An Interdisciplinary Approach To Teaching Agricultural Mechanics

RICHARD L. HOFFMAN, Chemistry Instructor
MILTON RENAUD, Agricultural Mechanics Instructor
Illinois Central College – East Peoria, Illinois 61611

The 1968-1969 academic year at Illinois Central College saw two faculty members from different divisions cooperate in developing what we think is an unusual approach to teaching the technical aspects of agricultural mechanics. In keeping with our philosophy of giving all students the most comprehensive treatment of subject matter possible, we embarked on a trial program of voluntary interdivisional teacher exchange between our Agriculture and Science divisions. Our purpose was to supplement course material in Welding, Hydraulics, and Gas Engines, by allowing a science teacher to treat topics of pertinence and interest that were not normally emphasized in standard technical textbooks.

We accomplished this end by exploiting the cooperative enthusiasm of the instructors in agricultural mechanics and chemistry. Our chemistry teacher, who also teaches a physical science course for non-science majors, wanted to deepen his understanding of practical mechanisms and processes that occur in everyday life so that he could better explain them to his regular classes in chemistry and physics. It became evident to him that such training possibilities already existed within our institution.

Sensing an opportunity to learn while teaching, the science teacher actually joined classes of students in the areas to be supplemented. The agricultural mechanics instructor introduced him as a teacher of physical science who was interested in their course of study and asked that the students cooperate in helping him along.

Our teacher-student dressed in coveralls and participated in laboratory sessions wherein everyone dismantled and repaired engines, overhauled hydraulic devices, and welded metals. All this was accomplished with the watchful participation of the agricultural mechanics instructor. As practical realities of the work appeared in the laboratory, the science teacher explained the hows and whys. Thus, laboratory and lecture became a unified learning experience beneficial to all concerned.

For example, in welding class, students are taught to pay heed to electrode polarity when welding with a D. C. unit. The science teacher explained metallurgically why such attention is necessary. He did so by discussing current flow theory and the arc temperatures derived therefrom. Laboratory discussions included other topics such as composition of electrode coatings and fluxes. Hazards of ultraviolet emissions and of vapors from arc decomposition products were pointed out. When attention shifted toward oxyacetylene processes, students were treated to demonstrations of metal combustion.

In hydraulics class the science teacher explained the physics of hydraulic machinery and the method of calculating mechanical advantage. He discussed the chemical and physical composition of hydraulic fluids, hoses, and seals. All calculations regarding hydraulic devices were performed relative to an actually available piece of equipment.

The gas engines class provided ample opportunity to discuss oxidation of hydrocarbons relative to fuels and lubricants. Octane numbers were treated by comparing gasoline to exotic fuels such as alcohol and nitromethane. The physics of carburetors and superchargers was dealt with as actual devices were dismantled. Lubricant additives, structures, and applications were examined in relation to the chemical and physical stresses placed upon them.

At every possible opportunity theoretical hows and whys were tied to practical observations in the laboratory. Students benefited from their opportunity to understand each teaching tool from a point of view that supported practical with theoretical. Our science teacher benefited from his opportunity to supplement his understandings of theory with practical experiences. He also discovered the stimulating challenge that comes from teaching students with which he would otherwise have little encounter. His efforts to put science into the very practical field of agricultural mechanics produced new descriptions, approaches, and teaching techniques that were helpful to him in the formal areas of chemistry and physics.

The product of our effort was a group of students with increased understanding of their subject matter and a teacher with an appreciation of another field of endeavor. Perhaps even more important were the attitude changes wrought among the participants. Students met a teacher who wanted to learn as well as to teach and who was appreciative of their cooperation as he learned. Teaching a teacher was a delightful experience that made the students eager to display their competence.

Successes that this approach have enjoyed are doubtless related to having a teacher join classes of students *as a student*. While the students and their "classmate" came to know each other, an atmosphere of free conversation of enlightening proportions was stimulated. They recognized that this science teacher was interested in them and in the dignity of their chosen field. Their teachers had cooperated with each other in an effective way that surpassed any guest lecturer approach.

We attempted to unite the apparently different fields of agricultural mechanics and physical science in a meaningful way. In so doing we found an approach that brings the teacher closer to the student in a less formal way to achieve greater understanding of subject matter. Enthusiastic student and teacher response indicates the success of our experiment.

Techniques For Building Teaching Equipment In The Laboratory

L. ROLAND DOERSCHUG
Agricultural and Technical College, Alfred, New York

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In this day of innovative teaching there is an urgent need for demonstration and laboratory equipment which can be used in agricultural engineering courses. The specialized needs of this area makes for a limited market; therefore, very little commercial equipment is available and thus it must be built at the local campus. This paper will offer a general procedure one can follow in order to build effective teaching equipment.

The steps in selecting and possibly building effective teaching equipment are as follows:

1. Determine type of equipment needed.
2. Demonstrations desired.
3. Ascertain commercial availability.

If you elect to build the teaching device then the following steps are in order:

4. List components needed.
   a. purchase items.
   b. parts available in department, either as parts of