results and Discussion

When asked to summarize their preferences during classroom surveys, the respondents overwhelmingly (67 percent) indicated their preference for technology instruction over conventional lecture method.

Average multiple choice and essay test scores of 82.6 and 82.0 respectively received in Phase II are relatively higher than those (78.3 and 78.6) received in Phase I (Table 2). The implication is that multiple instructional technologies supported by hands-on activities utilizing community resources as teaching aides allow students to learn better than relying on exclusively on conventional lecturing methods.

The test scores in Phase II are statistically higher for Agricultural Sales (AGEC 3063) and Marketing Agricultural Specialty products (AGEC 3063) than for the other agribusiness courses in the study. These two courses relied more on community-based resources as teaching aides than did the other courses. The implication is that these supports of technology instruction methods – educational visits to local firms and the visits of their representatives to classes - improved students learning.

Table 1. Students Enrollment in Agribusiness Courses in the College of Agriculture (1998 – 1999)

	Conventional Lecture-Phase I		Technology Instruction-Phase II		
	Spring 1998	Fall 1998	Spring 1999	Fall 1999	Total
AGEC 3003	40	0	36	25	101
AGEC 3043	23	0	33	0	56
AGEC 3063	0	34	0	40	74
AGEC 4023	32	31	23	0	86
Total	95	65	92	65	317

Table 2. Comparison of Student Test Performance from Teaching Techniques

	Conventional Lecture (Phase I) Multiple Choice Test Scores					Technology Instruction (Phase II) Multiple Choice Test Scores				
	N	Mean	δ^y	CV^z	R	N	Mean	δ^y	CV^z	R
AGEC 3003	40	79.3	15.9	0.20	24	61	81.2	9.7	0.12	22
AGEC 3043	23	78.4	14.1	0.18	26	33	83.5	13.7	0.17	23
AGEC 3063	34	77.2	13.1	0.17	21	40	84.6	10.5	0.13	19
AGEC 4023	63	78.3	12.5	0.16	25	23	81.2	12.2	0.15	20
Comp. Mean	40	78.3	14.1	0.18	24	39	82.6	12.1	0.15	21
		Essay Tests Scores					**Essay Tests Scores**			
AGEC 3003	40	79.4	15.1	0.19	22	61	80.1	12.0	0.15	19
AGEC 3043	23	79.1	18.2	0.23	25	33	82.7	16.1	0.20	21
AGEC 3063	34	78.3	16.4	0.21	24	40	83.9	13.1	0.16	19
AGEC 4023	63	77.6	14.7	0.19	21	23	81.4	10.6	0.13	19
Comp. Mean	40	78.6	16.5	0.21	23	39	82.0	12.9	0.16	20

[z]Coefficient of variation
[y]Standard of deviation

Combining the standard deviation with the coefficient of variation provides insights into the teaching method which improved the knowledge or learning of most agribusiness students over time. Multiple choice and essay test scores in Phase I have relatively larger standard of deviations and coefficient of variations than those in Phase II (Table 2). Mean standard of deviation and coefficient of variation in Phase I are 14.1 and 0.18 respectively for multiple choice, and 16.5 and 0.21 respectively for essay test scores. Standard deviation and coefficient of variation in Phase II are 12.1 and 0.15 respectively for multiple choice, and 12.9 and 0.16 respectively for essay test scores. The low degree of variability in Phase II suggests that more agribusiness students gained learning in Phase II than in Phase I.

Gender analysis of the test scores in Phase I revealed that generally women performed better than men in both multiple choice and essay tests (disagreeing with much of the literature earlier). However, in Phase II, men performed better than women in multiple choice tests while women performed better than men in essay tests (consistent with earlier research). Perceptions held by Agribusiness students regarding benefits from Phases I and II of the study are reflected in Table 3.

Overall, significant differences existed between the means of Phases I and II (Table 3). The implication is that, in general, students expressed more positive benefits from instructional technologies than from conventional lectures. Positive differences in means were evident for all categories except three ("Encouraged students to ask ideas", "Encouraged thinking by asking probing questions", "Teacher-

Table 3. Comparisons of Perceived Benefits From Student Evaluations of Teaching (SET)[z]

	Conventional Lecture (Phase I)		Technology Instruction (Phase II)		
	Mean	Std. Dev	Mean	Std. Dev	Diff[y]
THE INSTRUCTOR....					
Used a variety of teaching methods	3.1	0.65	4.8	0.58	+1.7
Has ability to get ideas across effectively	4.1	0.71	4.8	0.57	+0.7
Was an effective lecturer	4.0	0.65	4.5	0.62	+0.5
Used examples to simplify complex concepts	4.1	0.77	4.5	0.60	+0.4
Challenged me to reach high standards	4.0	0.79	4.5	0.64	+0.5
Was well prepared for class	3.9	0.67	4.5	0.59	+0.6
Stimulated my interest in the subject matter	3.7	0.83	4.3	0.66	+0.6
Was concerned with student learning	3.8	0.88	4.2	0.70	+0.4
Was sensitive to student progress	4.0	0.69	4.0	0.73	+0.0
Provided constructive feedback	3.9	0.81	4.0	0.79	+0.1
Encouraged students to ask ideas	3.9	0.79	3.8	0.77	-0.1
Encouraged thinking by asking questions	4.0	0.86	3.9	0.88	-0.1
Was willing to assist students outside classroom	3.7	0.84	3.8	0.81	+0.1
THE COURSE					
Increased my knowledge of the subject	4.1	0.68	4.4	0.61	+0.3
Was well organized	4.0	0.83	4.5	0.68	+0.5
Objectives were clearly stated at start of course	3.9	0.89	4.1	0.81	+0.2
Assignments contributed to course objectives	3.8	0.91	3.8	0.87	+0.0
OTHERS					
Understanding of teaching materials	4.0	0.66	4.5	0.64	+0.5
Teacher-student interaction	4.1	0.79	3.7	0.79	-0.4
Student-student interaction	3.8	0.82	4.1	0.68	+0.3

