Agricultural Mechanics in Agricultural Education

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should (Finley, 1955), and should not (Russell, 1955) be used in a "farm shop" program. Alda and Miller (1955) report on a study of 205 "farm mechanics skills" (p. 150), and conclude that, "The rapid changes taking place in farm mechanics means more work will be added rapidly... and that some skills now in use may gain or lose importance in a short period of time" (p. 164). Through the years, the debate has continued. "Great strides have taken place in the mechanization of agriculture. How has the vocational agriculture farm mechanics program kept pace with this change?" (Gail, 1958, p. 150). "Are you keeping up with the agricultural engineering aspects of farming in your teaching?" (Johnson, 1956, p. 256).

Clearly, in-service education is vital to the process of upgrading teacher skills as technology advances. While most of us now support the use of circular saws, how many of us are prepared to include instruction in the electronic sensor, Global Positioning and data management systems? Who is needed for prescription farming? James Daniels (1986) suggested that we are at all various stages of being "out-date," and must work steadily to "stay current." Don Johnson (1986) outlined six "tools" vocational agriculture teachers could use to stay current. In this issue Swan and Zimmerman (p. 16) describe a model for effective in-service and Johnson (p. 41) provides three views of the role of agricultural mechanics and its place in the curriculum. Believe it or not, with all this support for adopting innovative technologies in our in-service curriculum, some states 1997 summer in-service schedule includes courses in advanced lighting and air-cooled engine repair, and basic electrical wiring and hydraulics.... continued on page 27

The relevance of instruction in agricultural mechanics has been addressed a few times before. Christensen (1964) suggested that many teachers need to revamp their entire curriculum in agricultural mechanics. Woodin (1964) suggested that citizens outside the "shop" and classroom to find relevant experiences for our students. Shinna's 53 friendly critics in this issue (p. 6), outlining the purposes of an agricultural mechanics program, echo Johnson (1964) when he said, "In the past we perhaps taught our students too much of the 'know why' and not enough of the 'know how'" (p. 198). Why didn't I suggest in my opening paragraph that Mozart would appreciate the "music" we make in the agricultural mechanics laboratory? No, it is not because he was deaf, that was Beethoven. The answer is because his music, more so than any other composer, is an exercise in higher mathematics. I had a music teacher who once told me that he wanted his students to see the math behind the music. My wife is a statistician, and she said that it's far better to hear the music in mathematics. I'll borrow from the past for my argument, "What better way is there to learn mathematics and physics than to apply them to the problems of farming?" (Johnson, 1962, p. 193). The world is changing fast, more rapidly now than ever. Perhaps nowhere as quickly as in the fields associated with the applications of agricultural technology to the solution of problems. Students will need to be prepared to live in a world in which all human knowledge doubles every other week, or even days. A world in which specialized knowledge becomes obsolete very rapidly. In such a world, those who "know why" will prosper, while those who "know what" will not.
Agricultural Mechanization

Agricultural Education:

Three Common Views

By Donald M. Johnson

Dr. Johnson is an associate professor of agricultural education in the Department of Agricultural and Extension Education at the University of Arkansas, Fayetteville.

As agricultural education moves to a more science-based curriculum, the role of agricultural mechanics has been a subject of extended discussion and debate. As both a participant and an interested observer of this discussion, it seems to me that three different views of agricultural mechanics and its place in the curriculum have emerged.

The First View

The first view holds that agricultural mechanics is no longer relevant in a science-based curriculum. Persons with this view equate agricultural mechanics with training in "shop skills." They see the curriculum as emphasizing manipulative skill development in welding, woodworking, tool fitting and other "low-tech" areas. Based on this perspective, they feel time devoted to agricultural mechanics simply detracts from the time available for teaching more "important" subjects (e.g., biological sciences).

This view was expressed by a recent national "Agri-sciences Teacher of the Year" award winner.

The Second View

Individuals holding the second view of agricultural mechanics share one key element with those in the first group: they equate agricultural mechanics with shop skills, again, with primary emphasis on manipulative skill development.

However, to the second group, this emphasis on skill development is a strength for three reasons.

First, they feel that developing skills in the use of tools and equipment has both intrinsic worth and utilitarian value. Second, shop skills classes provide a situation where even those with limited academic ability can experience success, since the emphasis is on "hand skills" not "head skills." Finally, though less commonly admitted, these classes are popular with students and tend to have fairly large enrollments. Thus, they help maintain the student numbers necessary to justify the entire agricultural education program.

The Third View

The third view of agricultural mechanics is much different than the first two. Those with this view see agricultural mechanics as being much broader than traditional shop skills. To those with this view, instruction should emphasize the basic principles of modern agricultural technology such as electronics, mechanics, hydraulics, pneumatics, computers, energy and power systems, machine systems and other "high-tech" applications.

Proponents of this view believe that instruction in agricultural mechanics should emphasize hands-on laboratory experience designed to help students learn the basic scientific principles and mathematical relationships that undergird modern agricultural technology. According to Harper (1992, p.5), the goal is "not to convert our agricultural mechanics instruction to a science curriculum, but rather to a technology curriculum...in order to prepare students to work in a rapidly changing technology-based industry."

Diversity, Non-traditional Science, and the Direction of Agricultural Education

These are the buzz words that describe the direction agricultural education has traveled over the past several years. Mice and gerbils are replacing cows and cows as supervised agricultural experience programs. Laboratories with test tubes and pipettes are becoming more prevalent than are and MG welders.

It is possible to have a very successful agriculture program without a mechanics laboratory, but at what cost? The opportunity to develop basic mechanical and home maintenance skills is lost. The shop can be a very intimidating place because of the instructional content, but I feel it is even more important to teach the student to use inadequately asssistive devices and to value this very rewarding area of instruction.

Students who live in town and on non-production farms have the opportunity to use the shop as an SAE laboratory, and there is never a shortage of projects for those students who cannot afford to build something for themselves. These projects reinforce the students' use of basic skills and often require initiative and decision making. The agricultural mechanics laboratory also provides endless recognition for the agriculture program through community service projects. Our community would be a worse place if the welding services provided by agriculture students were not available.

