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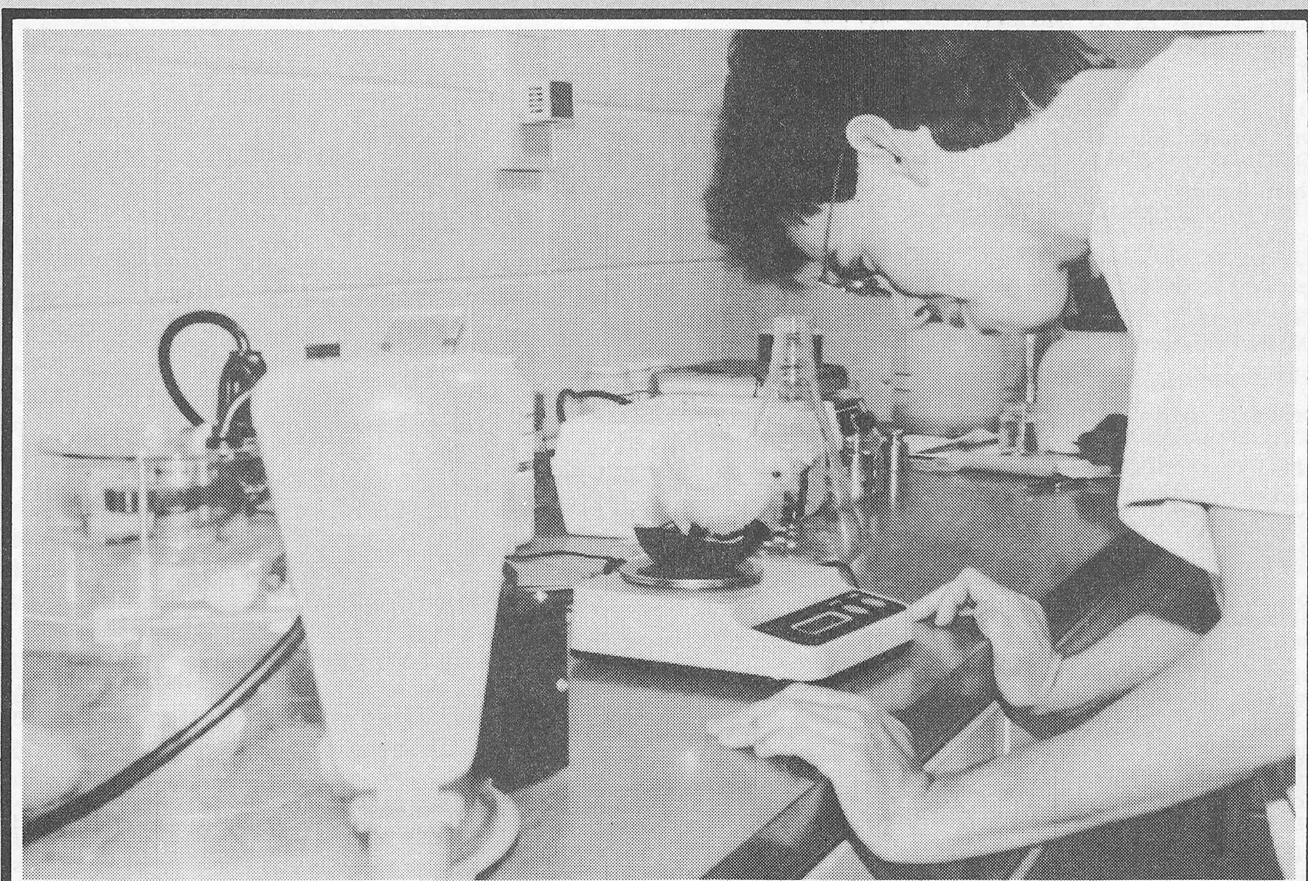

THEME: Enhancing Problem Solving

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ARTICLE SUBMISSION

Articles and photographs should be submitted to the Editor, Regional Editors, or Special Editors. Items to be considered for publication should be submitted at least 90 days prior to the date of issue intended for the article or photograph. All submissions will be acknowledged by the Editor. No items are returned unless accompanied by a written request. Articles should be typed, double-spaced, and include information about the author(s). Two copies of articles should be submitted. A recent photograph should accompany an article unless one is on file with the Editor.

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Alienation In Agriculture

"If It Ain't Broke, Fix It"

BY PHILLIP R. ZURBRICK, EDITOR
(Dr. Zurbrick is Professor, Department of Agricultural Education, The University of Arizona.)

We have all heard of people being sued for "alientation of affection" and have some concept of the actions involved in such a circumstance. The question might logically be asked as to how the concept could possibly be employed in the field of agriculture. Perhaps in the legal sense the terminology is not appropriate, but in the sense of "turning away" it is appropriate. Many of the leading Colleges of Agriculture at land grant institutions in this country have disengaged themselves from their clientele. This turning away from the industry clientele who have supported and promoted educational and research programs in agriculture will seriously erode the already diminished support resulting from change in the demographics of this country.

Public land grant institutions of higher education must rely on the good will and trust of the many publics served for their continued financial support. As pressure for tax dollars increase on state government and the number of supporters of colleges of agriculture become fewer in proportion to the total population, dollars appropriated for support of colleges will also diminish. Colleges of agriculture in many states are in serious difficulties and face challenges to their continued existence.

The question might be asked as to how this sad circumstance developed. The number of people whose livelihood is derived from production agriculture has been diminishing for more than sixty years, thus the change in demographics is not a new phenomena! Until recently, the decrease in the size of the public served by educational and research programs in agriculture had tended to intensify the support by those it served.

There was a sense of "one for all and all for agriculture," which resulted in a "sense of family" by those involved in any phase of agriculture. This sense of family embraced colleges of agriculture to the point that producers, commodity groups and agricultural organizations felt a sense of pride in and brotherhood with the college faculty. Agriculturalists believed they could turn to the college of agriculture for help and assistance with agricultural problems and for the education of their children. Deans of colleges of agriculture could, with a few well placed telephone calls, rally immediate support with the state legislature for issues important to the college's future. Certainly, the situation in many states has strayed far from such a cozy sense of family.

Why are colleges of agriculture disengaging themselves from their clientele? The answer is multifaceted and requires close scrutiny by those who want to avoid a similar preordained demise.

One of the leading inveiglements has been research dollars offered by various government agencies combined with greedy university presidents. In recent years, a considerable number of research dollars were available in biotechnology and related areas. Universities hired Deans for the colleges of agriculture who were not prepared in the disciplines of agriculture in hopes that they could enrich the University's coffers with fat research grants.

These academic "carpetbaggers" had no appreciation for the agricultural industry and, in many cases, sold the agricultural industry a "bill-of-goods" on the technology of the future. They promised a new technology for agriculture knowing full well that the current technology must sustain agriculture for at least the next thirty years. In their impetuous rush to secure lucrative research grants, these "carpetbaggers" raped academic diversity in department faculty and the college curriculum. Undergraduate programs were eliminated so as to expand graduate programs and hire more graduate students to conduct funded research.

Faculty members were freed of teaching responsibilities so they could pursue additional research monies. New faculty were hired who lacked any comprehension of agriculture and most assuredly rejected any brotherhood with those in the agricultural industry. Individuals who for years had supported colleges of agriculture were no longer finding support and assistance. Further, they were told to send their children to some other institution of higher education as the college of agriculture was only interested in young people who desired a "high science" career requiring a graduate degree. Such institutions are at best a poor excuse for a college of agriculture, and in many cases simply an unnecessary duplication of existing colleges of arts and sciences. Sooner or later an enlightened electorate or bright legislator will wake up to this duplication and recommend the elimination of the college of agriculture.

It is essential for agricultural education programs at the secondary school level to avoid the mistakes made by colleges of agriculture and not alienate program supports. It is crucial that in the hast to expand the mission that teachers and school administrators not disengage the clientele who have supported and been served by the vocational agriculture programs. The key is to balance the programs so as to serve both the "in agriculture" clientele while developing programs for the "about agriculture" clientele. Abandoning one clientele group so as to serve the other is not prudent, nor is simply changing the name without changing program content wise. While it is judicious advice to "fix it before it breaks," it is equally prudent to do so in a manner that precludes alientation of the clientele served.

THEME

Getting The Most Out Of Group Problem Solving

How many times have we been at a committee meeting and watched intelligent people, capable of solving complex problems by themselves, fall apart when forced to approach a problem as a group? From local FFA Executive Committee meetings to the corporate boardroom, many problems facing agriculture today are best solved by groups, not individuals. The need for agriculturists to collaborate on mutual problems has never been so keenly felt, from local communities to global arenas. Our vision of leadership training in agricultural education must be expanded to include formal training in group problem solving, beyond parliamentary procedure.

Group problem solving has something for everybody, and can motivate different students in many different ways. While solving group problems, students can learn about teamwork, leadership, the subject matter area of the problem and problem solving itself. Teachers can do several things to help their students become more proficient group problem solvers.

By Thomas J. Dormody, Theme Editor

(Dr. Dormody is Assistant Professor, Department of Agricultural and Extension Education, New Mexico State University.)

Student and Teacher Interaction

A good place to begin is by defining the teacher's role during group problem-solving activities. In adult group problem-solving situations involving a recognized authority figure and subordinates, like a boss and workers, experts recommend the authority figure become a group member, participating in discussion, leadership and decision making, but without dominating or completely turning it all over to others. To make sure everyone's ideas are incorporated into the solution, group decisions should be reached by consensus whenever possible. Finally, mutual respect between all group members is essential for harmony and productivity.

Does this adult model work during group problem-solving activities involving a teacher and adolescent students? Yes, according to a recently completed study with 9th and 10th-graders in upstate New York. After finishing a seven-period, group problem-solving activity, most students wanted their teachers to share in group discussions, decision making and leadership. The majority also preferred reaching group agreements by consensus, not by voting. The students were least motivated when they felt their teachers were dominating the activities. However, handing over all of the responsibility to students also created problems. In classes with the most complete outcomes, teachers were prepared to provide information, leadership, guidance and resources when needed.