[z] Scale:1 = strongly disagree; 2 = disagree: 3 = undecided; 4 = agree; 5 = strongly agree
[y] Difference between conventional lecture and technology instruction means

student interaction"). The negative mean difference in the "Teacher-student interaction" indicates that students on average agree that the conventional lecture (Phase I) offers more teacher-student interaction than instructional technology (Phase II), probably because Phase II encouraged student-student interaction in projects and the interaction of community resources and other hands-on experiential learning activities that required less instructor direction.

The comparison of the standard deviations with the means provides insights into the proportion of students and their level of agreement on their responses to the SET questions posed. Student responses to SET questions in Phase II consistently registered higher means and lower standard of deviations than in Phase I, indicating a lower degree of variability in Phase II than in Phase I (Table 3). This lower degree of variability in Phase II suggests that in general the level of agreement on the positive benefits from the two study periods is higher among most students in Phase II than in Phase I.

The Instructor

The data analysis revealed that most students strongly agree (mean 4.8) that Phase II used more variety of teaching methods than in Phase I (3.1 mean). Furthermore, the variety of teaching methods in Phase II enabled the instructor to use greater range of examples to simplify complex concepts in Phase II (4.5 mean) than in Phase I (mean 4.1). Most students also felt that Phase II provided the instructor the ability to get ideas more effectively across than in Phase I, and as a result stimulated their interest in the subject matter more in Phase II (4.3 mean) than in Phase I (3.7 mean). The combination of positive benefits available in Phase II made students strongly agree that the instructor challenged them to reach higher standards in Phase II than in Phase I. Most student also agreed that the instructor was better prepared in Phase II (4.5 mean) than in Phase I (3.9 mean) and therefore the instructor was more effective in the classroom in Phase II than in Phase I. Interestingly, most students felt that instructional technologies used in Phase II was equally sensitive to student progress as conventional lecture used in Phase I.

The Course

Most students did not believe that assignments given in both Phase I or Phase II contributed significantly to course objectives (mean 3.8 in both Phase I and Phase II). However, students revealed that course objectives were more clearly stated in Phase II (mean 4.1) than in Phase I (mean 3.9). More students in Phase II also believed that delivering agribusiness courses with various technologies (mean 4.5) enabled courses to be well organized than did students in Phase I which relied on conventional lectures (mean 4.0). A greater number of students agreed that their knowledge of the subject matter increased more in Phase II (mean 4.4) than in Phase I (mean 4.1). This is probably the result of the effective organization and delivery of agribusiness courses in Phase II period.

Others

Most students believed that teacher-student interaction did not significantly improve in Phase II (3.7 mean) over Phase I (4.1 mean). However, students agreed that student-student interaction improved more in Phase II than in Phase I. The implication is that the use of multiple instructional technologies increased opportunities for student-student interaction. Similarly, the mean score of 4.5 in Phase II compared to 4.0 in Phase I indicates that instructional technology helped students understand materials better than they did in Phase I.

Summary

Teaching outcomes in agribusiness courses generally benefit from the use of instructional technology, which shifts the more traditional approach to a more students-centered one. Through a variety of evaluation instruments, the study found consistent evidence that instructional technology plays a positive role in facilitating students learning, attitudes and academic performance. The combination of student interactivity with multiple technologies (videos, computer, telecommunications, etc) supported by community-based resources as teaching aides, leads to improved student performance and satisfaction with the academic experience. The preceding findings suggest that the effectiveness of instruction varies as a function of course content and medium of instructional delivery. These results from agribusiness courses do in fact provide a model for the College of Agriculture as a whole.

The study has shown that student achievement outcomes in agribusiness courses can be improved by integrating technology in delivering course materials. Therefore, incorporation of technology in instruction can provide agribusiness instructors with the opportunity to collaboratively construct new visions for teaching and learning. However, the ability of agribusiness instructors to foster such changes depends significantly on training which prepares them to integrate technology into content specific instructional methods.

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Animal and Plant Metabolism - Self-test for Chapter 2, set #1
August 31, 2000

Points missed _____ Points out of 20 points _____

1) What are three macromolecules or cellular component whose proper shape is dependent on the presence of water?
   a _____ (1pt)
   b _____ (1pt)
   c _____ (1pt)

2) What are the three primary functions of water in biological systems
   a _____ (1pt)
   b _____ (1pt)
   c _____ (1pt)

3) It was stated in class that life on earth can be thought of as being based on two substances. One is an element and the other is a compound. What are they
   a _____ - based (1pt)
   b _____ - based (1pt)

4) Water is a polar compound. What does that mean?
   a _____
   _____ (3pt)

5) What two elements make a water molecule and which one has a partial negative charge with it when it is part of the water molecule?
   a _____ (1pt)
   b _____ (1pt)

6) In the liquid state, water molecules are loosely held together by what kind of bond? _____ _____ (1pt)
7) How many water molecules are loosely held to one water molecule by these bonds? _____ _____ (1pt)
8) When water freezes, are these bonds longer or shorter? _____ (1pt)
9) When water is a solid, are these bonds rigid or somewhat flexible? _____ (1pt)
10) When water is a liquid are these bonds rigid or somewhat flexible? _____ (1pt)
11) When water is a gas are these bonds rigid or somewhat flexible? _____ _____ (2pt)