The shop is also where students with learning disabilities can excel. Developing welding skills and building a project can provide those students with a much-needed boost to their self-worth and overall self-esteem. All of this became even more evident to me during this past Christmas season. A young lady in my Agricultural Science II class was afraid to even set foot in the shop. With encouragement, not only from myself but also from her classmates, she overcame her fear and learned how to weld. In just a few short weeks, she completed a metal project for her father as a gift. I'm not sure which one was the most proud, the dad or his daughter. Since that experience, this student has been less intimidated by new experiences and has more confidence to take on new educational challenges.

Job Performance Skills as Problem Solving

Job performance skills such as problem solving, following through to completion of a task, sales and pride in workmanship can be attained by the students in construction classes. These skills can become an integral part of an agriculture education program through the construction classes. During Operation Desert Storm, a former student wrote me from the front lines. His responsibilities included welding military tanks when the tracking broke, many times under the protection of fighter planes flying overhead. He commented in his letter about how much he enjoyed what he did and how grateful he was to have learned to weld in high school. He took great pride in his responsibilities and realized the importance of getting the job done right the first time.

The basic reasoning for men and women giving up traditional mechanics programs stems not from the pressure to include more science-related curriculum, but also from a lack of confidence in their basic shop skills or a general lack of interest in the shop as a learning laboratory. This lack of interest is justified by comments of how today's students are not as interested in the areas of the mechanics or they no longer have the need to know these skills. Now in response to this theory, we have young people who cannot make even basic home repairs or even know how to use common tools properly. We cannot depend on parents to teach these basic skills because the parents are no longer spending that kind of time with their children.

This lack of interest in mechanical skills may be substantiated further by our universities. It appears that new teachers entering the field are not as well trained in mechanical...
Spending 15 Minutes Listening to Our Critics...

By Glen C. Shinn

Dr. Shinn is professor and head of agricultural education at Texas A&M University College Station.

Have you noticed that several talks by opinion leaders in education and industry have been more than just a little critical of our agricultural mechanics curriculum? Some even go so far as to charge that the secondary program must undergo revolutionary change or be abandoned! Perhaps our first response was to ask just where do these "so-called experts" get the license to tell us what to do?

Now before we get defensive, it may be well to consider the advice of Henry James. A noted 19th century philosopher, James reasoned that we should see the critic as a helper, as a torch bearing outsider, ...and even as a brother. Well then, we could just ask 53 of our friendly critics to share their perspectives in writing and see what advice they would offer. Surprisingly, it was not difficult to get them to make recommendations!

The way you ask the question will influence the answer you get.

The group of 53 friendly critics was assembled from departments of agricultural education, agricultural engineering, colleges of agriculture and state departments of education across the nation. A personal letter invited each friendly critic to share their opinions regarding the content, context, process and interrelationships of agricultural mechanics as a course of study in secondary agricultural education. Members of the Council Task Force on Agricultural Mechanics provided advice for the design. Ralph Tyler's work in evaluation provided a framework for the questions. The process allowed anonymous critics to write and rate critical statements in three independent rounds.

What should be the purposes of the secondary agricultural mechanics program?

Our critics reached agreement on three broad statements when asked about the purposes of high school programs. They recommended that the curriculum:

1. Develop positive attitudes about safety and quality of work;
2. Include knowledge of principles that govern science; and
3. Develop useful skills that are appropriate for current applications.

Well, who would agree with that?

Positive Attitudes

When examining specific statements, the critics agreed that the program should develop attitudes about safety while using technology in agriculture. They also agreed that the curriculum should foster positive workmanship, work habits, time-on-task and decisions about the quality of one's work. As a result, the program should instill desirable work habits in students using a variety of "hands-on" activities that come from the modern workplace.

Universal Principles

Critics agreed that the secondary curriculum should develop a working knowledge of science. Specifically, they agreed that the curriculum should acquaint students with principles and competencies related to the application of physical sciences to real problems of agriculture. Students should use agricultural technologies as tools to reinforce physical and biological science principles, mathematics and communication skills. Students should also develop an understanding of the role that technology plays in agriculture. The curriculum should complement a comprehensive curriculum in agricultural education.

Useful Skills

A consensus purpose for the secondary curriculum included agreement that the student recognize agricultural mechanics is much broader than production agriculture and shop. Specifically, the curriculum should develop knowledge and application of basic principles of power units, machinery systems, electricity and electronics, structures, agricultural construction and soil and water conservation and management. These understandings are used in decision-making for economic, social and environmental advantages in their careers. In a practical vein, the critics also agreed that the curriculum should develop a variety of mechanical skills that the student can use throughout life in both vocational and avocational settings.

What are the best educational experiences for students in the secondary agricultural mechanics program?

In the final analysis, the critics agreed on three broad categories of educational experience that included:

1. Integrating teaching methods that foster knowledge and problem-solving in holistic systems;
2. Using project methods that employ current technology; and
3. Facilitating actual work experience for all students.

I'll bet we all agree on these recommendations!

Facilitating Work Experience

Universally, critics recognized the value of increasing on-the-job experiences with real-world application. There was unanimous agreement for developing more opportunity for actual work experiences that include internships and co-op programs. When working with a group of students, the critics stressed the value of experience from the workplace, one would likely agree with this recommendation.

Combination of classroom, laboratory and community-based activities that are very different from the past and more closely linked with current post-secondary programs are necessary. Classroom and laboratory activities should be integrated, connecting scientific principles and practical skills. The teaching should link acquiring technical information with hands-on experiences.

Using Projects

In order to connect project methods with real-world applications, the critics encouraged a variety of laboratory activities, simulations and projects. They believed instruction should emphasize safe use of equipment and develop critical reasoning skills regarding safety and work quality. Students should participate in hands-on activities in the laboratory with enough time assigned to accomplish the skills. Critics agreed that project methods provide opportunities to work on real problems using modern tools and equipment. They also agreed on the need to develop or retrofit shops (laboratories) that emphasize new technology. YES!