Consensus is an appropriate method to reach agreements in small groups. Webster defines consensus as group solidarity in sentiment and belief, but how does a group achieve this solidarity? A good rule for teaching consensus is to require each group member to express their opinion while the others listen. If group members disagree about the proper course of action after everyone has been heard, each member must be willing to give up part of their idea if another part is incorporated into the final decision. Following these two rules makes managing the agreement easier. The objective is to avoid a false perception of group solidarity, only to find some group members sabotaging the activity later. Parliamentary approach has this drawback. Although more time efficient than consensus, voting can leave a wide gap between winners and losers. What the losers do after a vote can be a problem.

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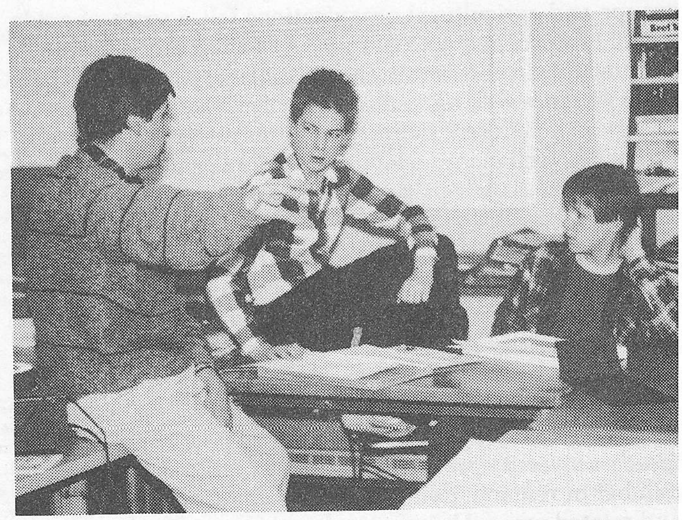


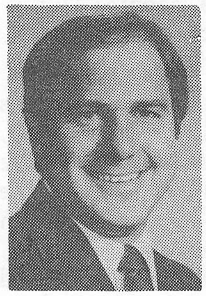
Teachers should interact with students as a group member, while monitoring and facilitating the activity.

About the Cover

Small animals can be easily weighed to draw conclusions in feed ration experiments. (Photo courtesy of Elizabeth Wilson, Charles E. Jordan High School, Durham, NC.)

AGRICULTURAL MECHANIZATION

The Next Step — Technology Transfer



By Joe G. Harper, Special Editor
(Dr. Harper is Associate Professor, Department of Agricultural Education, Clemson University.)

New curricula, new programs, new ideas, new visions, what is next? Probably new stress. As I have had an opportunity to visit several agricultural mechanics education programs and visit with many teachers, I am impressed by the scope of our technology. Yes, agricultural mechanics students need a base of scientific educational experiences, but the greatest emphasis of our instruction will continue to be technology education. Sometimes we focus upon the principles of technology, other times the application of technology. However, the critical factor for the future of agricultural mechanics education will be our abilities to effectively transfer technology.

Technology transfer is not a new concept by any means. At least thirty years ago people were discussing the relative impacts of technology and how the rapid development of technology will influence education, not only what we teach, but also how we teach. As I visit teachers, there are many concerns; student apathy, inadequate facilities, the learning environment, discipline, declining enrollments, changing values, and the difficulty of staying current with today's rapidly changing technology. It appears as though all of these factors are related.

Before we can be effective transferrers of technology, we need to begin with the basics:

Technology - applied science.

Transfer - to convey from one person, place, or situation to another.

From these two definitions we can create:

Technology Transfer - to convey the applied sciences from one person to another

Well, that seems to make sense. (pause) Let's think about this for a minute. (pause, again) It appears as though we have been in the technology transfer business since the beginning of agricultural education. So, why such a renewed interest in technology transfer?

Let's take a look at technology transfer. Owen in Innovation in the Information Chain, states that technology innovation, which infers transfer, is "not just the introduction of something new, but the use of technology for **doing new things.**" A key point Owen states is that technology innovation is a slow process. The average introduction time for a new technology is estimated at five years for a **well-advanced** organization. For other organizations, it may take five to ten additional years. With an average estimate of ten years, it becomes clear why technology does not seem to be transferred to a local school system. The concept of the latest technology of today which has already taken five to ten years to get to industry, and will take an additional five to ten years to get to our classrooms, is not a comforting thought. Reality sometimes is not very comfortable.

As an example, according to Owen the computer local networks were first discussed as an information technology by industry in 1979, with the inital introduction in 1981, and the routine use by business and industry in 1986. The fascimile (fax) process follows a very similar time-frame with routine use being established by 1984. Now, we are almost through 1991, more than twelve years later, and would you consider the use of local computer networks and the fax as being rourtine in your school? How about as a teaching and learning activity? The process of technology transfer appears to be really slow in educational systems. Quite frankly, as I visit schools, I usually see facilities and equipment, such items as small engines and welding equipment, which are much older than twenty years.

The process of technology transfer from the basic technology to its use in society depends upon four factors according to Owen:

1. market potential - depending on such things as the needs and acceptance of users;
2. the infrastructure conditions;
3. cooperation between parties involved in the development of the technology and its application; and
4. cultural, economic, and political factors.

Well, son-of-a-gun, no wonder technology transfer is not an effective process in our schools. These factors have an overwhelming impact on our schools and the educational system in general. Will we ever be able to catch up with technology? Maybe, but a more realistic expectation may be, can we keep from getting further behind?

Owen makes another significant observation in that "Technology innovation depends to a large extent on its acceptance by those who have to work with the new technology." For us, this is one factor we can do something about in our programs because we have greater control here than we do for the other factors and this is the most important one.

In order to determine where we are in the technology transfer process, first we need to know the process. At the

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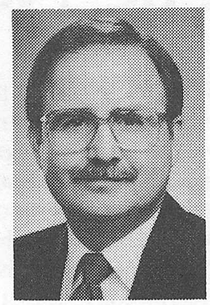
Educating For The New Workplace

"The direction in which education starts a man will determine his future life."

—Plato



BY DAVID WHALEY AND DANIEL LUCERO

(Dr. Whaley is Associate Professor, Agricultural Education and Dr. Lucero is Associate Professor, Vocational Administration, Colorado State University.)

The Challenge

In a keynote address to delegates attending the Holmes Group Far West Regional Conference in October, 1990, Robert Hughes, General Manager of Professional Software Products, Boeing Computer Services, boldly challenged the audience in his opening remarks: "Our educational system is doomed to failure; it encourages dropouts, non-thinkers, and, at best, produces non-motivated learners." As reported in his speech, today's educators have focused their attention on subject matter outcomes, instead of empowering students with critical thinking abilities, problem solving skills, and interpersonal/attitudinal compentencies. This approach has produced students competent in content but educationally impoverished in construct. Hughes further claimed that in order to maximize productivity and employee vitality, successfull businesses have had to look to their own employee training programs to enhance the reasoning and problem solving abilities of their "hires."

With today's heightened scrutiny of public education, statements such as these by Mr. Hughes are not entirely unexpected. Education at all levels and in all places is being challenged to re-examine itself. Reports such as "A Nation at Risk" (1983) and "The Forgotten Half" (1988) have addressed the matter of failing schools. Motorola, Inc. (1991) recently distributed the booklet, "The Crisis in American Education," in which its President and Chief Operating Officer, Gary L. Tooker, wrote:

> . . . we are finding it increasingly difficult to find the types of new employees we need in order to continue producing the very best products and services. This difficulty is due in major part to the failure of the kindergarten through 12th grade education system in developing America's young people to meet the needs of the new workplace (p. 2).

In general, the structure of the present educational system promotes learning as an individual effort (don't talk in class), as "expert" driven (don't question the teacher), and as a series of memorized facts (teach to the test). In a metaphoric sense, the delivery of the present educational system is one in which up to thirty adolescent "workers" gather in a classroom for fifty-five minutes at a time, and are instructed to work on a problem without talking to each other. At the end of the educational session, "workers" pass to another classroom where they are reformed into new groups to address entire new problems. This system is based on "authorities" in policy positions establishing standards and telling management (teachers and principals) what to do and how to do it.

Because agricultural education is integral to the public school system, businesses' indictment of public education is a cause for concern to local vocational agricultural teachers, university teacher educators, and state supervisors. Should businesses' needs "drive" public education, defining its instructional strategies and learning outcomes? If so, what are businesses' needs? Are the traditional delivery systems of vocational education, proposed by Dewey, outdated and ineffective for meeting the needs of the new workplace?

Agriculture in Transition

Agriculture has evolved rapidly at the national and state levels, a transformation fueled by advances in technology, greater efficiency, and a more accessible global marketplace. Farms today are bigger and increasingly more productive; men and women entering agriculture are more likely to be consultants rather than actual producers of food and fiber. Computer managed feeding programs for dairy cattle, embryo transfers in beef cattle, genetic alterations of seed crops, hydroponic gardening practices, and tissue culture of plant species are only a few of the more significant advances impacting the modern agricultural industry. In 1960, one farmer fed an average of 26 people with the output from his fields. Today's farmer feeds approximately 90 people. Successful agriculturalists in the 1980's and 1990's generally have training in business and management principles as well as in the traditional production areas.

The evolution of agriculture has necessitated parallel changes in the preparation of its agricultural labor force. In 1989, the National Summit on Agricultural Education was held in St. Louis, MO, for the purpose of examining the role of vocational agricultural education in supplying a trained workforce to the dynamic agricultural industry. The serious nature of this task was reflected in the Summit's final report (1990) which stated, "Change is rampant in agriculture, and agricultural education must keep pace or become an obsolete remnant of the past." (p. 1). Vocational agriculture, as originally defined through the Smith-Hughes Act of 1917, was very specific and was essentially intended to train boys in agricultural production practices in order that these boys could return to farming. Agricultural education today has a significantly expanded mission and diversified clientele.

Should businesses' needs "drive" education? The USDA estimates that only 8% of new agriculturalists will find jobs as agricultural production specialists. The other 92% will work in marketing, research and engineering, management and finance, social services, and education and communication. As such, the needs of the business sector are valued considerations for agricultural educators as they prepare students for future agricultural careers.

What are businesses' needs? In June, 1989, the Lincoln Institute of Land Policy published AGRIBUSINESS EDUCATION IN TRANSITION: STRATEGIES FOR CHANGE. Reported in this study was a comprehensive list of employee characteristics desired by agribusiness firms. Interpersonal skills, communication skills, and business and economic skills ranked significantly higher in importance than did technical and quantitative skills. According to this report, agribusiness industries are not as concerned with subject matter competencies in their employees as they are with other skills.

