"This is a good first draft, now clean up the mechanical errors"; "What is meant here"; "Who does this pronoun refer to"; "You need extra help with transitions" (paraphrased from 12).

A short cut to all of this is to use straight horizontal or vertical lines to mark good passages and wavy lines for sections that require additional work.

Summary

There are three major fears that we have of incorporating more writing in our courses. One, it will detract from subject matter content by taking time away from an already cramped schedule. Two, it takes skill that I don't have to evaluate writing. And three, it takes time that I don't have. These barriers are really a figment of our imaginations. Students learn better if they write; you can tell the difference between good and poor writing, and there are efficient ways of getting feedback to students.

Initially it will take effort to incorporate meaningful writing assignments and to design grading and evaluating techniques that will provide helpful feedback to students. Change takes effort. But isn't it a question of priorities? We owe it to our students and profession to enhance student communication skills.

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New Format

Farm Equipment Operations Course

James W. Rumsey

Introduction

As more of our university agricultural students come to us with a lack of on-farm experience or background, the need for hands-on courses in agricultural practices has become increasingly important (Mortensen, 1981; Mayer, 1980; Vorst, 1979). The ability to learn farm equipment operation unquestionably has positive benefit to agricultural students with little or no farm experience. This paper will address the author's experience in developing a farm equipment operations course. Specific attention will be given to the objectives of the course, course format and content, course facilities and equipment, student comments and responses to the course and currently planned new developments for the course. In keeping with an educational philosophy of preparing students for management and decision-making, the course was expanded in an attempt to expose students to facets of day-to-day management of farm machinery. Through a combination of in-field lectures and field laboratory exercises, the course has also been expanded to include farm machinery operation, components, types, set-up, field adjustment, uses, maintenance and troubleshooting.

Background

The agricultural practices courses were begun on the U.C. Davis campus nearly 35 years ago. Throughout the years the field equipment operation course has been taught during the fall and spring and the field equipment maintenance course has been taught during the winter months. The still existing farm shop and tractor storage sheds were built by the first classes of students. Facilities also include 38 acres of ground that is exclusively used for the course. The soils are a Yolo loam and a Reiff loam. Both soils are mapped as Class I soils and both have a Storie Index of 98.

We currently have 7-row crop wheel tractors and 2 crawler tractors. In addition, we have a mounted, 3-

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bottom 2-way plow, a mounted 3-bottom plow, two 2.9 m (9.5 ft) right-hand offset transportable disc harrows, a towed right-hand vineyard disc, a spring- and spike-tooth harrow, a mounted ditcher, a 3.0 m (10 ft) roller, a lister, bed shaper, two subsoilers, a 3.0 m (10 ft) landplane, a hay rake, a disc ridger, a cutterbar mower, two 2.4 m (8 ft) grain drills and a four-row corn planer. Additionally, the farm shop is equipped with a typical complement of hand and power tools including both gas and electric arc welding set-ups. Routine maintenance and routine repair jobs can be handled on site.

Enrollment and Funding

Course Enrollment

The new course format was initiated in the spring quarter of 1984. The course has been taught a total of 4 quarters (spring and fall of each year) since that time. Although pre-1984 course enrollment trends were decreasing as is consistent with general enrollment trends in the College of Agriculture and Environmental Sciences at U.C. Davis, the enrollment under the new course format has increased from 111 students (total of spring and fall quarters in 1984) to 136 students (total of spring and fall quarters of 1985). Several more years of data will be required to determine if this trend is positive or not.

Course Pre-Requisites and Student Demographics

There are neither pre-requisite courses nor experience requirements for the course. A recent survey of students enrolled in the course indicated that 71 percent of the students had no farm experience and only 39 percent of the students had more than one summer's experience on a farm. A three-year survey indicates that between 35 and 40 percent of the students are female. The percentage of graduate students has ranged between 9 and 21 percent during the same time period.

Class enrollment is limited to 18 students per 3-hour laboratory period. The limit is imposed because even with modification the seating on each of the nine tractors can only carry two students.

Course Funding and Costs

The course is funded entirely (exclusive of professorial salary) out of an endowment fund. The Fred H. Bixby Fund provides approximately $18,000 per year for this field equipment operations course as well as an equipment maintenance course taught during the winter quarter. These funds have been more than adequate to cover all materials, supplies and student teaching assistants for the course. Excess funds are accumulating as a reserve for new and replacement equipment purchases. As a result of the fund, no student laboratory fees are required for the course.

The course also returns approximately $100 per student in instructional and research funds to the parent (Agricultural Engineering) department. Because of these two major funding sources, a cost/benefit analysis for the course has not been conducted, nor has there been pressure or interest from the administration to do so.