How should the experiences be organized?

Four primary categories described the consensus of our critics:

1. Insuring all experiences are safe;
2. Simultaneously coupling practical examples with theory in experiential learning settings;
3. Inquiring to broader settings and applications; and
4. Organizing spirally sequenced experiences that foster technological knowledge, personal development, employability and entrepreneurship.

Safe Experiences

Like parents, critics warned that the experience must be safe for the individual student. They recognized that what is safe for one student may not be safe for another. Critics recommended safety lessons that simultaneously involved theory and practical exercises to encourage active learning and teamwork.

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Practice and Theory
Experimental learning that develops problem-solving and decision-making skills was encouraged by the critics. They agreed that the experiences should develop within a coordinated classroom, laboratory, supervised experience and FFA context. In order to better apply theory with practice, they endorsed a sequential curriculum where basic skills are followed with specific job-cluster skills.

Organizing Spiral Experiences
The curriculum should include semester-length courses that are sequenced from basic to complex. Specialization during the 11th and 12th grade and prerequisite courses before students enroll were recommended by the critics. The group criticized allowing open-entry enrollment in advanced courses.

Broader Settings
Technology skills needed in work settings should be integrated within the specific course. For example, horticultural courses with greenhouses should include a unit on electrical safety, circuits and controls. There was broad support for a broad-based curriculum and the critics agreed that the experiences should develop within a coordinated classroom, laboratory, supervised experience and FFA context. In order to better apply theory with practice, they endorsed a sequential curriculum where basic skills are followed with specific job-cluster skills.

The critics recommended engaging each student in meaningful learning experiences.

Building Self-Concept
Critics believed that the agricultural mechanics program provides opportunities for students to succeed. The program includes activities that build their self-esteem. Too, critics recognized that the curriculum currently teaches students who sometimes have difficulty with "academic" classes. They were very complimentary of the curriculum that develops and applies practical skills and includes "real-world" applications. All of us have who have watched an at-risk student succeed in agricultural mechanics know the positive influence on self-worth and individual dignity.

What are the Limitations?
If you are still reading, you are likely willing to listen to our limitations as seen by 53 unnamed critics. Some of the observations were not pretty! They agreed on five clusters of limitations:

(1) poor housekeeping;
(2) failing to address higher-level technology skills;
(3) using projects that are not appropriate;
(4) failing to incorporate electronics and other technologies into the curriculum;
(5) limited teacher background and preparation.

Poor Housekeeping
This limitation was universally recognized by the 53 critics. Too, the critics concluded that females generally hold a more negative perception of the program. The program was often described by the group as dirty and low-tech. The critics recommended better laboratory organization to improve the image of the program.

Failing to Address Higher-Level Technology Skills
Critics agreed that many programs appear to be "low-tech" and "old-fashioned," certainly not "state of the art". In many cases, critics believe that the courses are not addressing higher level technology skills that are commonly required for employment in agricultural industry or for ownership.

Projects That Are Not Appropriate
Critics reasoned that the projects used in many courses are based on past needs and experiences. They recommended that project methods use activities that are appropriate for the "new" agricultural industry: not "deer stands and BBQ pits." There was support for using components from electronics and hydraulic systems.

Failing to Incorporate Electronics and Other High-Tech Systems
The use of equipment that is outdated was a common criticism. Many critics believed the courses fail to address new technology and do not meet the demands of today's agricultural worker. The critics specifically cited the need for more electronics, controls and robotics.

Teacher Background and Preparation
Critics recognized the rapid changes that have occurred in agricultural technology and were concerned that the program is limited by proper background and preparation of teachers. The critics encouraged short courses and professional development for teachers. There was broad support for summer internships where teachers work in industry settings.

What Should We Do? What Can We Do?
Often, "friendly critics" shared the same high goals and deep frustrations that "insiders" hold regarding the adoption of change. To be successful, the contemporary curriculum must foster positive attitudes, apply fundamental principles and concepts and develop useful skills. Educational experiences must be integrated and holistic. Training must be designed to maintain both Biological and physical sciences safety is a primary concern. Experiential learning must simultaneously couple practice with theory. Evaluation must use recognized techniques, but make use of authentic assessment and task performance.

The positive perceptions were that the current program uses active learning methods and build self-esteem among students. However, the program has a broad image of being dirty and low-tech. More often, projects are not appropriate for today's needs and the teacher is often viewed as a limiting factor to a high quality program. Those preparing materials must develop stronger collaboration with industry, extend problem-solving skills and seek courses from non-traditional sources. Teachers must be active learners who continually re-evaluate needs and assess new technology through instruction and collaboration.
Agricultural Systems Management/Technology Programs

By Leon G. Schumacher

Schumacher is an associate professor of agricultural education and engineering at the University of Missouri, Columbia.

Introduction

Agricultural mechanization has been a strong component of the local high school agricultural education program since its early beginnings. The mechanization of agriculture allowed farmers to expand their business operations and to operate more efficiently. As a result, agricultural mechanization instruction was accepted as an integral part of the agricultural education program.

Agricultural teachers soon sought ways to reward students for their skills in agricultural mechanization. According to Hagen, "agricultural mechanization contests provided that reward as early as 1938" (Hagen, 1976). This was approximately 53 years before the National FFA Organization founded the National FFA Agricultural Mechanics Contest. The contest, which was a reflection of the instruction at that time, focused on mechanization skills that related directly to production agriculture.

Agricultural education programs at the university level moved quickly to provide mechanical skills needed by agriculture teachers and others employed in this facet of the agricultural industry. The academic programs at this level were named "agricultural mechanization" and "mechanized agriculture." These programs, like those provided at the high school level, provided students with knowledge about the mechanical skills that were needed in production agriculture.