Problem Solving in Agricultural Education

The principle of problem solving in vocational education is well-founded. Problem solving is an instructional strategy arising from real problems encountered by students. In agricultural education programs, these problems oftentimes are those faced through students' supervised agricultural experience programs.

Problem solving enhances general thinking abilities and, because problem solving provides for realistic outcomes, knowledge, as such, becomes relevant and operational in the lives of students. Problem solving stimulates interest, develops thinking abilities, and helps students make decisions; it makes instruction meaningful and relevant and develops attitudes of questioning, comparison, and synthesis. As students develop successful abilities to think through, and solve problems, their self-esteem improves. Further, when students participate in the learning process by seeking solutions to their problems, then learning becomes inspired.

Agricultural education programs offer a curriculum that is rich in potential for problem solving activities. One such example occurred this past fall at the Front Range Community College/Larimer Center in Fort Collins, Colorado, where students collaborated on a group project addressing problems of lamb management and marketing. While studying the business practices of livestock organizations, students formed a general partnership for managing a commercial lamb feeding operation.

They each contributed $50.00 to the partnership and elected a chief executive officer and business manager. The in-class instruction dealt with the development of a budget, labor management plan, feed rations, purchase plan, and marketing plan. Students selected and purchased their feeder lambs from the county sale barn. The lambs were fed on rations developed by the students under the supervision of a local feed dealer. All labor and management practices were carried out by the students including feeding, health maintenance, and record keeping.

The agriculture students entered two pens of six in the fed lamb contest at the National Western Stock Show. The rest of the lambs were marketed locally as carcasses. At the livestock show, students had the opportunity to see the carcasses of their lambs and to compare these with others entered. The carcass statistics provided through the contest enabled the students to evaluate their total efforts. The project concluded with each student earning a profit of $16 on their original investment. More importantly, through their group problem solving efforts, students gained first-hand experience with problems associated in the management and marketing of livestock.

A different problem solving activity involved senior agriculture students enrolled this past spring at the Woodlin School in Woodrow, Colorado. These students were challenged with the real problem of recommending agricultural practices to improve the production on a local farm. Specifically, students were asked to collaboratively study past production practices, review all records, and interview the owner/manager and his spouse in order to provide a foundation for their final recommendations.

After obtaining range guides and conducting their own soil surveys, after inventorying all equipment and livestock, and after obtaining past financial statements and projecting future financial statements, the students presented recommendations for adoption to their teacher and to the farm's owner. In order to arrive at the appropriate decisions, this teacher-directed effort required students to consider costs, profit potential, facilities, labor, capital resources, and managerial resources. Alternative production practices were identified and researched. Analytical and decision making skills were refined through this instructional strategy. Interpersonal skills were polished through the students' efforts in interviewing farm personnel and in working with other students investigating this problem.

Meeting the Needs of the New Workplace

Teachers who effectively use instructional techniques which promote problem solving and critical thinking become facilitators of student success. In their classrooms, these teachers create a classroom atmosphere in which students are active participants in the learning process. Knowledge, by itself, is of limited value without the reasoning, thinking, and decision making abilities necessary to work with and to solve problems.

Are the traditional delivery systems of vocational education outdated and ineffective in meeting the needs of the new workplace? No, as reported regularly and with fervor in our agricultural education literature, problem solving works — and with lasting outcomes. It motivates students to learn — to inquire into the "how" and "why," as well as the "what." Its real world emphasis enables students to fine tune their critical thinking and reasoning abilities as they face challenging situations. And through their involvement in group problem solving activities, students exercise and advance their interpersonal skills. These are valued traits that the business sector seeks in its new employees.

Yet according to major business leaders, these traits are often lacking in those new "hires." The apparent disparity between what the business sector wants in its new employees and what public education delivers in its graduates is cause for concern to all educators. A renewed emphasis on and

(Continued on page 11)

Enhanced Problem Solving and Agriscience: A Perfect Pair

By Elizabeth B. Wilson
(Ms. Wilson is the 1989 National Agriscienc Teacher of the Year from Charles E. Jordan Higl School, Durham, NC.)

Agriculture educators must increase their emphasis on science, technology and thinking skills to prepare well-informed, skilled problem solvers for the workplace. Such an emphasis fits naturally into agricultural education enhanced problem solving activities that already require students to utilize technology and solve problems.

In 1989 the North Carolina Department of Public Instruction issued a research and development grant "Updating Vocational Teachers for the Delivery of Higher Order Thinking Skills" to address this idea. Using Agricultural Education as a model for other vocations, the project established a model classroom at Charles E. Jordan High School to demonstrate and test a developing agriscience/higher order thinking skills curriculum.

A strong advisory committee made up of Rhone-Poulenc Ag. Co., the North Carolina Biotechnology Center and North Carolina State University representatives helped the principal investigator to develop a new scope and sequence.

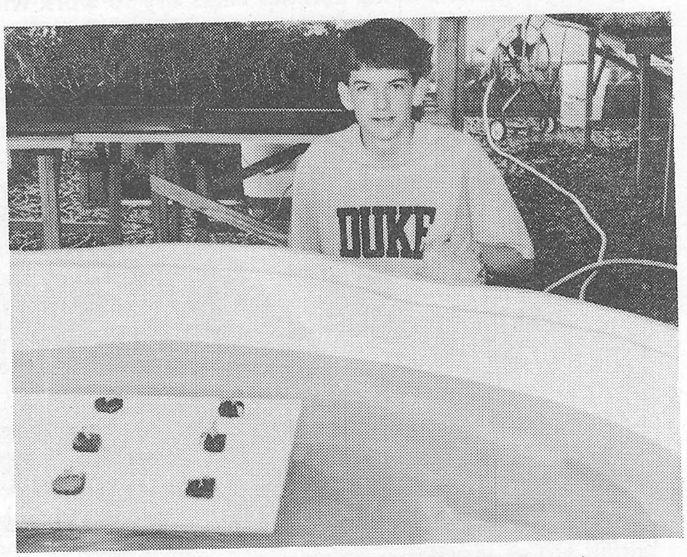
Students begin in Introduction to Agriscience their freshmen or sophomore year and proceed to Plant Science or Animal Science their sophomore or junior year. In these courses, students learn basic information and are exposed to current agricultural topics.

After completing Animal Science or Plant Science students take the completer course Agriscience and Technology. The emphasis of classroom instruction in Agriscience and Technology is on teaching students where and how to find information, not the memorization of facts. Student are encouraged to raise questions and the teacher freely admits to not having all the answers. Instead the students and instructor act as a team to solve problems. Students are cor stantly reminded that technology is forever changing an to be successful in the future one must be able to find an use information.

The course begins with an introduction to careers, cu rent events and the Agriscience Student Recognition Pr gram. Several weeks are spent reviewing basic laborator procedures and the scientific method.

During the year-long course, current topics in Pla Science and Animal Science are discussed and appropria laboratory activities are carried out. Students are encourage to use higher order thinking skills by creating model brainstorming solutions, diagramming processes and thin ing out loud.

Halfway through the course, students begin an indivi ualized nine-week project based on the scientific metho Each student identifies a problem in Agriculture and stat a hypothesis which could solve the problem. Class field tri



Creative projects such as an aquaculture/hydroponics symbiotic growing system capture student interest.

The laboratory is a natural setting for problem solving.

Agriscience and Technology Courses
Charles E. Jordan High School

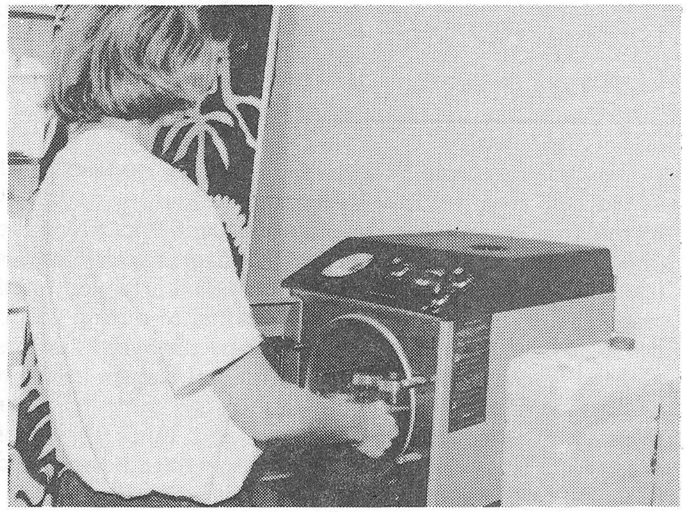
I. Introduction
   A. Careers in Agriscience
   B. Current Events in Research
   C. FFA Agriscience Award and Agriscience Project
   D. Relationship to Existing SAE
   E. Planning, Recordkeeping, Written Projects, Oral Presentations
   F. Basic Lab Procedures and Equipment

II. Plant Science Technology/Biotechnology
   A. Propagation of Plants
      1. Cloning of Seedlings
      2. Tissue Culture
   B. New Horticultural Practices
      1. Organic Gardening
      2. Hydroponics
      3. Genetically Engineered Bacteria
   C. Horticultural Pest and Disease Control
      1. Biological Pest Control
      2. Chemicals vs. Biopesticides
      3. Integrated Pest Management
   D. Computers
      1. Recordkeeping
      2. Landscape design (LANDCADD)

III. Animal Science Technology/Biotechnology
   A. Animal Breeding and Selection
      1. Embryonic Cloning
      2. Animal Tissue Culture
      3. Artificial Insemination
   B. New Animal Science Practices
      1. Growth Hormones/Enhancers
      2. Diagnostic Testing
      3. Waste Management
      4. Aquaculture
   C. Animal Health
      1. Animal Nutrition/Feed Analysis/Feed Processing
      2. Animal Immunity
      3. Vaccines/Drug Use
   D. Computers
      1. Ultrasonic Grading
      2. Recordkeeping

IV. Environmental Management
   A. Chemical Waste
   B. Conservation Tillage
   C. Water Quality and Conservation
   D. Genetically Altered Organisms
   E. Ethical Issues and Patents in Biotechnology

V. Genetic Engineering
   A. Animal and Plant Cells
   B. DNA and Protein Synthesis
   C. Classical Versus rDNA Breeding Techniques
   D. Demonstration of rDNA through Phenotype Expression
   E. Genetic Engineering of Plants and Animals
   F. Current Applications of Genetic Engineering in Agriculture



Students also learn to be responsible for prepping labs and recording data in addition to problem solving.

are taken to local libraries where students can find more detailed information. Students are also introduced to advisory committee members in government and private industry to get more background information.

