

## Methods Used for Teaching Psychomotor Skills in Crop Production

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The psychomotor domain of educational objectives includes motor skill activity, manipulation of materials or objectives, and acts requiring neuromuscular coordination (Krathwohl, Bloom, & Masia, 1964). "When man performs purposeful movement, he is coordinating the cognitive, the psychomotor, and the affective domains" (Harrow, 1972, p. 6). One of the major goals of vocational education is student acquisition of relevant psychomotor skills. Nevertheless, vocational teachers often fail to teach students to perform psychomotor skills, and students are expected to acquire such skills while learning activities are focused only on content and attitude (PaDelford, 1984).

Psychomotor skills are developed through a four-stage process: perception, motivation, imitation, and practice (PaDelford, 1984). When teaching psychomotor skills, merely talking about the skill is not sufficient. Students must see and practice an ordered procedure before psychomotor skills may be acquired (Newcomb, McCracken, & Warmbrod, 1986). Furthermore, retention and transfer of psychomotor skills is highly dependent upon initial skill proficiency (Stallings, 1982).

### Objectives of the Study

The development of psychomotor skills in agricultural production programs, especially in crop production, has presented some specific challenges to teachers. Illinois is a strong agricultural state with nearly every county heavily involved in field crop production (Illinois Statistics, 1986). Although teachers may have recognized the need to help their students acquire essential psychomotor skills in crop production, the extent and nature of this teaching in Illinois agricultural production programs had not been investigated. Therefore, the major purpose of this study was to determine the degree of psychomotor skill instruction in crop production provided by agricultural production teachers in Illinois and the methods reportedly used for this teaching. This article reports on the second element of a broader study (Osborne, 1987) that examined teacher self-reported performance and confidence levels with respect to crop production skills and teaching methods used.

The following research questions provided focus for this portion of the study:

1. What were the self-reported methods used for teaching psychomotor skills in crop production?
2. What was the relationship between methods of psychomotor skill instruction and teachers' skill performance level, confidence level, and selected demographic characteristics?

### Procedures

This descriptive correlational study included as a target population all Illinois agricultural production teachers during the 1984-85 school year. The Annual Directory of the Illinois Association of Vocational Agriculture Teachers (1984) served as the frame for the population (N = 370).

Since the intent of the study was to determine if and how crop production skills were being taught, the initial phase of instrument development consisted of determining the psychomotor skills important in producing the major field crops grown in Illinois. The list of skills was restricted to manipulative skills performed in the production of field crops. Major areas included implement adjustment and maintenance, tractor operation and maintenance, equipment operation and adjustment, and general crop production skills. These skills were identified using a two-step process, which included an extensive literature review followed by face-to-face interviews with two faculty members in the College of Agriculture at the University of Illinois. Since a large number of task analysis studies that identified industrial-validated crop production competencies had been completed in recent years, the researcher felt that the essential skills list could be compiled and accurately updated without further industry review. Also, both faculty members supervised the production of field crops on university farms on a regular basis. One faculty member focused his input on the agronomic phase of crop production, while the other considered psychomotor skills in crop production that involve agricultural mechanization applications. Based upon feedback provided by these faculty members, the researcher concluded that the set of 112 psychomotor skills needed in crop production possessed content validity.

Using the formula suggested by Elliott (1980) to determine the necessary sample size, a simple random sample of 100 teachers, or 27% of the population, was drawn. An accuracy level of 90% and a confidence level of 95% were used in the calculation of sample size. Prior to data collection, the instrument was field tested for clarity with a group of five faculty and graduate assistants in agricultural education. In addition, instrument reliability was assessed using pilot test data obtained from four teachers and new graduate students who had just left teaching. Coefficients of .98 for stability of responses (test-retest) and .98 for the internal consistency (Cronbach's Alpha) of performance level response were calculated.

The instrument was compiled in booklet fashion and mailed to the sample in May of 1985. A postcard follow-up reminder and two additional follow-up questionnaires were mailed during the next six weeks. A total of 81 questionnaires was returned. Since two of the returned questionnaires were incomplete, the data sample included 79 questionnaires, or 79% of the sample. A 20% simple random sample of nonrespondents was drawn for the purpose of examining possible differences between respondent and nonrespondent groups. Demographic data were examined and t-tests were performed, showing no significant differences between the two groups. Thus, the results of the study were considered representative of the target population. Descriptive statistics, including frequencies, percentages, measures of central tendency, and measures of association were used to summarize and analyze the data. Although three of the measures of association involved nominal and interval data, Pearson correlations were used in all cases. When the nominal data represent a true dichotomy, as in this study, Pearson correlation coefficients have been shown to be accurate and sufficient measures of association (Hinkle, Wiersma, & Jurs, 1979).