Course Programmatic Objectives

Three programmatic course objectives have been followed in the development of the course. These are: 1) farm equipment operation; 2) farm equipment operational management; and 3) farm equipment decision-making. Table I lists the three programmatic course objectives along with a more detailed statement of what is to be accomplished within each objective.

Table I. Programmatic Course Objectives

I.	**Farm Equipment Operation**	
	A.	Farm equipment types, components and terminology
	B.	Operation of farm tractors
	C.	Operation of farm field equipment
	D.	Safety and accident prevention
II.	**Farm Equipment Operational Management**	
	A.	Farm Equipment set-up
	B.	Field adjustment of farm field equipment and tractors
	C.	Scheduled maintenance of farm field equipment and tractors
	D.	Troubleshooting of farm field equipment and tractors
III.	**Farm Equipment Decision-making**	
	A.	Uses and strategies for use of farm equipment
	B.	Tillage systems and tillage sequences
	C.	Specifying a tractor for acquisition

The farm equipment operation component of the course is designed to give students hands-on operating experience with the farm machinery that is currently available. Farm equipment operation includes farm equipment types, components, terminology, operation of farm equipment and safety and accident prevention.

Farm equipment operational management stresses those items that the student should be aware of to assure proper field operation and maintenance of farm machinery. The students are made aware of and are expected to perform farm equipment set-up, perform field adjustments of equipment and tractors if and when needed and be aware of and perform scheduled maintenance when required. Students are made aware of troubleshooting charts for farm equipment and tractors and, on occasion, are expected to perform troubleshooting activities.

Farm equipment decision-making is an objective that attempts to make the student aware of the various uses and strategies for use of farm equipment. In conjunction with this objective, tillage systems and common tillage sequences are discussed and used in laboratory exercises. Students are also taught details of how to specify a tractor for acquisition as well as specifications for fuel and oils.

Course Content

Due to the variety of subjects covered in the course, no one textbook has been found suitable. Therefore, lecture notes in an outline form are provided each student. Laboratory exercises are also provided to each student in written form. Called Laboratory Activity Packets (or LAPS), the LAP provides the student an introduction to the exercise, equipment used in the exercise and instructions to perform the exercise.

Table II. Topical Outline To Meet Programmatic Course Objectives

I. **Farm Equipment Operation**
- A. Farm equipment types, components and terminology
  - 1. Tractors
    - a) Crawler tractors
    - b) Wheel tractors
- B. Operation of farm tractors
  - 1. Using the operator's manual
  - 2. Pre-starting maintenance and safety checks
  - 3. Refueling
  - 4. Starting the tractor engine
  - 5. Selecting tractor speed, engine rpm and gear
  - 6. Tractor driver responsibilities
  - 7. Starting tractor movement
- C. Operation of farm field equipment
  - 1. Primary tillage equipment
  - 2. Secondary tillage equipment
  - 3. Cultivating tillage equipment
  - 4. Row crop planters and grain drills
- D. Safety and accident prevention
  - 1. Tractor ROPS
  - 2. Farm tractor fatality statistics
  - 3. Accident prevention

II. **Farm Equipment Operational Management**
- A. Farm equipment set-up
  - 1. Tractors
    - a) Wheel tread adjustment
    - b) Tractor weighting
    - c) Hitching/attachments
  - 2. Farm field equipment
    - a) Calibration
    - b) Performance adjustments
- B. Field adjustment of farm field equipment and tractors
  - 1. Performance adjustments
  - 2. Measuring field speed
  - 3. Measuring and estimating tractor wheel slip
- C. Scheduled maintenance of farm field equipment and tractors according to operator's manual
- D. Troubleshooting of farm field equipment and tractors
  - 1. Operator's manual troubleshooting charts

III. **Farm Equipment Decision-making**
- A. Uses and strategies for use of farm equipment
  - 1. Generic actions of farm field equipment
  - 2. Typical uses of farm field equipment
  - 3. Machinery capacities
  - 4. Selecting implements and 2-wheel tractors from a power requirement standpoint
- B. Tillage systems and tillage sequences
  - 1. Tillage definitions
  - 2. Tillage objectives
  - 3. Tillage systems
  - 4. Typical tillage sequences for Northern California row and field crop farming
- C. Specifying a tractor for acquisition

Table II presents a topical outline based upon programmatic course objectives from which course lectures were developed. The scope of the farm equipment used in the outline is restricted to that which is currently available in the course inventory. The specific lecture sequence used in the course is presented in Table III. The last lecture period in the 10-week course was used to administer a final written exam.