A New Name

Changing times have brought about change within the agricultural industry. As early as the 1970s, fewer and fewer agricultural mechanization graduates were being employed in production agriculture. Rather, graduates were hired in managerial positions that required a sound understanding of mechanical systems and the business economics associated with these systems.

As a result, the former agricultural mechanization curriculum was redesigned and renamed "agricultural systems management/technical systems management" at most U.S. universities. These programs were designed to prepare students for careers that required the application, management, and marketing of engineering technologies. Students study technological systems with more emphasis placed on business and economics (including organization, operation, management, marketing, and sales) and oral and written communications.

The change of name to "agricultural systems management/technology" (ASTM/AST) occurred as our graduates reported that the name "agricultural mechanization" no longer described the activities they performed in the agricultural industry. Our graduates reported that the food industry had become dependent on many complex, automated and mechanical systems for successful operation. Whether it was a computer-controlled grain terminal on the Mississippi River, a processing line at a food plant or a combine used during harvesting, the successful operation and management of these complex systems required people who understood physical systems such as energy and power utilization, mechanical, electrical, and computer systems.

ASTM/AST programs prepare students to be problem solvers in their professions. ASTM/AST programs focus on skill development that leads to careers related to entrepreneurship, marketing representatives, project managers, plant managers, leaders of service organizations or trade associations, manufacturers, corporate farm managers, retail dealers, power suppliers, contractors and management companies from production through processing and distribution. Each of these career opportunities present our graduates with unique problems that "systems thinking" students are capable of solving. For example, resetting a breaker in a service entrance panel may momentarily get a production line back up and running; it may also serve as an indicator of other issues to be addressed. Specifically, an electric motor may be overloaded. Resetting the breaker or restarting the motor, but does not reduce the excess load which caused the tripping of the breaker due to the overload. If this situation continues, the motor will need to be replaced. The replacement of the motor will most likely occur at a critical time, causing much inconvenience and lost revenue for the company involved.

Courses Taken by ASTM/AST Students

Problem-solving skills are attained as a result of students enrolling in a broad spectrum of ASTM/AST courses, as well as business and economics courses. Table 1 lists the mechanical and economic related courses typically taken by ASTM/AST students.

Leadership Development

Each university sponsors an ASTM/AST Club, where students sharpen their leadership and communication skills. They also become acquainted with other students, as well as professionals from many areas. Activities in which these students commonly participate include field trips, attending professional meetings and conducting fund raisers which allow the club to cover travel expenses related to professional meetings, national competitions and extended field trips. Students also sponsor and participate in social activities such as bowling, pizza parties, picnics, and barbecues projects. Professionally often speak at club meetings, sharing cutting-edge technology with the ASTM/AST students.

Professional Growth/Study Through Research

Agricultural systems management/technology professors conduct applied research. The information learned through this research better prepares ASTM/AST professors to teach the skills needed by their students. Problems commonly researched include issues related to student enrollment, recruitment, skills needed by our graduates, safety, water quality, soil and water management, efficient use of machinery and more. In essence, this program provides a link between the design engineer and the consumer.

Table 1

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Business and Economics Course Title</th>
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<tbody>
<tr>
<td>Agricultural Equipment &amp; Machinery</td>
<td>Accounting I</td>
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<tr>
<td>Agricultural/Industrial Structures</td>
<td>Accounting II</td>
</tr>
<tr>
<td>Electricity/Wiring &amp; Equipment</td>
<td>Introduction to Business Law</td>
</tr>
<tr>
<td>Materials Handling &amp; Equipment</td>
<td>Introduction to Management</td>
</tr>
<tr>
<td>Mechanization Systems Management (Crops)</td>
<td>Introduction to Fertilizing</td>
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<tr>
<td>Mobile Hydraulics</td>
<td>Financing the Farm Business</td>
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<tr>
<td>Pesticide Application Management</td>
<td>Legal Aspects of Businesses</td>
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<tr>
<td>Physical Principles for Agricultural Applications</td>
<td>Macro Economics</td>
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<tr>
<td>Surface Water Management</td>
<td>Micro Economics</td>
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...continued on page 12
Is "Agricultural Electronics" Being Taught as Part of Your Curriculum?

By Joe Muller and Randy Tidwell

Dr. Muller is an agricultural electronics curriculum specialist with the Instructional Materials Service at Texas A&M University College Station and Mr. Tidwell is an agricultural science and technology instructor at Truro High School, Truro, TX.

Curriculum of Instruction

From the broad perspective, a course on agricultural electronics is an outline of specific units and topics of instruction was formulated by members of the committee (see Table 1, page 15). A semester shop/laboratory-oriented course in agricultural electronics was developed. The course content outline was designed to reinforce and extend a student's knowledge of mathematical and scientific principles and concepts involved in producing and controlling electronic circuits. With technical input from the committee members and other specialists within the agricultural electronics field, student information topics were developed for the course.

Hands-on activities were included to provide students with generic workplace skills relevant to electronics applications in agriculture. Although developed in a coherent sequence for a complete semester course, each of the student topics can be used individually as stand-alone units of instruction.

For example, instructors teaching horticulture or aquaculture courses may wish to integrate several topics such as "Operation and Use of Actuators and Displays" or "Integration of Electronic Systems" on their own.
The content course outline was designed to reinforce and extend a student's knowledge of mathematical and scientific principles and concepts involved in producing and controlling electronic impulses. 99

Success of Agricultural Electronics at Troop High School

Troop Independent School District is a small, rural district in East Texas. As such, we attempt to meet the diverse needs of our students in a wide variety of areas. We emphasize the use of technology in the classroom as a way to help prepare our students for life in the 21st century.

I was introduced to the concept of an experimental agricultural electronics course as part of agricultural mechanics curriculum at an in-service workshop held during the Professional Improvement Conference last summer. I felt that this course would enhance our current curriculum. Fortunately, our superintendent, Dr. W. L. Sanders, is a proponent of innovative ideas, particularly in technology. His support helped us get the course started.