## Findings

### Characteristics of Teachers

The average teacher in the study had taught 12.4 years, with 51.3% of the teachers reporting less than 10 years of teaching experience. Fifty-eight percent of the teachers indicated that they supervised crop production on land owned or rented by the school. Ninety percent of the

teachers were reared on a farm where field crops were grown. One-half of the teachers currently worked on a farm where field crops were grown. Sixty-six percent of the teachers had completed 4 years of high school agriculture, and the average number of years completed was 3.0.

### Teaching Methods Used

For each of the 112 crop production skills, teachers were asked to report their performance level, ranging from no knowledge (1) to possess mastery (5); their confidence level, ranging from very low (1) to very high (5); and their teaching methods. Each of these scales was assumed to be interval. Teachers were asked to cite all applicable teaching methods contained in the following continuum: (a) did not teach, (b) classroom discussion, (c) field observation, (d) teacher demonstration, and (e) student practice. When teachers circled more than one method, only the highest, or most performance-oriented, method was entered into the data set. This strategy was followed since the intent of the study was to determine how far teachers extend their teaching toward the practice stage. Teachers consistently circled the methods leading up to their highest method circled, so focus on the highest method circled appeared to be appropriate and accurate. This scale of teaching methods was based upon the level of involvement by the student with "did not teach" representing no involvement and "student practice" representing a high level of firsthand experience in performing the skill.

The number of teachers who reported they had provided no instruction of any kind varied considerably from skill to skill. Methods used by teachers who devoted instructional time to crop production skills also varied widely across the 112 skills. However, for only 9 of the 112 skills did 25% or more of the teachers report using student practice. Ten percent or more of the teachers reported using teacher demonstrations as their highest method for only one skill. Furthermore, at least 25% of the teachers reported using field observation as their highest method for only two skills, both dealing with operating combines.

The average percentages of teachers reporting the use of various teaching methods is presented by skill area in Table 1. In general, these results indicated that teachers reported a heavy use of classroom discussion as their teaching approach to psychomotor skill development in crop production. Field observation was used only a small percentage of the time, and a considerable percentage of teachers reported that they gave no instructional time to skill development in these areas.

Further examination of Table 1 indicates that, overall, an average of nearly three-fourths of the teachers (74.6%) reported either not teaching the skill or using classroom discussion and field observation as their highest method of teaching. Only one-fourth of the teachers provided demonstrations and/or student practice in performing the skill.

### Correlational Findings

As described earlier, teachers reported performance levels, confidence levels, and methods used to teach each skill. While the data cannot be included here due to space limitations, teachers were found to report high confidence levels and performance levels. The relationship between these variables and teaching methods used was examined (see Table 2).

Table 1

Most Performance-Oriented Teaching Method Reported by Teachers by Crop Production Skill Area

Skill Area <sup>a</sup>	Teaching Method				
	Did Not Teach %	Classroom Discussion %	Field Observ. %	Teacher Demon. %	Student Practice %
Implements (11)	22.3	43.4	14.7	6.2	13.4
Tractors (34)	28.7	30.5	3.2	7.0	30.6
Adjustment (21)	39.6	32.1	11.0	3.6	13.0
Operation (26)	29.5	40.8	14.5	2.6	12.6
General (20)	18.3	40.6	11.6	4.7	24.9
Overall (112)	28.4	36.3	9.9	4.8	20.4

Note. Percentages represent the mean percentage of teachers using each method for all skills contained in each skill area. Percentages represent the highest, or most performance-oriented method, reported by teachers, with "did not teach" as the lowest and "student practice" as the highest method of skill instruction provided.

<sup>a</sup>Number of skills per area.

Table 2

Pearson Correlation of Teaching Methods of Skill Performance and Confidence Levels in Each Skill Area

Skill Area	Performance Level $r$	Confidence Level $r$
Implements	.26*	.16
Tractors	.41***	.34**
Adjusting Equipment	.35**	.31**
Operating Equipment	.16	.16
General Crop Production	.19	.06
Overall	.25*	.21

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

Results shown in Table 2 demonstrated positive significant relationships between teaching method and performance and confidence levels for some skill areas. Teachers who reported using methods involving teacher demonstrations and student practice tended to report higher performance levels overall and in the implements, tractors, and equipment adjustment skill areas. These teachers also tended to report higher levels of confidence in their ability to demonstrate the skills pertaining to tractor operation and maintenance and equipment adjustment.

The relationships between teaching methods used and selected demographic factors are presented in Table 3. Significant, low relationships, using the convention described by Davis (1971), were found between teaching method and years of teaching experience, supervision of school farms where field crops are grown, number of acres in the school farm, and the size of the crop farm currently owned or worked. Teachers reporting the use of firsthand methods involving teacher demonstrations and student practice tended to report fewer acres in the crop farm which they owned or worked on a regular basis.

Table 3

Pearson Correlation of Teaching Method by Teacher Demographic Factors

Factor	r
Supervision of school crop farm	.27*
Acres supervised in school crop farm	.30**
Acres in crop farm owned or worked	-.25*
Years teaching experience	.27*
Acres in crop farm where reared	-.17
Reared on crop farm	.17
Years of high school agriculture	.15
Current crop farm work or ownership	.08

\*p<.05. \*\*p<.01.