Table III. Lecture Sequence

Lecture	Lecture Topic
1	Starting and Operating the Farm Tractor
2	Tractor Set-up and Hitching
3	Tillage Objectives and Systems
4	Field Equipment Actions, Functions, Adjustments and Operation (Part I)
5	Field Equipment Actions, Functions, Adjustments and Operation (Part II)
6	Field Equipment Actions, Functions, Adjustments and Operation (Part III)
7	Planters and Planting
8	Machinery Capacities, Miscellaneous Calculations and Estimating Tractor Power Requirements
9	Tractor Engine Components, Operation and Routine Maintenance
10	Final Exam

Table IV presents a listing of laboratory exercises in the order that they are to be accomplished by the student. The exercises are normally designed to be accomplished by two students. The general flow of laboratory exercises is to familiarize students with the operation and set-up of the tractors (weeks 1 through 3); have them perform set-up, hitching, field operation, adjustment and troubleshooting of farm field equipment (weeks 4 through 7); perform routine scheduled maintenance on farm field equipment and tractors

Table IV. Laboratory Exercises

Week	Laboratory Exercise
1	1. Tractor familiarization
	2. Open field driving
2	1. Adjusting front and rear wheel tread
	2. Attaching to a 3-point hitch
	3. Attaching to a drawbar
	4. Attaching to tractor auxiliary hydraulics
	5. Backing and driving course
3	1. Measuring field speed
	2. Measuring wheel slip
4	1. Plowing
	2. Discing
	3. Flail mowing
5.	1. Precision discing and changing the offset position of a right-hand offset disc
	2. Harrowing
	3. Subsoiling
	4. Landplaning
6	1. Cultivating
	2. Listing
	3. Bedding
	4. Pulling a ditch
7	1. Row crop planter set-up and calibration #1
	2. Row crop planter set-up and calibration #2
	3. Grain drill set-up and calibration
	4. Field planting
8	1. Spark plug inspection, cleaning and adjustment
	2. Changing oil and the oil filter
	3. Lubricating the tractor and implements
	4. Air cleaner inspection and maintenance
	5. Battery inspection and maintenance
9	1. Adjusting valves
	2. Compression test
	3. Vacuum gauge test
	4. Timing the gasoline engine
	5. Distributor check and adjustment
	6. Carburetor adjustment
10	1. Preparation of a seedbed

(weeks 8 and 9); and have them prepare ground to seedbed condition in the last week. This last exercise is designed such that the students must choose equipment and an operational sequence to form the seedbed from stubble covered or weed covered ground.

Student Comments

Student responses to the newly developed course have been solicited. On a course rating scale of 1 to 5 (1=excellent, 2=very good, 3=good, 4=fair, 5=poor), students have rated the course at an average of 1.6, i.e., between very good and excellent. When asked whether students felt that they could apply information and skills learned in the course, 97% of students answered in the affirmative. When asked whether they learned a great deal of new information and skills from the course, 100% of the students responded in the affirmative.

Written comments from students tended to fall into five general areas. Forty-three percent of all students wrote, in effect, that they "liked the hands-on orientation of the course." Eighteen percent of the students liked the "clear and concise lecture handouts." Another 12 percent of the students commented that "the course needs more time to go into more details." Six percent of the students commented that the course "needs more equipment and a better shop facility." Three percent of the students commented that "the course should be required of all College of Agriculture students."

Actions have been taken in response to student comments. The course has recently been changed from a 1 to a 2 unit course. In this format, the student receives a 1 hour lecture once a week. The lecture is followed by a 3 hour laboratory period. This has increased the student's laboratory time from 2 to 3 hours per week.

In response to student comments regarding the need for more equipment, we are in the process of acquiring additional farm equipment. In the short-term, a power incorporator and a small tractor will be acquired. Final negotiations are taking place which will lead to the acquisition of a linear move irrigation system which will be used for both teaching and research activities.

Future Course Developments

Future course developments are currently being planned in two areas. For the existing course the author is planning for additional equipment and the introduction of other agricultural practices.

Several items of equipment will be acquired in the near-term future. In addition to the equipment mentioned in the student comments section of this paper, acquisition of a dry fertilizer rig, a spray rig, a front-end bucket loader and a small combine are planned. With the exception of the front-end loader, acquisition of the aforementioned equipment will round out our inventory so that students are familiar with a complement of equipment that could be used for row or field crop production.

Because an irrigation system consisting of a deep well pump and buried underground pipes with alfalfa valves services the 38 acres dedicated to the course, development of other agricultural practices for the course will center on irrigation management and practices. Table V presents programmatic course objectives for an irrigation practices component of the existing farm equipment operations course. Similar programmatic objectives are used, i.e., irrigation equipment operation, irrigation operational management and irrigation decision-making.

Table V. Programmatic Course Objectives for Irrigation Practices

I.	**Irrigation Equipment Operation**
	A. Irrigation system types, components and terminology
	B. Operation of irrigation systems
	1. Furrow/siphon
	2. Border check
	3. Linear move
	C. Safety and accident prevention
II.	**Irrigation operation management**
	A. Irrigation set-up
	B. Adjustment and control of irrigation systems
	C. Maintenance of irrigation systems
III.	**Irrigation Decision-making**
	A. When to irrigate, i.e., basic irrigation scheduling
	B. How much water to add to the field
	C. Control of tailwater

The irrigation equipment operation component of the course would include irrigation system types, components and terminology. Operation of an irrigation system would mean that students would gain hands-on operating experience with each of the systems.

Irrigation operational management would give students the opportunity to learn how to set-up for irrigation. This would include pulling ditches, making furrows and border checks, setting siphons and setting temporary dams in irrigation ditches. The exercise would also include control of irrigation water, particularly in border check and furrow systems.

Irrigation decision-making would include determination of when to irrigate (basic irrigation scheduling), how much water to apply to the field and control of tailwater.

Summary

A hands-on agricultural practices course in field equipment operation has been developed with three programmatic course objectives used to formulate course lecture and laboratory content: 1) farm equipment operation; 2) farm equipment operational management; and 3) farm equipment decision-making.

Current course content includes operation, components, types, set-up, field adjustment, uses, maintenance and troubleshooting of tractors and farm field machinery. The course is taught in a 1 hour lecture and a 3 hour laboratory format. Nine tractors and a complement of primary, secondary and cultivating tillage equipment as well as row and field crop planters are available. Course facilities include a

farm shop and 38 acres of ground dedicated exclusively for course use.

Student comments concerning the course were used to make course changes. These changes included increasing laboratory time and acquisition of more equipment. Student comments lauded the hands-on nature of the course.

Future course developments are planned in two areas. These are: 1) acquisition of additional equipment and 2) addition of an irrigation practices component to the course.

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Relationship Agricultural Experience and Grades Earned

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The agricultural experience of college students preparing to become vocational agriculture teachers is essential for effective teaching. Moreover, two years or the equivalent of agricultural experience is needed in order to be certified to teach vocational agriculture at the secondary level in Nebraska.

As part of the assessment of this agricultural experience and to help determine if there is a basis for advising students to by-pass basic college courses in agriculture, the study was undertaken.

The problem was to determine the degree of relationship between the type of agricultural experience of junior and senior agricultural education majors and grades earned in selected basic agricultural college courses.

Purposes and Objectives

The specific objectives of the study were:

1. To determine the relationship between agricultural experience and grade earned in Animal Science 101 (Introductory Animal Science and Livestock Evaluation).
2. To determine the relationship between agricultural experience and grade earned in Agronomy 101 (Introductory Crop Science).
3. To determine the relationship between agricultural experience and grade earned for Mech Ag 117 (Metal Working).

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Literature Review

A review of literature found a variety of studies related to the problem. Stufflebeam (1978) found no differences between students reared on a farm and those reared in town in relation to grades earned in an introductory course in animal science. Petermann and Elliott (1964) found that performance in a college freshman botany course was not related to students' secondary school preparation in science or a combination of agriculture and science.

Benton (1964) and Schowengerdt (1971) studied the relationship of rank in high school graduating class and scholastic achievement in college courses. Both found that the rank in the high school graduating class was the single most important predictor of academic success in a college or university.

Two more comprehensive studies utilized regression analysis to predict college academic performance. Stevens and Herburger (1971) studied twenty independent variables. They found that students' personal attributes and backgrounds were of considerable value in predicting academic success in college; i.e., the motivational variables such as an older sibling graduated from college, and father's education level. They found that background employment had no significant influence on college academic grade point average. Knoblauch (1975) studied fourteen predictor variables. He found that high school vocational agriculture courses were important as predictors of performance in agricultural engineering, soil science, and animal husbandry courses. Only 60 percent of the variation, however, was explained using the variables studied.

The literature review was inconclusive in terms of the relationship of agricultural occupational experience to performance in undergraduate college courses.

Methodology

1. Forty-six agricultural education majors evaluated their agricultural occupational experience prior to entering the College of Agriculture. The National Ag Education Competencies Study Report (McClay, 1978), was used as the basis for development of the data collection instrument.
2. Ninety-eight job titles were chosen from the National Ag Education Competence Report, and listed with their supporting skills on the questionnaire. Each respondent was asked to respond to each job title, following the example below:

   In the left column check "yes" if you have had experience in the job title listed. Include experiences learned in vocational agriculture classes.

   For each job title checked "yes," check one column on the left side for each competency. Indicate by checking **strong, average, weak, or no** experience.