Once the problem and hypothesis are clear, experiments are designed and proposed. Supplies and materials are then secured and facilities are readied. Once the student begins the experiment he or she is responsible for gathering data outside of class time. Computers can be used to make data tables and graphs before and after school. As soon as the experiment is complete, results and conclusions are written.

Each students is required to turn in a written report and display board as well as present a five minute oral presentation to the class. Oral presentations provide an excellent way to infuse public speaking into the curriculum. Display boards are an excellent resource for public relation activities and recruitment.

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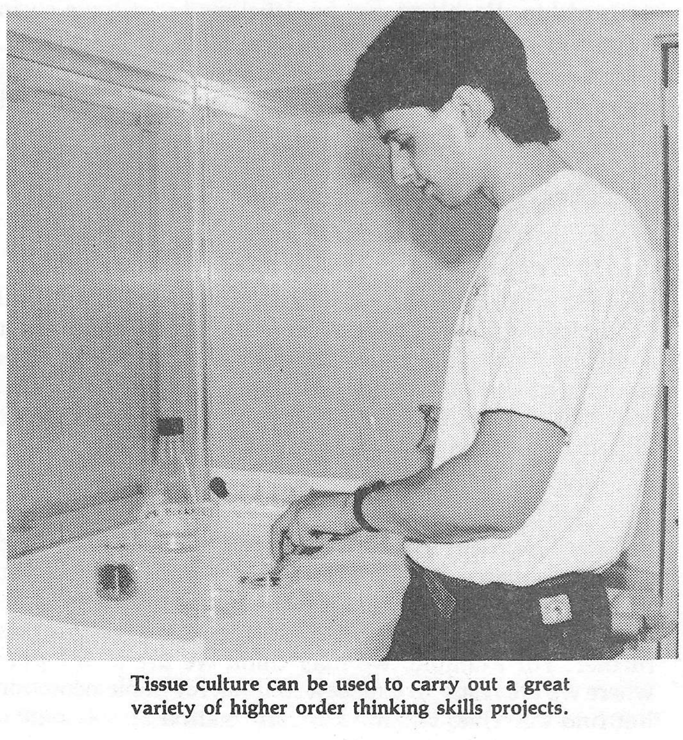


Tissue culture can be used to carry out a great variety of higher order thinking skills projects.

Getting The Most Out Of Group Problem Solving

(Continued from page 4)

How should students interact with other students? Just as teachers would do well by participating but not dominating or leaving the room, students should understand the importance of their participation. The teacher's role includes teaching students about shared responsibilities and mutual respect, then monitoring their performance during group problem-solving activities. Mutural respect between students and the teacher is important, but mutual respect between students may require more policing. A few students in our study were victimized by teasing and other forms of disrespect. This behavior is contrary to what students need to learn, and is also counter-productive.

All of this leads up to an important point. It's not enough for students to solve the problem. Group problem solving is a process. Students need to learn and to be evaluated on their process skills. Most of us have worked on a group project in high school or college plagued by uncomfortable group dynamics. We remember doing all or most of the work to pull it off. Although we ended up with a decent product, did we learn anything about group work? Yes . . . that it can be an unsavory process, overwhelming responsibility and complete waste of time if we are not taught and evaluated on process skills.

Problems Worth Solving

What problems are appropriate for group consideration? Just about any agriculturally-related problem can be tackled by a county agricultural task force or whatever the class wishes to call itself. We picked a problem in land resource stewardship for our study. Each class was a committee responsible for promoting good stewardship in the community. Committees had to develop a simple project to educate the public about one or more aspects of land resource stewardship. Problems can be developed that have social as well as production-related dimensions.

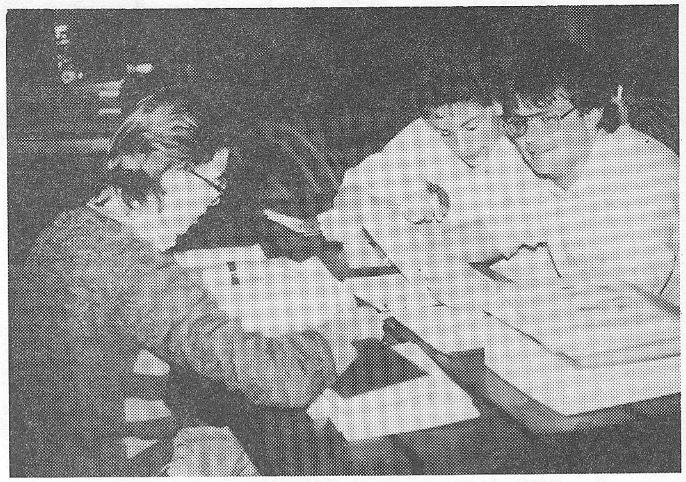
I recommend following Phipps and Osborne's criteria when developing group problems. Group problems should:

1. Be stated clearly.
2. Be of the proper scope and difficulty.
3. Demand thinking of superior quality.
4. Be interesting to the students.
5. Develop from the experiences of the students.

Real-life problems, with possible solutions that can and will be implemented, are the best. For example, one class in our study produced an educational display booth on land resource stewardship and placed it in a local festival. A final consideration is to develop problems that build in the required subject matter competencies.

Going Through The Phases

Group problem solving should follow a model through a series of phases. I use the word phases because we seldom proceed through a problem in a stepwise manner. We must often go back to an earlier phase before we can progress further. For example, we may think we are at the point where we are ready to choose a solution for implementation, but find ourselves lacking key information about some of the alternatives. So back we go to gather more information.



Breaking the class into subgroups can provide students with more responsibility and leadership opportunity.

In our study, the teachers commented on the obstacles they encountered during each phase of a six-phase model:

1. Define the problem.
2. Identify possible solutions.
3. Gather information.
4. Choose a solution.
5. Implement the solution.
6. Evaluate and modify the solution.

It's important to start off by making sure everybody understands what the problem is. Only one school in our study had trouble defining the problem. As the class attempted to enter the second phase, confusion reigned. The class had to go back and finish defining the problem before they could move on. It's a good idea for teachers to get involved in this phase, especially if particular competencies must be addressed in the activity.

Identifying possible solutions is a fun phase. Every student and the teacher should have an opportunity for input here. Students can lead group discussions and record ideas. Every idea should be recorded at this point. When the class has exhausted possible solutions, members may have to work together to eliminate a few that are not feasible or of interest. When the list is manageable, the class is ready to go on.

Although gathering information actually occurs throughout the group problem-solving activity, many problem-solving models show it as the second phase. I list it third because identifying possible solutions can motivate students and define what information gathering is needed. Subgroups of a few students, even individual work, can be an efficient way to gather information. Subgroups can research one of the possible solutions surviving the initial screening. Smaller groups provide more discussion, decision making and leadership opportunities to the students.

A crucial teacher responsibility during this phase is to help students identify and locate information resources. Resources used by participants in our study included computer programs, printed materials, audio-visual materials and resource people. The teacher's organization, assistance and motivation will probably determine whether the students enter the next phase with enough information and enthusiasm.

Another exciting phase of group problem solving is when the students come back together to choose a solution. The information gathered during the previous phase is used to present a case for each alternative. The class then decides which alternative is best. This is a great place to work on a consensus.

Keeping students active and the work load distributed fairly during the implementation phase is important. The class can choose more than one solution so there is enough work for everyone. Subgroups or individual work can again be employed. During implementation, students are reinforcing learning by applying what they learned in earlier phases. A solution may also require students to learn mechanical, journalistic or other new skills.

Evaluation is a higher-order thinking skill. The model's final phase lets the class evaluate the outcome and discuss what they would do to improve the solution, if given a second chance. If there is time, changes can be made and the solution tried again.

Summary

Group problem solving is a process. Careful attention to student and teacher interaction, development of group problems and activities during each phase will ensure a harmonious, successful and richly integrated learning experience. I hope you will see from this article and others in this issue, that problem solving has many faces. We'll see it related to the scientific method. Some will refer to it as a teaching method, while others will discuss it in context with the learning process. Keep an open mind as you read these articles. You will discover that enhanced problem solving depends on innovative application.

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Educating For The New Workplace

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commitment to problem solving as an appropriate educational strategy in public schools may well help to better prepare young people to meet the needs of the new workplace. In these rapidly changing times, success of the public school system will be maintained only through the invigorated use of appropriate educational deliverly systems. Problem solving appears to be one such system.

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Enhanced Problem Solving and Agriscience: A Perfect Pair

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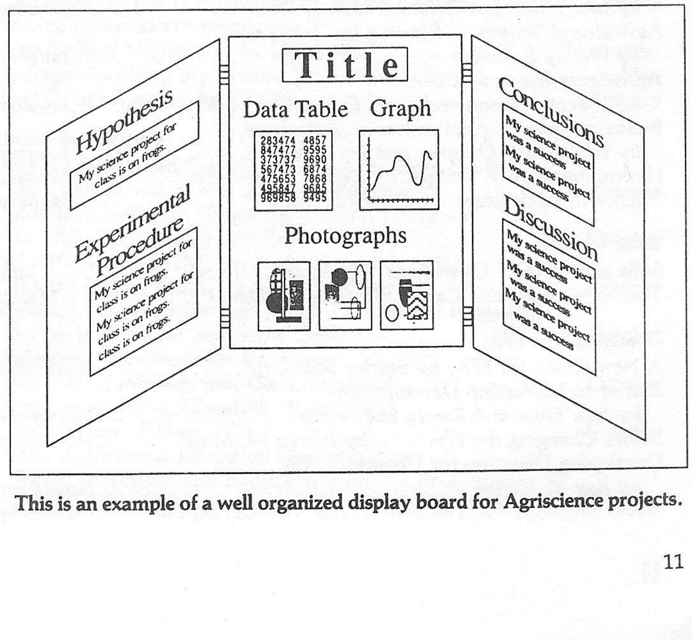
This course is unique compared to today's average classroom where students spend approximately eighty percent of their time memorizing facts. At first this problem solving approach to teaching may seem uncomfortable to the students and the teacher; however, students eventually adjust and develop a higher level of interest in agriculture.

Teaching problem solving skills should be a priority for every Agricultural Educator. Advances in technology are being made at such a rapid rate, our students will be faced with an industry that requires one to think rationally and logically. Information is being updated continuously; therefore, memorizing facts should no longer be a measurement of student achievement. Instead students should be taught how to find and use information.

Research has shown that students with a positive attitude toward problem solving will succeed more often. Enhanced problem solving activities in Agricultural Education allow us to turn students on to thinking and agriculture. What better way could we prepare our students for the future.



This is an example of a well organized display board for Agriscience projects.

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THEME

Thinking On Your Feet — A New Life Skill?

By Nancy Conjura-Colgan and Timothy Rollins

(Ms. Conjura-Colgan is Graduate Assistant and Dr. Rollins is Assistant Professor, Department of Agricultural and Extension Education, Pennsylvania State University.)

As agricultural educators, we pride ourselves on teaching leadership and other life skills to our students. One life skill that should be receiving considerable attention is problem solving or the ability to "think on your feet." Regardless of what you call it, problem solving is a technique that enables people to more effectively solve problems in their daily lives. Problem solving techniques can be learned by students if the processes are incorporated into subject matter. Students can be taught problem solving techniques and then asked when they can transfer these techniques into their real life situations.

This article discusses nine problem solving techniques that you can teach your students. These techniques are divided into three types: learning-to-learn skills; content area skills; and reasoning skills. An outline of a landscape project lesson plan (Fig. 1) is referred to throughout this article to show you where you can incorporate these problem solving techniques into subject matter. As you read this article, think of other ways you might be able to use these techniques in your teaching.

Learning-To-Learn Skills

Learning-to-learn skills help students focus on a task and stay focused until it is completed. Students who apply learning-to-learn skills focus more of their attention on learning and spend less time daydreaming.

Teaching Outline
Landscape Project

I. Site Selection
   A. Need for Site Beautification
   B. Identify Responsible Individuals
   C. Site Characteristics
II. Selection of Plant Materials
   A. Availability of Plant Materials
   B. Plant Selection Factors
   C. Final Determination
III. Landscape Design
   A. Principles
   B. Drawing
   C. Presentation
   D. Final Design
IV. Landscape Planting
   A. Obtaining Materials
   B. Planting Materials
V. Landscape Maintenance
   A. Short Term Maintenance Plans
   B. Long Term Maintenance Plans

Figure 1

The Responsibility Frame

One learning-to-learn skill known as the "responsibility frame" consists of four steps: setting the stage for the activity, goal setting, task engagement, and completion. The first step of the "responsibility frame," setting the stage, is composed of three phases: "focusing;" "awareness;" and "commitment." Set the stage for a class even if you are not teaching the "responsibility frame." Students can learn to block out thoughts that disturb them during a class and to "focus" their attention on the class activity. At the beginning of the class, have students write down thoughts that come into their minds that will prevent them from focusing on the class activity. Have them place the written thoughts in a shoe box or other container to symbolize putting them aside. At the end of the class activity, ask students to evaluate how well they blocked out their thoughts. Students learn that it is possible and often necessary to put distracting thoughts aside and completely engage in their present activities. Why not model this behavior yourself when asking students to do it?

Once students have blocked disturbing thoughts from their minds, they will be ready to "focus" their attention on a class project such as landscaping. To help students become "aware" of a landscape project, show them a site that needs to be landscaped and ask them to focus their attention on it. Ask students to be honest with themselves and answer the following questions: How much did you actually focus on the site?; Is it worthwhile improving this site?; Do you have the ability to improve this site?; How focused will you have to be to complete this task? These questions will help students understand the importance and impact the project will have on their school and community and, as a result, they will become "committed" to the project.

The second step in the "responsibility frame," goal setting, is a valuable skill that can also be taught separately. Students should learn to set both long-term and short-term goals. For example, a long-term goal of the landscape project is to install landscape plants (Fig. 1. IV) while short-term goals are to amend the soil and select plant materials (Fig. 1. II.) Goal setting is taught in a landscape project by having students set goals and monitor their progress in reaching them. Begin by telling students they will be starting a landscape project and are required to have the site landscaped in a given period of time. Ask the students, "What has to be done to accomplish this goal?" Explain that you have set the long-term goal for the project and, by describing what they do to accomplish this goal, they will set short term goals for the project. The class should also develop a plan to periodically monitor their progress.

The third step in "the responsibility frame," engaging in the task, occurs when students work toward completing their goals. During this step, students should monitor their progress in completing their goals, and if the project appears to be off schedule or has other problems, students should be encouraged to assess the situation, find alternative solutions, choose the best solution, and solve the problem. The last step in "the responsibility frame" is the successful completion of the task which, in this case, is the landscape project.

When teaching learning-to-learn skills such as "the responsibility frame," you need to encourage students to think about their thought processes and be responsible for their individual learning. Students who master learning-to-learn skills will be able to think more clearly about subject matter and the important occurrences in their daily lives.

Content Area Skills

How can students master course content? The following content area skills — concept attainment, proceduralizing, and synthesizing — will help students mentally process information into more easily understood forms.

Concept Attainment

Students are constantly being introduced to new concepts by their teachers, parents, and friends. Students may understand some concepts easily while it takes much longer for them to grasp others. If students are taught the process of concept attainment, they will be able to grasp new concepts more readily.

Concept attainment can be taught by introducing a new concept and then giving an assignment for practice in applying this concept. For example, students can understand the concept of landscape design in one class session by experiencing the concept and putting the concept to practical use (Fig. 1. III A). This can be done by showing students slides of landscapes that emphasize color, texture, line, and other design components, and then asking them to form mental pictures of each of the design principles. Show other slides and ask students how each of the design principles are being used. Modifications of this technique can be used to provide students with the opportunity to learn many other concepts in agriculture.

Proceduralizing

Much of what we teach is not abstract concepts but procedures such as starting a tractor, welding, or transplanting. "Proceduralizing" or internalizing a task allows a person to repeat it with little mental effort. What would life be like if we had to consciously think about tying our shoes or walking out the door?

Students can be taught to "proceduralize" if they are shown a task, asked to list and memorize the steps, and then complete that task. We may want students to memorize the steps to complete a task before they do it because of safety. Students should learn the actual process of proceduralizing so they can apply it to other areas of their lives. What skills are taught during a landscape unit that students can proceduralize?

Synthesizing

Students can learn how the subject matter fits together if they are taught "synthesizing" skills. Students who learn "mapping skills" can put course information into an abbreviated, pictorial form. The "web" or "spider" map (Fig. 2) can be used to diagram the major concepts covered in a unit. The "part to whole map" (Fig. 2a) breaks a subject into its parts. The "category map" (Fig. 3) puts things into classes or categories.

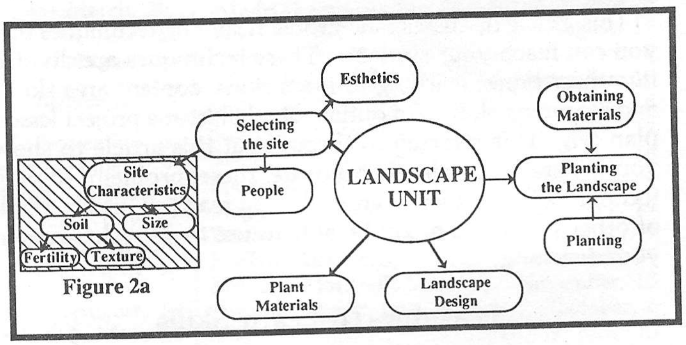


Figure 2

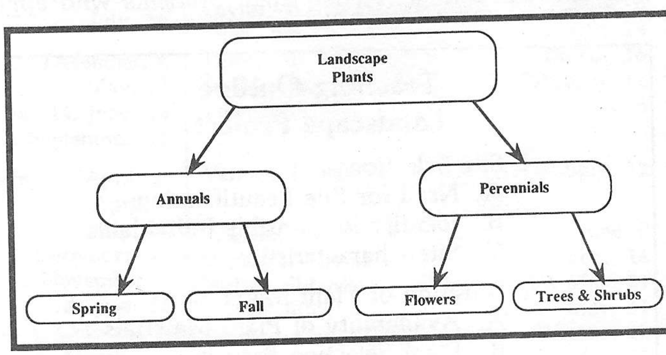


Figure 3

Content thinking skills help students learn subject matter in agricultural education classes. The ability to use content area thinking skills should help students learn information more rapidly. You can also teach students by showing them examples of how to transfer these skills to other courses and real life situations.

Reasoning Skills

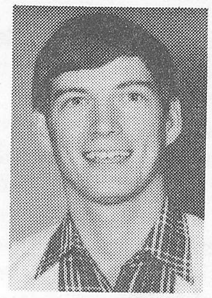
The next group of skills, reasoning skills, helps students to think ahead and solve problems. You can adapt your curriculum to teach students to solve problems or make decisions as they learn new subject matter. Students should learn

(Continued on page 23)

FEATURE COLUMN

TEACHING TIPS

Welding Demonstration Table



By Jerry Schmidt and Ed Osborne, Special Editor

(Mr. Schmidt is Agriculture Teacher, Stockton High School, Stockton, KS.

Dr. Osborne is Associate Professor and Chair, Department of Agricultural Education, University of Illinois, Urbana-Champaign.)

Most instructors teach and demonstrate the procedures for student to learn how to weld. To accomplish this the instructor needs a table or booth and students need welding helmets. We designed an adjustable welding table for group discussions. Viewers do not need a welding helmet, only safety glasses. We use this welding table for lab demonstrations and plan to use it when recruiting eighth grade students. It has added a new perspective for students learning how to weld.