Conclusions and Recommendations

A majority of Illinois vocational agriculture teachers devote instructional time to the teaching of psychomotor skills essential to the production of field crops. However, Illinois teachers tend to use classroom discussion as their primary method for teaching psychomotor skills in crop production. A relatively small percentage of crop skill instruction includes teacher demonstrations or actual student practice in performing skills. Thus, most teachers are telling their students about these psychomotor skills without actually having students observe or practice a procedure for skill performance. Teachers should be

encouraged, by way of workshops, other inservice activities, and lesson materials, to place greater emphasis on developing skill competence through the use of demonstrations and student practice.

Teachers who have performed these skills in crop production and who are confident in their ability to demonstrate them have a greater tendency to use teacher demonstrations and student practice. Therefore, the psychomotor skill performance and confidence levels of prospective and practicing teachers should be monitored and improved through workshops, courses, field days, and other preservice and inservice activities.

Having responsibility for supervising school crop farms is positively linked to teachers' use of demonstrations and student practice of crop production skills. However, further research is needed to more clearly describe the nature of this relationship.

Teachers with more years of teaching experience tend to use more performance-oriented methods, such as demonstrations and student practice, more often than younger teachers. Specially designed preservice and inservice activities should be planned that develop young teachers' performance and confidence levels faster and allow them the opportunity to discuss strategies used by more experienced teachers for psychomotor skill development.

Recommendations for further research in the area of psychomotor skill development in crop production include the following. Teachers should be surveyed to examine the nature of their activities related to supervising school crop farms. Barriers, or reasons for not providing demonstrations and student practice, need to be studied. Strategies for developing and managing school crop farms as teaching laboratories need to be identified and examined. The nature of crop farming activities undertaken by teachers on a personal basis should be examined for their potential and real contribution (or hindrance) to psychomotor skill development teaching strategies and opportunities for students.

#### References

- Annual directory of the Illinois Association of Vocational Agriculture Teachers. (1984). Roanoke, IL: Illinois Association of Vocational Agriculture Teachers.
- Davis, J. A. (1971). Elementary survey analysis. Englewood Cliffs, NJ: Prentice Hall.
- Elliott, B. (1980). Sizing the sample (without laundering the data). CEDR Quarterly, 18, 10-12.
- Harrow, A. J. (1972). A taxonomy of the psychomotor domain. New York: David McKay Company.
- Hinkle, D. E., Wiersma, W., & Jurs, S. G. (1979). Applied statistics for the behavioral sciences. Chicago: Rand McNally College Publishing.
- Illinois Statistics--Annual Summary. (1986). Springfield: Illinois Department of Agriculture.
- Krathwohl, D. R., Bloom, S. S., & Masia, B. B. (1964). Taxonomy of educational objectives. New York: David McKay Company.

- Newcomb, L. H., McCracken, J. D., & Warmbrod, J. R. (1986). Methods of teaching agriculture. Danville, IL: The Interstate Printers and Publishers.
- Osborne, E. W. (1987). Psychomotor skill performance levels in crop production reported by agricultural teachers in Illinois. The Journal of Vocational Education Research, 12(3), 69-80.
- PaDelford, H. (1984, December). Psychomotor skill acquisition in the technical subjects. Paper presented at the American Vocational Association, New Orleans.
- Stallings, L. M. (1982). Motor learning: From theory to practice. St. Louis: The C. V. Mosby Company.

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(Miller--continued from page 9)

The approximately 2,000 individuals identified for this study constitute only a small percentage of those who could be served in this state. What are the educational needs of the others? Why are they not participants? How do they meet their educational and informational needs? These, and other questions, need to be addressed by the profession, since this study only described the nature of the current participants in these organizations.

#### References

- Davis, J. A. (1971). Elementary survey analysis. Englewood Cliffs, NJ: Prentice-Hall.
- Dillman, D. A. (1978). Mail and telephone surveys. New York: John Wiley and Sons.
- Extension in the '80s. (1983). Washington, DC: U.S. Department of Agriculture.
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. Education and Psychological Measurement, 30, 607-610.
- Martin, R. A. (1987, June). Young farmer educational programs in the United States: Working toward a model. Paper presented at the International Week of Exchange, Stavorden, The Netherlands.
- Miller, L. E. (1987, June). Adult education and its agricultural component in the United States: An overview. Paper presented at the International Week of Exchange, Stavorden, The Netherlands.
- Miller, L. E., & Smith, K. L. (1983). Handling non-response issues. Journal of Extension, 21(5), 45-50.
- Nunnally, J. D. (1967). Psychometric theory. New York: McGraw-Hill.
- Todd, J. D., & Paulus, A. J. (1960, August). What causes farmers to attend adult classes? The Agricultural Education Magazine, 33, 33.
- U.S. Department of Agriculture. (1983). Challenge and change . . . A blueprint for the future--Extension Service, USDA. Washington, DC: