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EDITOR'S COMMENTS

Rediscovering Our Niche

how much science should I teach in my agriculture program? should I teach some science in all of my agriculture courses? what science concepts and principles should I teach? how should agriculture instructors differ from instruction offered by the science department in my school? should I request that science credit be awarded to students who complete agriculture courses? how much of my instructional program should be vocational agriculture, and how much should be aimed at other purposes? what other program objectives should I target? how does my agriculture program fit into the curriculum and goals of the entire school?

there is probably not an agriculture teacher in the country who has not been thinking about many of the above questions in recent years. in fact, most teachers will re-ask and re-answer these questions many times over the next several years. these are tough questions that do not have cut-inverses or easily implemented solutions. but if teachers can master the courage to ask these questions, then they are on their way toward rediscovering the niche of their programs in today’s public schools. clearly, we must focus on redefining the place and role of agricultural education in the secondary schools. but at the same time, it would be a drastic mistake to throw everything from the past and start from scratch.

we should continue to teach technical skills, job skills, entrepreneurship, and leadership skills. we should continue to teach how to grow plants and raise animals. we should continue to teach agricultural mechanics. but we should teach these topics better by linking the practices of agriculture with the science of plants and animals grow; how machines work; and why plants, animals, and materials respond to treatments as they do. the result will be a stronger agriculture curriculum, a student who makes better management decisions in plant and animal agriculture, and a student who has a working knowledge of science. the right kind of agricultural instruction will make the agriculture program stronger, while making a unique contribution to the scientific literacy of students in the school.

agriculture is still only one part of a comprehensive secondary agriculture curricula. big business and leadership are equally important. thus, we find ourselves in the precarious position of being forced to provide a dual curriculum, science based and business based, and lab and classroom oriented, but not too much of either extreme. we cannot afford to work only with vocational teachers; agriculture teachers must establish a good working relationship with other teachers especially those in the science department.

an abundance of excellent, new, agriscience curriculum materials has been developed in the past three years. teachers now find themselves in the unfamiliar position of having so many good options that it’s hard to know what to select. three viable options seem to exist for incorporating agriscience instructional materials: infusion of selected materials into existing courses, infusion of selected materials into new courses, or development of new, stand-alone agriscience courses. of course, the latter option requires that either a new teacher be hired or one or more “old” courses be dropped - perhaps not a bad option in either case.

teacher readiness to teach agriscience units or courses is a major concern. unfortunately, most of us learned science as an isolated, abstract subject. because of this, many of us just want to get our college science courses “out of the way.” in recent years, college agriculture courses have sought to combine the production and scientific aspects of agriculture. nevertheless, the science and management (practics) are still strong, in both secondary schools and colleges, agriculture is perfectly positioned from a disciplinary standpoint to link science and management. unfortunately, a reputation in some schools as a less rigorous, low skill curriculum has prevented this instructional linkage from occurring. we have some work to do. in these cases, an incremental approach to curriculum improvement and agriculture instruction may be best, while we continue to work toward the ultimate goal of science-based agriculture and relevant science.

our job is not to duplicate science instruction offered by science departments. our job is to teach science in a different way, focusing (continued on page 12)
Teaching Agriscience: A Few Cautions

Although it is only in recent years that we have begun to use the term "agriscience," science has been an important part of the curriculum in agricultural education since its inception. Plant and animal science were important components of agricultural education in high schools even before the Smith-Hughes Act officially started high school agriculture courses.

If we look at the college curriculum for an agriculture teacher we see further evidence that there has always been a tremendous amount of science in agricultural education. For years, administrators and certification officers have recognized this by certifying many agriculture teachers to teach high school science courses. My high school freshman biology teacher was my agriculture teacher, as was my senior high school chemistry teacher. My first two years as an agriculture teacher included periods where I taught junior high science and high school chemistry.

"Agriscience faces the potential danger of becoming absorbed within the science curriculum as a class rather than remaining a separate, distinct program. We must resist that temptation and make sure that the courses are truly agriscience rather than "regular" science."

Obviously, there are a lot of similarities between teaching "regular" science (biology, chemistry, etc) and agriscience. Therein lies a potential problem. While we see a big difference between a program such as agricultural education and a course such as chemistry, others may not. With the trend toward semester courses in agricultural education, it is very easy for an administrator (at both the local and state level) to view "regular" science courses and agriscience courses as being basically the same. Thus, it becomes logical to think that the chemistry teacher or the biology teacher, as well as the agriculture teacher, can teach agriscience. Agriscience faces the potential danger of becoming absorbed within the science curriculum as a class rather than remaining a separate, distinct program.

To keep this from happening, we must reinforce the differences between agriscience and "regular" science. There are two basic differences. The first is that the science we have taught in agricultural education has always been applied and is part of a total program. This application aspect has provided the rationale for our laboratories and for our supervised experience programs. It is what has made agricultural education relevant, practical, and meaningful.