We began teaching agricultural electronics as a separate course last fall. Because we operate under an accelerated block schedule, the entire course was taught in a nine-week period. The students benefited immensely from the hands-on applications designed into the course. They also enjoyed being able to see the results of their projects immediately.

The students explored AC and DC circuits and printed circuitry and implemented Ohm and Kirchhoff's Laws. They designed circuits which they tested with a multimeter. In addition, they examined the operation of semiconductors, investigated the "hole flow theory," and studied the various electronic controls used in electronic technology. They applied this knowledge while reading schematics. Students also developed skills necessary to evaluate logic circuitry using AND, OR, NOR gates, and NAND gates using truth tables for each.

The cost factor of implementing a new course was a concern. We were fortunate to have in place 12 classroom computers, a plotter, and several ink-jet printers. Thus, we were able to offer the course and use a limited budget to purchase instructional materials and electronic project kits from Radio Shack. Students were able to use CAD and other software programs to draw schematics and simulate electronic circuits.

Our students gained essential electronics knowledge and skills necessary for entry-level employment and/or further education at nearby colleges. Our high school principal, B. J. Anthony, was very impressed with student attentiveness and focus during class. I believe agricultural electronics was a success at Troop High School.

Making It Happen

It is one thing to simply say, "changes in the curriculum need to occur," assign a course name and develop or purchase quality instructional materials. For major changes or additions to the high school career education curriculum to be successful and long-term, additional factors must be addressed (as rank order implies):

1. Felt need for curriculum change on the part of instructors; not just that you need to or must teach this.
2. Felt need for the information on the part of students enrolled in the courses.
3. Proper in-service education for existing instructors.
4. Adequate changes and/or additions to pre-service courses required for teacher certification.
5. Commitment from local administration and school boards.

As educators, we must ask ourselves, "Are we adequately preparing our students for these careers?" 99
Quality Agricultural Technology and Mechanization In-Service

By Michael K. Swan and Steven Zimmerman

Dr. Swan is an associate professor and Mr. Zimmerman is a research associate of agricultural and extension education at North Dakota State University.

Quality curriculum is one critical factor in making agricultural education programs effective. A key goal is providing quality in-service and professional development to strengthen and upgrade our programs. Achieving this goal will require us to think differently when it comes to improving curricula adjustments and promoting basic skills.

In North Dakota, our goal was to enhance our agriculture programs through modifications to curriculum and to improve teaching techniques used to deliver the materials. The process started during the 1990-1991 school year as a result of our secondary teachers' curriculum committee meetings. A proposal was presented during the summer months. Instead of being told what was to be offered, they were in the driver's seat and were able to make the decisions regarding what was going to be offered.

for credit and no-credit. They were also asked to design a 5- to 10-year plan for the topics to be covered.

As teacher educators, we may not concur with everything a cur-riculum committee has to say, but we should agree that we cannot afford to ignore the importance of secondary instructor input. To a degree, we are doing the same thing Bill Gates does at the Microsoft Corporation. We provide our clients with what they want, when they want it, where they want it and from whom they want it. If this is done properly, they will come.

The first step for the secondary curriculum committee was grasping the idea that they were really making the decisions regarding what the offerings were going to be and who was going to be teaching each section of unit. The next step was to develop a timeline in which these programs would be going to be presented. This group decided to team with secondary teachers from Minnesota the first year and have a four-day session on agri-science mechanics. The teachers identified two people to coordinate the activity, one from North Dakota and one from Minnesota. The first year, we offered teaching small engine theory with computers, MIG welding, plastic cutting and electric motors. We used technical college instructors, University of Minnesota faculty and North Dakota State University faculty as instructors for the units. During the first year activities, we had 60 teachers participate in the in-service program.

The four-day format fit with what we wanted and the time an agri-science instructor could be away from the community and still maintain a summer program of activities. Over the years, we have presented a wide variety of topics with a very diverse teaching force. The teachers of these individual sessions are chosen for their expertise in a specific area or field and for their teaching abilities. No teacher was asked to present more than one topic in any one year. We have been able to spread the teaching load over many different teachers in order to recognize specific teachers for their strengths. The final format for the workshop offered in the summer of 1996 is on the next page. The Professional Development Seminar has been offered at Beulah High School since 1993 with total support of the two agri-science instructors, the administration and the local school board. It has become an annual event in developing "skills. There seems to be a continued lack of emphasis in this area of instruction in the university level, where student teachers are not always encouraged to enroll in mechanisms classes.

In our quest to enhance agricultural curricula by raising fish, growing fast plants or experimenting with recombinant DNA technology, we have failed to realize that there is still a need for mechanics in agriculture programs.

The Agricultural Education-Mechanization In-Service

Conclusion
Which of these three views of agricultural mechanics and its place in the agricultural education curriculum is closest to your view? I can only answer for myself, but I tend to support the third view. In my opinion, this approach to agricultural mechanics instruction makes sense for at least two reasons.

First, agriculture is becoming more technologically sophisticated. Computers, electronics, global positioning satellites, variable rate technology and a host of current and emerging applications with a basis in the physical sciences attest to this basic fact. Because of this, new skills and understandings are necessary if our students are to pursue meaningful careers and/or further education in agriculture. Second, enhancing students' science and math skills continues to be a priority for policy makers and citizens on the local, state and national levels. An agricultural mechanics curriculum emphasizing the hands-on science- and mathematics-based study of agricultural technology can make a significant contribution to achieving important school and national goals for education.

The articles in this issue of The Agricultural Education Magazine deal with the role of agricultural mechanics within the total agricultural education curriculum. As theme editor, I invite you to read each article and consider its meaning for you, your program, and, most importantly, your students. Then, decide for yourself if any of these thoughts and views most nearly reflects your view of agricultural mechanics and its place in the curriculum.

References
By Carlos Rosencrans Jr.
Dr. Rosencrans is an assistant professor of agricultural and extension education, New Mexico State University, Las Cruces.

The need for change in agricultural mechanization education in secondary agricultural education programs is well documented in the literature (Elghmry, 1995; Shinn, 1985; Laird, 1984; Buriak, 1992; Osborne, 1992; Bloombach, 1986) and often discussed in agricultural education circles. That there is a need for change in agricultural mechanization education is not disputed; how to go about making changes is the challenge.

When any curricular or program change is undertaken, clearly a well thought-out plan and course of action to initiate the desired change is necessary. Curriculum models are useful to explain and to make visual the interacting pieces of the curriculum and its processes and can be used to illustrate the needed revisions to a curriculum and program of instruction.

Visualizing the Future
The Curriculum Model for Agricultural Technology Education (CMATE) was developed to do just that. It can be used to formulate change within agricultural technology education programs, providing a plan and course of action for agricultural educators to follow. The components of the model are not necessarily new to agricultural mechanics/technology instruction, but putting their organization into a visual plan can assist educators in implementing the models within their programs.

The student in agricultural technology education is located at the center of the model. Education should be focused on the student and the student's needs, thus the model reflects that by placing the student at the heart of the model.

What Do We Want Students to Learn?
The large rectangular box entitled “Curriculum Inputs and Outcomes” encompasses input areas of instruction as determined by desired curricular outcomes within an institution’s mission and philosophy. The eight distinctive components of curriculum identified in this model should be incorporated into every subject area taught: 1. Basic and general knowledge and skills about agricultural technology 2. Cooperation 3. Entrepreneurship 4. Competencies specific to careers


The curriculum input, basic skills and general knowledge about agricultural technology involves instruction in a wide range of information about agricultural technology. Additionally, students will develop an awareness of the relationship between technology and other areas of agriculture, as well as other areas of general education. Cooperation and entrepreneurship both focus on the development of interpersonal skills. Small group projects define the spirit of cooperation and are excellent learning situations in which to develop these skills. Competencies in specific career areas continue to provide the opportunity for a variety of hands-on learning experiences. Problem-solving and critical thinking skills help students make well-informed decisions. Self-esteem and creativity both focus on the development of personal skills. Applied science and math principles and skills involve teaching the “how” and “why” of the way things work. Students learn the science, physics or mathematical principles behind a concept, then the skills to apply those concepts.

How will we teach?
The delivery systems for teaching the curriculum in agricultural technology include: 1. Practical hands-on applications 2. Experiential learning on the job

3. Systems approach to instruction in technology 4. Integration into subject areas in agriculture

Students must be given the opportunity to actually engage in learning through practical applications of the concepts learned. Designing and building appropriate projects would be an example. Experiential learning on the job is tied very closely to practical applications, with the emphasis on simulating the “on the job” aspect of the component. Lawn mowing could be brought in for repairs and/or maintenance; or in a greenhouse situation, ornamental plants could be grown for sale to the local community. Either example could be simulated using a business-type atmosphere. Apprentice programs within industry would be another example.

Using a “systems approach” to teaching involves presenting the interrelated concepts together rather than as individual units. Integration into subject areas in agriculture involves integrating agricultural technology throughout the agricultural education curricula. A horticulture class offering

"Blending the concepts, principles and skills from one subject area to the next combine to provide students with a basis of understanding the inter-relatedness and application of what they have learned."

Who Will Help Us?
The linkages represented in the model reflect supportive structures necessary for agricultural technology education to move forward. The structure includes linkages for: 1. Other educational programs in school 2. Teacher preparation, certification and in-service education, curriculum reform 3. Articulation with secondary, post-secondary and university levels

Curriculum Model for Agricultural Technology Education (CMATE)

Using "systems approach" to teaching involves presenting the interrelated concepts together rather than as individual units. Integration into subject areas in agriculture involves integrating agricultural technology throughout the agricultural education curricula. A horticulture class offering...
The National FFA Agricultural Mechanics Career Development Event: The First 25 Years

Introduction

In 1972, the first National FFA Agricultural Mechanics Contest was conducted at the Fort Osage Area Vocational-Technical School near Independence, Missouri. Teams representing 35 states participated in the contest which consisted of skill and problem-solving activities, and a written exam covering power and machinery, electric power and processing, and agricultural mechanics skills. The Danielson, Connecticut team, coached by Phillip Hoyt, won top honors in the first national contest.

Twenty-five years later, the 1996 edition of what has become known as the FFA Agricultural Mechanics Career Development Event (CDE) was significantly different from the original contest. The 1996 CDE focused on the integrating theme of "chemical application," and consisted of individual skill and problem-solving activities, a written exam, and team problem-solving activities in machinery and equipment systems, industry/marketing systems, energy systems, structural systems, and environmental/natural resource systems. The North Shelby, Missouri team placed first in the two-day event. (The national champion teams are listed in Table 1.)

Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Team</th>
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<tbody>
<tr>
<td>1972</td>
<td>Danielson, CT</td>
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<td>1973</td>
<td>Worthington, MN</td>
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<tr>
<td>1974</td>
<td>Milaca, MN</td>
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<td>1975</td>
<td>Hawley, MN</td>
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<tr>
<td>1976</td>
<td>Lancaster, OH</td>
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<td>1977</td>
<td>Santa Rosa, CA</td>
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<td>1978</td>
<td>Nephi, UT</td>
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<td>1979</td>
<td>Pelican Rapids, MN</td>
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<td>1980</td>
<td>LeRoy, MN</td>
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<td>1981</td>
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<td>1982</td>
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<td>1983</td>
<td>Adams, MN</td>
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<td>1984</td>
<td>Vancouver, WA</td>
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<td>1985</td>
<td>Troy, MO</td>
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<td>1986</td>
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<td>1987</td>
<td>Troy, MO</td>
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<td>1988</td>
<td>Riverville, IA</td>
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<td>1989</td>
<td>LeRoy, MN</td>
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<td>1990</td>
<td>Rugby, ND</td>
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<td>1991</td>
<td>Miles, TX</td>
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<td>1993</td>
<td>Manor, TX</td>
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<tr>
<td>1994</td>
<td>Cerrington, ND</td>
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<tr>
<td>1995</td>
<td>Fredonia, KS</td>
</tr>
<tr>
<td>1996</td>
<td>North Shelby, MO</td>
</tr>
</tbody>
</table>

Purpose

The National FFA Agricultural Mechanics CDE has made significant contributions to the personal and career development of agriculture students, to the improvement of instruction in agricultural mechanics, and to the betterment of agricultural education as a whole. The purpose of this article is to briefly review the first 25 years of the Agricultural Mechanics CDE with special emphasis on the key people and events in its development.

Origin and Early Development

The first meaningful discussion leading to the present National FFA Agricultural Mechanics CDE occurred at the 1967 Northeastern States Agricultural Education Seminar. During the seminar, Frank Anthony (Pennsylvania), Joe Grubowski (Maryland), James Pope (Maryland), and Thomas A. Hoerner (Pennsylvania) met informally to discuss the possibility of promoting the development of a national FFA contest in the area of agricultural mechanics. Tom Hoerner summarized the meeting in a written report which was submitted to the National FFA Organization.

The possibility of a national contest was discussed further at the 1967 winter meeting of the American Society of Agricultural Engineers (ASAE). Tom Hoerner presented the idea of a national contest to the ASAE Education and Research Committee (ER-35), a committee consisting primarily of teacher educators in the area of agricultural mechanics. After considerable discussion, the ER-35 committee decided not to "support the idea of a national agricultural mechanics contest as a group, but would encourage individual committee members to continue work on the idea if they so desired." Again, Tom Hoerner submitted a written summary of this meeting to the National FFA Organization.

From 1967 to 1971, the idea of a national agricultural mechanics contest continued to be discussed, but no formal action was taken. Then, in May 1971, the National FFA Organization chartered a consultant committee to further explore the idea and make recommendations to the National FFA Organization. Robert Seefieldt of the National FFA Organization served as facilitator and Tom Hoerner (by then at Iowa State University) served as secretary for the committee.

After considerable discussion, the consultant committee voted unanimously to support development of a National FFA Agricultural Mechanics Contest. The committee also recommended that the contest consist of a written exam, problem-solving activities, and performance skills drawn from the ASAE recognized instructional areas of power and machinery.
What Do You Know About Music and the FFA?

By Gary E. Moore

Dr. Moore is a professor of agricultural education and extension education at North Carolina State University, Raleigh, and is Historian for the American Association for Agricultural Education.

Music has been associated with the FFA and the New Farmers of America (NFA) since the inception of both organizations. Do you go to the head of the class if you can answer the following music-related questions. The answers can be found on page 25.

5. Since small states didn't have FFA bands, it was suggested that a national band made up representatives from various states be organized. In 1947, a 120-member band made up of FFA members from across the nation first appeared on the stage of the national convention and has existed ever since. This band has been frequently called:
   A. The All-American Band
   B. The FFA Band
   C. The Blue and Gold Band
   D. The Rocky Mountain Band

6. A number of state FFA choruses provided entertainment at the national FFA convention during the early days of the FFA. The success of the national band led to the development of a national chorus in:
   A. 1940
   B. 1950
   C. 1960
   D. 1950

7. The New Farmers of America had a national music-oriented contest. The name of this contest was:
   A. Song Writing
   B. Band
   C. Instrumental
   D. Quartet

8. The NFA published a songbook. Which of the following songs IS NOT found in the songbook:
   A. The HPA Crew Song
   B. HPA Songs Are We
   C. Old HPA Spirit
   D. I'm In Love With a Boy of the NFA

9. The national spokesperson for the FFA alumni is a country and western recording artist. This person is:
   A. John P. Fongumardi
   B. Ty England
   C. Luther Parrish
   D. George Strait

10. A popular country song had a verse about the 4-H and FFA taking a field trip to a farm and uncovering a covered-up spill. This song was:
    A. Chug A Jug by Roger Miller
    B. Enlist in the Chapmboy by George Strait
    C. Bear and Bonet by John Michael Montgomery
    D. Chug Whiskey by Fearless McCabe

The answers to this quiz are located on page 25 of this issue.
Author Guidelines
for The Agricultural Education Magazine

The Agricultural Education Magazine is a magazine specifically designed for teachers of secondary agriculture programs. The Magazine is published six times per year and articles are contributed by agriculture instructors, agriculture students in secondary and post-secondary programs, agriculture teacher educators, agricultural industry professionals and education specialists.

The Agricultural Education Magazine reaches a national audience, so we seek articles which emphasize and demonstrate practical teaching, laboratory exercises, FFA training and activities, and textbook use for the classroom. We hope to provide insight from teachers to teachers of practices that work effectively in the agriculture classroom, laboratory and student organization.

Potential authors are encouraged to review back issues to note how topics are covered and how articles are written. The articles are not generally research articles, but practical application materials. Articles accepted for publication are selected on the basis of:

- their relevancy to the profession and to the theme of the issue in which they are to be published
- originality
- readability
- soundness
- expressiveness
- the viewpoint

Authors are also encouraged to contact the theme editor of the issue for which they wish to submit an article. As a general rule, articles submitted to the editor by the theme editor are given publication preference, although some unsolicited articles submitted directly to the editor are published.

How do I prepare my manuscript?