Advantages of this Welding Demonstration Table

- Simple and inexpensive
- Adjusts to the height that is comfortable for the welder
- Shield eliminates need for each student to have a welding helmet (students are required to wear safety glasses)
- Shield forms a semi-circle allowing groups to see
- Table can be lowered to explain procedure then raised to demonstrate
- Table can be separated into three pieces (base, table and screen) for storage

Procedures to Construct Welding Demonstration Table

We use a 30 gallon barrel as a pattern to bend the flat metal into a semi-circle for the frame of the screen. The table is then cut to fit the frame of the screen. The plastic screen is 20″ x 50″ and is purchased from the Book Division of the Lincoln Electric Company for $7.50. The shield is flexible and inexpensive. The screen is pop-riveted every 3″ to the frame which adequately holds it in a semi-circle shape. Three machine screws with wing nuts make it easy to remove. We use 1¼″ square tubing to attach to the base and 1″ square tubing welded to the table to telescope inside. A ⅜″ nut is welded to the base upright to hold a set screw for adjusting the height. Two used disc blades are welded to form a stable base for the table.

Bill of Materials

1 - Welding Screen-Shield	$7.50
1 - 3/16″ x 18″ x 23″ smooth plate - Table	8.04
2 - 1/4″ x 3/4″ x 18½″ flat - Screen Frame Uprights	.30
2 - 1/4″ x 3/4″ x 50½″ flat - Screen	.84
2 - 1/4″ x 3/4″ x 18½″ flat - Inside Braces	.30
1 - 1″ x 14 ga. x 24″ square tubing - Table Extension	.86
1 - 1/4″ x 14 ga. x 30″ square tubing - Base Upright	1.30
2 - Used Disc Blades - Base	1.00
1 - 3/8″ set screw with handle - Adjustments	.50
Total Cost	$20.64

The Next Step — Technology Transfer

(Continued from page 5)

present time there are a number of models of technology transfer. The USDA Forest Service utilizes an eight step model. The elements of this model of technology transfer include conception, development, evaluation, demonstration, user training, adoption and implementation, networking, and improvement.

Where do we, as educators, fit in this model? Probably, for most technologies, in the middle. Every time you go to an Experiment Station field day, you are experiencing the demonstration stage. For those of you who become active in the research process, you may from time-to-time find yourself at the conception, development, or evaluation stages. If you attend a workshop on some technology, you are probably at the user training stage. Once you use the technology, you are within the latter stages of the process.

Too many times we are out of the technology transfer model! Often times universities, industries, and governmental agencies do not include us in the process. At this point, go back and review the previous paragraphs and focus in on Owen's point. If industry can spend maybe ten to twenty percent of their resources on research and development, then how much time and effort do we need to spend? But we do not have enough time! Well, if we do not spend some time now we will never be able to keep pace, let alone catch up.

(Continued on page 23)

THEME

Attention Directors Help Maintain A Problem Solving Approach

Many articles and other professional resources describe in detail how to begin teaching through a problem solving approach, including how to develop your lesson plans, determine objectives, and establish questions or problems to be answered. Also, that students should be involved in this overall effort. But as we look at how to keep the problem solving moving once class is underway, the literature becomes scarcer. If we, as teachers, do not keep problem solving foremost in our minds as we teach throughout the class period, then chances are we will fall back into a strictly lecture/discussion mode of teaching.

Once a class is underway, we, as teachers, must continually compete for the students' attention. External factors such as daydreaming, peer problems, uncomfortable classroom environmental conditions as well as other outside pressures can divert the student's mind or attention away from an educational focus. Thus, the challenge to the teacher is to plan teaching strategies, activities, and learning exercises that serve to direct and hold the mind or attention of the students to the topic (objectives, problems) of the class.

By John R. Crunkilton

(Dr. Crunkilton is Associate Dean, College of Education, Virginia Polytechnic Institute and State University.)

Table 1 identifies what could be called attention directors, teaching/learning activities that will assist in focusing and holding the attention of the students to the topic. These are just a few examples of many teaching/learning activities that will help keep the problem solving approach to teaching alive. The key is that once a problem solving approach is started in the class, the teacher must continually compete for the students' attention and problem solving learning activities can help maintain this teaching approach.

TABLE 1 — ATTENTION DIRECTORS

Teaching/Learning Activity	Description of Activity Intent	Application Example
Effect, what was the cause?	What may have lead to an effect? Student determines the causes that preceded the effect.	A rejected loan application
Cause and effect	If certain conditions exist, what effect may this lead to?	Welding at a lower than recommended amperage
Given a situation to be improved, what would you do?	A real situation exists. Students decide how it can be improved.	A building in need of renovation
Forked road situation	Two alternatives exist. Students determine which alternative is best for the situation.	Rent or buy a fertilizer applicator
Possibilities factors chart	More than two alternatives are available. Students determine important factors to consider, collect information, then determine which alternative is best for the situation.	Selecting seed
Similarity/dissimilarity table	A task is at hand, several alternatives are available. Develop a table on how the alternatives are similar/dissimilar.	Harvesting forage
Intervention Concept	A problem is identified, steps are listed that are likely to intervene to correct the problem.	Dairy calf with scours
Advantages/Disadvantages Strengths/Weaknesses Pluses/Minuses	A situation is identified and students list the extremes.	Advertising by radio/newspaper/flyers
Step isolation	Isolate a certain psychomotor step from a series of steps where the importance/characteristics of that particular step can be studied.	Running a bead — isolate the "position of a welding rod"
Sequence of events/steps	Studying a series of steps to examine the relationships and how each step builds upon the other.	Following directions on a product label
Predicting outcomes	Given a series of data/trends, students identify the most likely and least likely outcomes.	Price of an agricultural
Quiet in the classroom	Teacher asks a question, poses a problem, raises a problem, raises a concern. Then insist on quiet for 5 minutes to allow students time to think, write a response, before discussion.	Any topic

Agriscience Program Stimulates Student Inquiry and Problem-Solving

By Linda Whent and Robin McC. Greenler

(Dr. Whent is Supervisor of Teacher Education, Department of Applied Behavioral Sciences, University of California, Davis.

Ms. Greenler is AgriScience Institute Director, Department of Plant Pathology, University of Wisconsin, Madison.)

When does real learning take place? Some say it occurs when students accomplish a task. Others say it occurs when students understand the reason behind why something is done. Yet others say real learning takes place when students ask questions, inquire about ways to discover the answers, and then find the answers themselves.

Within the last several years educators have been talking about the critical thinking and problem-solving approach to learning. It has been argued that students need less lecture and spoon-fed information and more learning techniques that stimulate the thinking process. Many educators have asserted the American students have become sponges, soaking up information, rather than thinkers, creating information. They contend that while young children are very creative, by the end of public school training, most students have lost their creativity and have conformed to educational norms.

Agriculture classes have traditionally offered hands-on experience within a vocational setting. Generally, vocational classes teach the practical skills rather than the scientific approach to agriculture. Today, with the explosion of technical agricultural knowledge, agricultural education, in order to keep pace, must address the scientific principles as they apply to agriculture as well as the practical applications. In addition, instruction must create an environment where the student is deeply involved in the learning process. One approach to increasing creative thinking and problem-solving and involving the student in the learning process is being modeled in a National AgriScience Institute and Outreach Project funded through a grant from the W.K. Kellogg Foundation.

National AgriScience Institute and Outreach Project

The National Council for Agricultural Education in cooperation with the University of Wisconsin-Madison and the University of California-Davis is initiating this three-year project. The primary purpose of the project is to integrate the teaching of agriculture and the teaching of science. The project uses the involvement and collaboration of science and agriculture teacher teams and scientists throughout the nation. They will develop hands-on instructional materials for secondary agriculture and science students that are imaginative, classroom tested, abreast of current scientific developments, have direct agricultural applications, and that stimulate critical thinking and problem-solving skills.

Problem-Solving Approach to Learning

The teaching approach used in this project will differ from traditional education in that students are immediately challenged to become involved in the actual process of science. Instead of being provided with information, students will be asked to observe a situation, develop questions from their observations, form a hypothesis, and then design an experiment (in the laboratory or in the field) that will test the hypothesis.

Students will then collect data, analyze results, and form conclusions and recommendations based on their results. The results may stimulate more questions and a new hypothesis; if this is the case, a subsequent experiment will be designed and conducted. Obviously the research process is not new since scientists have been using this research process for many years. What is new is that students will now be directly involved in the process of discovery and learning, instead of memorizing information or performing specific tasks. The instructional materials from this project will be developed by science and agriculture teacher teams using Wisconsin Fast Plants and Bottle Biology in laboratory settings.

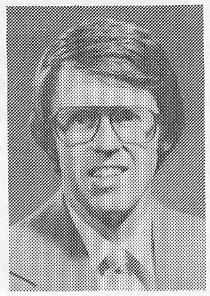
Wisconsin Fast Plants and Bottle Biology

A student sows seeds of a small, yellow-flowered plant and in just five weeks the resulting plants are producing seeds of their own. These Wisconsin Fast Plants, a variety of *Brassica rapa*, were initially developed as a research tool by Dr. Paul Williams at the University of Wisconsin-Madison.

At the present time, the Wisconsin Fast Plants are proving to be an exciting tool for teaching plant science in classrooms from preschool through college. In addition to their remarkably short life cycle, the Wisconsin Fast Plants

(Continued on page 22)

HISTORICAL REVIEW
August 1941 - 1966



By John Hillison, Special Editor
(Dr. Hillison is Professor and Programs Area Leader, Agricultural Education, Virginia Polytechnic Institute and State University.)

August 1941

The editorial page reported increased activity on the importance of education for national defense. Such an activity involved the concept of how essential agriculture was in the total defense picture. It was noted that agricultural eductors always came through when the cause was important. One state supervisor had noted that the third year was the crucial year for a teacher of agriculture, "During this year, he will either slip into a rut or he will find something new and challenging, and will continue to grow by virtue of the fact that he is attacking a new problem with the same vigor with which he started his first year of teaching." A suggestion was made that before starting school each fall teachers should decide to try something new or to do something old in a new way. In an article entitled "anthracite for peaches" the editorial page suggested an exchange of agricultural teachers from one state to another. The suggestion was that experienced teachers would be refreshed, renewed, and subsequently be more effective.

George P. Deyoe (teacher education, Michigan State University) suggested that it was time to use better methods for selecting and culling livestock than that of physical appearance. "This overemphasis on judging is being continued in the face of scientific investigations which have shown that it is but a crude approach to determining the values of greatest worth in livestock." Deyoe cited evidence that the average annual butterfat production of 180 lbs. per cow had remained so low because cows were generally selected on the basis of physical appearance. However, when records were used as the basis for culling cows the average annual butterfat production went above 300 pounds. He suggested some use of judging, but concluded it is important to emphasize new methods such as record-keeping.