- Double space your manuscript for ease of editing. Set all margins at one inch.
- Use capital and lower case letters in Times New Roman, font size 10.
- Do not number pages and print only one side of the page.
- Use minimal special formatting (bold, italic, etc.).
- If you have an electronic copy of tables and/or graphs, include them in the text where you want them printed. Provide an explanation for any and all tables and graphs included in the article. If you do not have an electronic copy of the table and/or graph, indicate their placement in the text and include the actual table/graph on a separate sheet. Make sure the copy is clean and crisp, as these items will be scanned into a computer and placed as graphics.
- Include a current head-and-shoulders photograph of all article authors to be published with your article. Be sure that the name(s) of the author(s) are written on the back of their individual photographs.
- Include references in the text in parentheses with the author's last name, followed by the date of publication, e.g., (Williams, 1996). If a direct quote is used, also include the page number where the quote appears in the original publication, e.g., (Williams, 1996, pg. 276).
- Cite all references used at the end of the article in a reference section according to Merriam Webster's Collegiate Dictionary, Tenth Edition.
- Give your article an interesting title and use subheadings to identify changes in topics and add visual interest to the article.
- Include photographs suitable for publication with captions and the name of the person who took the photo so proper credit can be given. Candid photos of activities are preferred.
- Include your name, address, telephone number, fax number, and e-mail address in a cover letter to the editor or theme editor if there are questions regarding your submission, we may need to contact you. If your manuscript is selected for publication, you will receive a complimentary copy of the issue in which it is published.

How should I submit my manuscript?

- Send three hard copies of your article to the theme editor or the editor to whom you are submitting your article.
- Send a 3.5" diskette with a copy of your article on it. The disk MUST be PC-compatible, not Macintosh. If possible, please submit the manuscript in Microsoft Word for Windows 6.0 or higher. We can convert WordPerfect, but prefer Word. Please write the following information on the disk label:
  - File name of the manuscript.
  - Specific version of word processing program.
  - Whether the disk is formatted high or low density.
  - Your name and telephone number.

If you cannot submit a disk, we will scan the article into the computer. Therefore, the hard copies must be clean and sharp.

Where should I submit my manuscript?

Theme editors for each issue are published yearly in The Magazine along with their addresses, telephone numbers and e-mail addresses. If you wish to submit an article on a specific theme, the theme editor should be your first contact.

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Here are the answers to the questions published on page 23 of this issue of The Agricultural Education Magazine.

Next Issue:
LOCAL PROGRAM SUCCESS

Coming Next Issue:
LOCAL PROGRAM SUCCESS

THE AGRICULTURAL EDUCATION MAGAZINE
May-June 1997

THE AGRICULTURAL EDUCATION MAGAZINE
May-June 1997
Such Are the Lessons in the
Agricultural Mechanics Laboratory
A View from the Agricultural Mechanics Laboratory
Egress Opening (Shop Door)

By Jim Sorensen
Mr. Sorensen is an agricultural education instructor, Kimberly High School, Kimberly, ID.

It's spring, so I am standing in the egress catching a few rays of radiant light from the outside while pondering the subtleties of life and watching kids work on the inside. I just passed 80 a few weeks ago, so I have had plenty of time to think about the future as well as the past. I am wondering that the future will look more like the past than many will want to believe.

One thing that I have noticed is that kids are getting tired of computers. They are tired of sitting at the computer and looking at a screen. I see computers going the way of the VCR. Many readers will remember when VCRs first entered the classrooms. Do you recall the excitement from the students as well as the instructors? For the students, it meant something new; it was like having a guest speaker, or even better yet, watching television at school. For the instructor, it meant not having to thread the projector or fix the films when it broke. It meant bringing what happened yesterday into the classroom today. It also meant that one didn't have to worry about sending the movie back if one happened to remember to order it in the first place. Ah, yes, most importantly-INSTANT LESSON PLANS!

Sorensen

Agricultural Mechanics classes, properly presented by the teacher and absorbed by the students, teach most of the skills necessary for students to obtain employment. Agricultural mechanics classes expose students to critical thinking skills, the use of common sense, reading for content, practical mathematics applications, cooperation, and interactive skills and probably a lot more fancy educational stuff, the terminology for which I cannot recall. Agricultural mechanics classes are even outcome based. I know I should not bring this up, but agricultural mechanics classes are also fun.

Most importantly for both the teacher and the student is that agricultural mechanics classes are a time when a young person and an adult can work and spend some time together. It's one-on-one, hands-on interaction. Could this be why students and teachers both like these classes? Watching a student learn to weld, construct a project, work with wood or make a small engine run again is very satisfying. Watching a student smile when you tell them they have done a quality job—then seeing them come back to try to do better—is why some of us teach. This must be the same feeling that an elementary teacher gets when they see someone read for the first time.

Oh, oh, no more time for pondering. I hear screaming from the welding booths. It smells a little like burning sneaker with maybe a tinge of smoking overalls. Such are the lessons in the agricultural mechanics laboratory. Now, where in the world are the handbags?

Everything Old is New Again, continued from page 2

I think that just as long as we, those of us involved in teaching students interested in agricultural mechanics, care more about what the project does for the student than about what the student does to the project, as long as we include the "why" with the "what" in our curriculum and instruction, our programs will be relevant and successful.

References


Guy E. Calo, "Improving Instruction in Farm Mechanics," The Agricultural Education Magazine 30, 7 (1958): 150, 152, 156.

V. E. Christensen, "Hay Racks or Hat Racks?" The Agricultural Education Magazine 36, 9 (1964): 207.


4. Business and industry, career pathways

The link to other educational programs within the school itself is imperative. Blending the concepts, principles and skills from one subject area to the next concurrently provide students with a basis of understanding the inter-relatedness and application of what they have learned.

Linkages with teacher education and curriculum reform are necessary to continually assess where the curriculum is and where it is going, and that those presenting the curriculum to students are knowledgeable about what is being taught and how it is being taught.

Linkage and articulation among educators at all levels—secondary, post-secondary and university—is vital to the development and implementation of a successful program in agricultural technology. These are: communication and cooperation with business and industry.

In Conclusion: What Do You Think?

The CMATE model provides a visual plan and course of action for use in teaching agricultural technology. The model includes curriculum inputs and outcomes, delivery systems for the curriculum inputs, and a support system of linkages with other educators, higher educational institutions and educators, and business and industry professionals.

This is not to imply that this model is all inclusive and should be adopted as a national curriculum model. However, it is a starting point from which discussion can begin on what a model for agricultural technology education should look like. What do you think? How well does this model fit your program? Let's talk...
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