B.L. Bible (Teacher, Bruceton Mills, West Virginia) wrote an article about utilizing home and community resources in adult classes. One example of such activities involved FFA Chapter and adult students cooperatively purchasing baby chicks to save money. The evening adult students through group action were able to obtain electricity for their communities. Another example included group participation in a triple superphosphate demonstration on pasture land. Several helpful hints for success in working with adults were included in the article — the program must be practical, there must be give and take in class discussions, and follow-up visits must be made as farmers expect help with their specific problems.

August 1966

In a guest editorial, H.M. Hamlin (Center for Occupation Education, North Carolina State University) wrote that agricultural education was slated with opportunity laid with non-vocational education in agriculture. Funding for general education in agriculture could come from the Elementary and Secondary Act of 1965. He particularly encouraged development of elementary agriculture. Hamlin suggested that one impediment to such a change was the illusion that agricultural education had to result in cash benefits. A second impediment (and the major one) was ". . . provided by teachers, teacher educators, and supervisors with limited vision. Many of them are used to small operations of a traditional kind which they have become able to manage. A field as broad as that non-vocational education might occupy is terrifying."

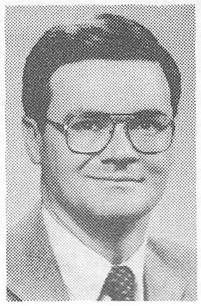
Editor Cayce Scarborough wrote about the concept of the one teacher department. He noted that the one-man complete program may be fascinating, but possibly impossible to implement. It was suggested that teacher preparation and supervision would have to change for multiple teacher departments. "It is my belief that the new phenomena of multi-teacher program: have not received enough special consideration by teachers, supervisors, teacher educators, or researchers. It is my guess that the most important single advantage of the multi-teacher situation is giving each teacher full opportunity to become an effective teacher in a specialized area, forgetting the concept of a one-man, complete program."

Herbert H. Bruce reported the results of a study on Factors Related to the Enrollment of High School Boys in Vocational Agriculture in Kentucky with such recommendations as follows:

1. Only boys who can profit from the training, should enroll,
2. Boys and parents should be visited before enrollment in agriculture,
3. Boys should make plans for supervised practice before they enroll,
4. Teachers of agriculture should work with the counselor, principal, and other teachers in enrolling boys in agriculture, and
5. Teachers of agriculture should use key people to help contact and encourage rural boys who want to enroll

COMPUTER TECHNOLOGY RESOURCES

Dot Matrix Versatility



By W. Wade Miller, Special Editor

(Dr. Miller is Associate Professor, Department of Agricultural Education and Studies, Iowa State University.)

Virtually every agriculture department has a computer. The most common peripheral for that computer is a dot matrix printer. Even though you might like to have an ink jet printer or a laser printer, the fact remains that you probably have a dot matrix printer. You and your students may use that printer for letters, work sheets, tests, transparency masters, spreadsheet printouts, and various other papers. If the print quality is not very good, you may not be using the printer to its fullest potential.

Most dot matrix printers manufactured in the past seven years have a variety of built-in features which make them a versatile machine for printing. The normal or default print setting for most printers is "draft quality." This default setting is usually 10 characters per inch (CPI) and the print head pins strike the paper only one time. Draft quality is fine for much of the printing you do, but it is not good enough for correspondence and other papers that need higher print quality. Ten CPI is also fine for most printing, but is not acceptable when printing out wide spreadsheets or database files.

Your printer may have a number of features you are not using. Most modern dot matrix printers allow you to select the text quality you need, to vary the CPI, to change the lines per page, to choose a variety of paper and form types, and to select high-resolution graphics for better transparency masters and signs. You may be able to select character sets, underlining, double-strike, italics, subscripts, and superscripts. Where can you find out what features are available with your printer? The User's Manual or Owner's Guide that came with the printer holds the answers to these and many other questions you have about your printer.

The User's Manual will not only contain descriptions of the features of the printer, it will also let you know how those features are accessed. The special features may be accessed through the software package you are using or they may be accessed through a control panel on the printer. In some cases features are selected from a set of switches called DIP switches inside your printer or on the printer card itself (if your computer is equipped with a printer card). You may need to consult the User's manuals which came with your software package, your computer, and your printer card.

One of the most useful features of a dot matrix printer is a near letter quality mode. Given that you have a good ribbon, the printer will produce print quality similar to a typewriter. In addition the typestyle will change from draft to either Pica pitch or Elite pitch. This feature is normally selected from the control panel on the printer. Most Epson printers have this feature as does the ImageWriter II printer. The speed of printing slows down greatly, but the increased print quality is worth this inconvenience. Near letter quality mode is usually adequate for business letters and other important documents.

If your printer does not have a near letter quality mode, you may still be able to select a double-strike mode or emphasized mode for higher quality printing. You may also use the emphasized mode for better quality graphics for signs and transparency masters.

Another important feature is to be able to select various numbers of characters per inch (CPI). Pica is usually 10 CPI and Elite is usually 12 CPI. These two settings are good for correspondence and assignments, but they are not adequate for those times when you need to print many characters across a page. If you use spreadsheets or database programs, there are many times when you will need to select a "condensed" or "compressed" print such as 17 CPI. With this CPI you can print more characters across a page. At other times, you may want to print large characters for titles, signs, or transparency masters. Your printer may allow you to select 5 or 6 CPI.

There are a number of other features that you may find useful at various times. These include underlining, subscripts, and superscripts. Check the User's manual. By using the built-in features of a versatile dot matrix printer, you and your students can produce high-quality, attractive documents. Yes, a laser printer would be better, but if you don't have one, why not use your dot matrix printer to its fullest potential?

Historical Review - August 1941-1966

and have an opportunity for supervised practice to enroll.

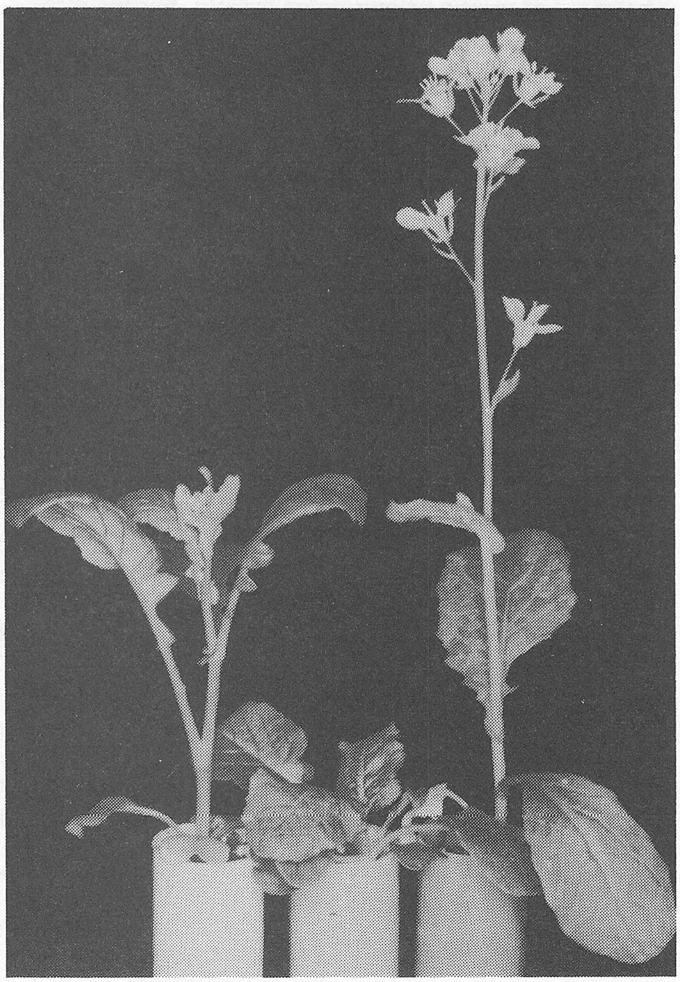
Other articles written for this issue were on such topics as the small animal laboratory, employment opportunities in retail fertilizer distribution, competencies needed in agricultural-supply business, guidance counselor-friend or foe, and a good curriculum becomes obsolete.

Agriscience Program Stimulates Student Inquiry and Problem-Solving

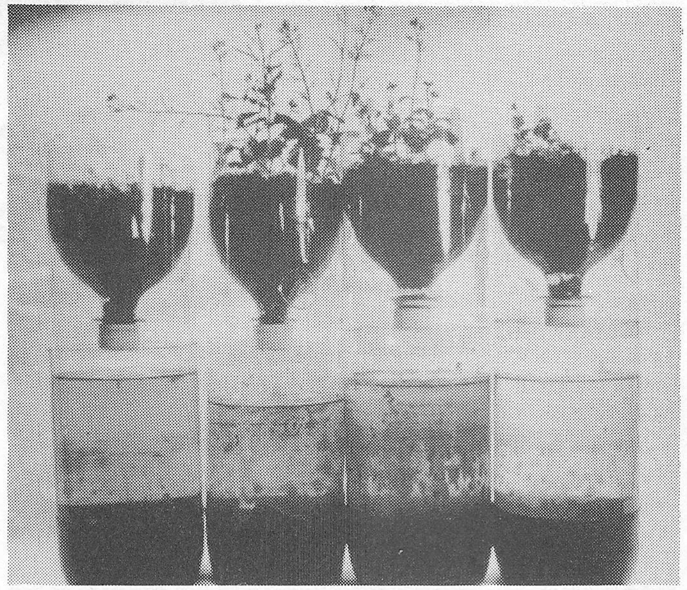
(Continued from page 19)

respond rapidly to environmental stimuli, can be easily hand-pollinated by students, and grow and reproduce at high densities. Different genetic strains can be crossed allowing students to conduct a number of generations of genetic studies in a single semester. These plants provide an inexpensive way to teach such areas of biological and plant science as growth and development, reproduction, physiology, genetics, evolution, and ecology. Innovative teacher teams will be able to develop many new directions and hands-on experiments for their students to explore that have real-life agricultural applications.

Bottle Biology is a classroom-tested approach to hands-on agriscience using plastic beverage bottles and other throw-away containers. Designed for science at all levels, Bottle Biology offers a low-cost way to create experiments and life science explorations which may be used to study a variety of biological principles and agricultural applications. Students can explore interrelationships between biological science and physical science using various combinations of bottle systems. Experiments can address areas such as physiology, land-water interactions, population dynamics, and community ecology.



Fast Plants showing growth differences due to presence of gibberellin, a plant growth hormone. On the right is a normal plant, center is a mutant plant which does not produce the hormone, and left is the mutant type after treatment with hormone.



Bottle Biology TerrAqua Columns. From left: column treated without fertilizer, column with normal rate of fertilizer, column with double the amount of fertilizer, column with five times the amount of fertilizer.

Collaboration Between Agriculture Teachers, Science Teachers, and Researchers

Twenty teachers (ten science teachers and agriculture teacher teams) will attend a two-week AgriScience Institute at the University of Wisconsin, Madison campus. Throughout the two weeks, teachers will attend intensive lectures on new developments in selected fields that reflect the union of science and agriculture. The teachers will collaborate with university researchers, educators, and each other as they develop model hands-on laboratories for their students that reflect current research questions with agricultural applications.

As teacher teams work together, it is anticipated that increased collaboration, communication, and sharing of facilities and equipment will result. It is also anticipated that teachers will work together and team teach science and agriculture courses. This combination may result in one-to-one science credit for agriculture courses and the use of applied agricultural practices in science courses.

There is a gap between researchers' new discoveries and information available to teachers and students. Researchers are lacking in expertise of how to package or share information; teachers are limited by not having ready access to new information. By bringing together teachers and researchers, it is expected that they will share needs and concerns and begin to bridge this communication gap. Using their new knowledge base, teachers can develop creative instructional materials emphasizing laboratory experiments that are on the cutting edge of new technologies used in agriculture. These new technologies would also illustrate biological science principles that are creative and stimulate student problem-solving and critical thinking skills.

Outreach Program

After developing laboratory exercises during the AgriScience Institute, teacher teams will field test the material in their classrooms. These materials will be revised and packaged for dissemination during the outreach program. The outreach program will involve teacher teams instructing other agriculture teachers and science teachers across the nation. The instructional materials and inservice sessions will emphasize the problem-solving approach to learning using Wisconsin Fast Plants and Bottle Biology in laboratory experiments.

A Model for Future Institutes

This AgriScience Institute, with its problem-solving approach to learning and using science and agriculture teacher teams, may serve as a model to encourage other universities throughout the nation to set up similar institutes and outreach programs for teacher teams in their areas. This model emphasizes bridging the communications gap between agriculture and science teachers at the local level, and increasing communication between researchers and teachers.

From kindergarten through college, teachers at all grade levels can help students learn plant biology, physiology, reproduction, genetics, evolution, and ecology through experiments. Using Wisconsin Fast Plants and Bottle Biology in laboratory exercises, teachers can strengthen student problem-solving and critical thinking skills and involve them in **doing** science rather than **learning about** science.

Thinking On Your Feet — A New Life Skill?

(Continued from page 16)

to solve problems by themselves and in groups to prepare them to work in both situations throughout their lives.

Brainstorming

"Brainstorming" is a technique that helps people search for all possible solutions when solving problems. Students can be taught to accept ideas of others by using class brainstorming activities. Start a class brainstorming activity by asking the students to identify sites in the community that need to be landscaped (Fig. 1. I). As they name places, write them on the board or an overhead transparency. Accept all ideas initially. Some will be eliminated later based upon established criteria.

Decision Making

Brainstorming is a method of enhancing the decision making process. Decision making is a process that students practice when they select one option from several. For example, during a welding unit, students choose a project and decide on the appropriate materials and construction techniques. A more advanced form of decision making is called judging when students decide the order in which to place objects based upon given criteria.

The problem solving procedure should be emphasized whenever students are asked to make a decision. Is there a simple problem solving procedure to use? The steps of problem solving are understanding the situation, identifying the problem, finding alternative solutions, and choosing the best solution.

Decision making can be taught throughout a landscape project. Students may be given the opportunity to select the site to be landscaped (Fig. 1. I). They should discuss the landscape site, including important points such as sunlight and soil. Students can apply this same process when selecting plant material (Fig. 1. II). Decision making can also be used to determine the final design of the landscape (Fig. 1. III D).

Group Decision Making

Although students need to learn to solve problems independently, they should also learn to use this technique as a member of a group. For example, students can develop a landscape site plan in a group (Fig. 1. III B) and then the group can present their proposals to the class. The class can then decide which elements from plans might be combined to form the final plan. The key is for students "to think through" the decision making process. To assure that every individual in the group participates, have each student draw part of the site. Monitor group discussions to make sure that everyone stays on task. This skill can be practiced by having committees solve problems that surface during FFA meetings.

The problem solving skills presented in this article can be taught to students and reinforced through class work, Supervised Agricultural Experience Programs, and FFA activities. Students should be encouraged to apply these skills in other classes as well. You will need to emphasize problem solving skills repeatedly to help students "think on their feet."

Incorporating these skills into subject matter will prepare students for their future. Students who learn subject matter in an agricultural education class will be able to apply the skills they have mastered to occupations, advanced education, and their personal lives as well. Those who master problem solving skills will be able to "think on their feet" and handle unexpected life situations better.

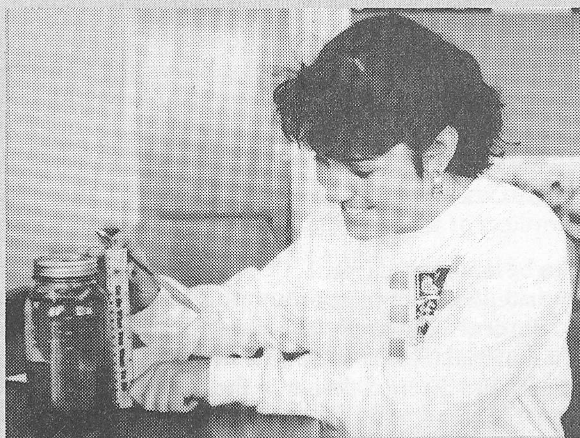
The Next Step — Technology Transfer

(Continued from page 17)

What do we do? Quite simply we must become **active in the technology transfer process.** Go to those field days, workshops, industry meetings, and attend those graduate level classes. Whether it is welding, engines, hydraulics, structures, electricity, environmental, engineering, or any other field, take the time to get involved in the technology transfer process.

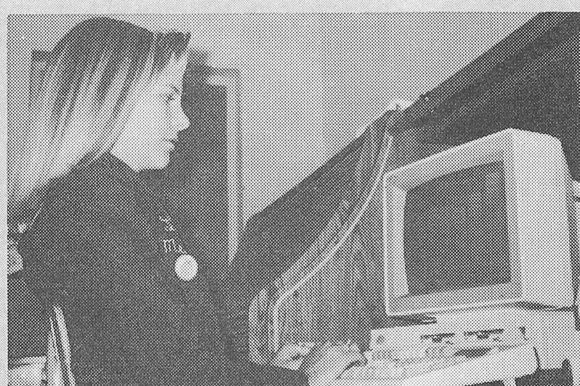
As a summary, we are in the technology transfer business. Agricultural education has been since day one, and if we continue to do so, we will also continue to survive. However, we must be a part of the process of technology transfer, not an observer. You owe it to yourself and your students to become an active technology transferrer; it is the next step.

Stories in Pictures



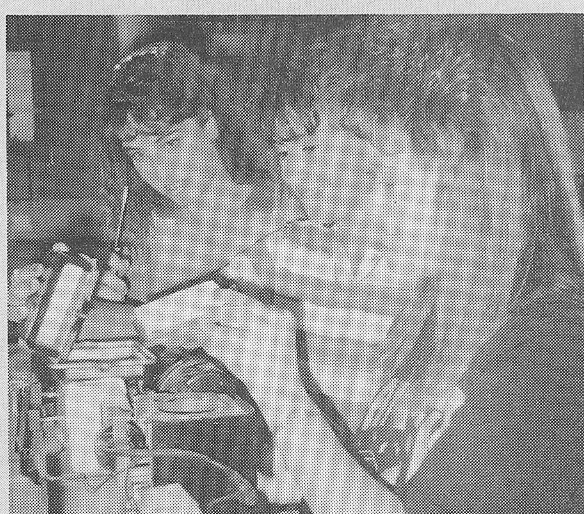
New Mexico State University student Shannon McGonegal demonstrating how to determine the percentages of sand, silt, and clay in a soil using a sedimentation technique. (Photo courtesy of Tom Dormody, NMSU.)

Many different practical and mathematical problems can be solved though surveying. (Photo courtesy of Shawn Dennis, New Mexico State University.)

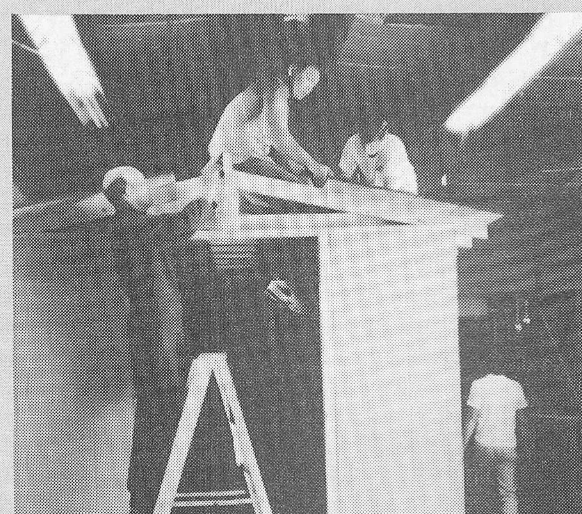


Libby Medlin from Tatum High School in New Mexico, determining enterprise expenses using Lotus 1-2-3.

(Photo courtesy of Tom Dormody, New Mexico State University.)



A group problem solving approach can be followed to repair small engines. (Photo courtesy of Tom Dormody, New Mexico State University.)



Many problems will be solved during the planning and construction of portable storage sheds like this one in Floyd, New Mexico. (Photo courtesy of Tom Dormody, New Mexico State University.)