The second difference between "regular" science and science in agricultural education is the inclusion of youth organization activities as an integral part of the agricultural instructional program. The value of the FFA and its leadership training is unmatched in support by business, educational, and community leaders. It is the most unique aspect of agricultural education and is not found in the "regular" science curriculum.

As we plan for teaching agriscience in the 21st century, it is extremely important that we continue to incorporate these two essential components into the instructional programs in agricultural education. Teaching environmental science, aquaculture, physical science, and computer science in agriculture are exciting additions to our curriculum and represent tremendous changes from the "traditional" production agriculture subjects we have taught in the past. There will be a temptation to treat these subjects as unique aspects of agricultural education and to perhaps leave out essential components of an overall agricultural education program. We must resist that temptation and make sure that the courses are truly agriscience rather than "regular" science. The only way to do that is by always: (1) using laboratory instruction and supervised experience to make instruction in agriscience applied, and (2) including FFA activities as an integral part of the agricultural curriculum. If we fail to do this, it may mean that we will not be teaching agriscience very far into the 21st century.

About the Cover

Tissue culture is a very useful tool in plant breeding and genetics. (Photo courtesy of Information Services, University of Illinois.)

Environmental Studies in Agriscience — An Integrated Approach

Agricultural education at the secondary level has gone through many revisions, updates, and mandates during the past two decades. Programs are constantly being evaluated as administrators have to determine how limited capital and human resources will be used to achieve campus and district instructional goals. Many administrators are aware of the value of these programs in the development of skilled workers and community leaders.

However, few recognize the complementarity of agricultural education programs to academic subjects such as math, English, social studies, and science. By integrating concepts and skills from these subjects into agriscience courses, more academic credibility is attained, but more importantly students begin to realize the importance of academic subjects by applying them to solving agriculturally related problems.

However, few recognize the complementary nature of agricultural education programs to academic subjects such as math, English, social studies, and science.

Environmental concerns are everpresent in today's headlines and on the evening news. Science disciplines like biology and ecology focus on the cause and effect of environmental problems. Seldom does instruction in these areas provide reasonable or feasible solutions to environmental problems.

Production agriculture and agriculture industries face, as well as contribute to, environmental concerns. The use of fertilizers and pesticides has, in some areas, affected groundwater supplies and wildlife populations. The cultivation of ever-widening food and forage production and the use of forests for timber has brought additional negative publicity to agriculture. The concentration of large numbers of livestock and poultry has also created problems such as waste disposal, runoff, and offensive odors. If agricultural educators recognize these concerns and teach their students how to develop solutions to these problems through the application of scientific principles, then the students, the agricultural industry, and the profession of agricultural education will all benefit.

Getting Started

Getting your students started in conducting environmental studies may be easier than you think. You probably are already involved to some degree if you teach courses in plant science, soil science, horticulture, or natural resources. But what about those courses in agricultural construction, animal science, and agronomy management?

Plant science, horticulture, and soil science all include concepts related to plant nutrition and soil fertility. Do you teach students how to monitor the level of soil nutrients and pH? Do you also teach them how to solve problems of nutrient deficiencies? This is one example of how teachers are already including environmental studies in their curriculum. Why stop there? Table 1 provides examples of how environmental concepts could be addressed in other agriculture courses.

Materials and Resources

In order to successfully integrate environmental studies into the agriscience curriculum, additional materials and resources may be...
needed. In addition to soil test kits, laboratory equipment for analyzing water and air quality would be helpful. Items such as thermometers, cameras, recording tapes, and maps might also be useful. Scientific equipment is available through laboratory supply catalogs. However, many instruments and materials designed especially for use in environmental education are available from TERC, a non-profit organization which promotes hands-on math and science education.

An excellent source for information on the environment and opportunities for collaborative study is ECONET, a computer information network with electronic mail and computer conferencing capabilities that focus primarily on environmental issues. The AGH/AgHA Network is a good source for lessons and news items related to the environment. Both networks require subscriptions, and you will also need computer communications software and a modem for access.

Projects and Activities

Environmental studies often facilitate specific interests in students, encouraging them to pursue more indepth studies or develop more intensive research activities. This motivation provides opportunities to promote involvement in local action and community improvement projects such as Building Our American Community (BOAC) and competition in FFA award programs, including proficiency awards, public speaking, and the Agriscience Student Recognition Program. Many successful activities in agricultural education rely on integrating classroom and laboratory experiences with academic skills in oral and written communications, math, science, and social studies. The following project is such an example.

The Global Laboratory Project

During the 1992-93 school year, Wilson High School students in Agriscience 101 were introduced to an environmental studies project that offered true interdisciplinary learning activities to all participants. This project, the Global Laboratory Project, was sponsored by the National Science Foundation and administered by TERC. Students from schools around the world participated in the project that included hands-on laboratory activities in environmental science. Collaborative activities included the collection and sharing of environmental data collected at each study site, as well as research ideas and suggestions by participants and TERC scientists through electronic mail and computer conferences on ECONET.

Global Laboratory Project participants were divided into groups or clusters. Schools participating in the cluster with Wilson High School students include: Alachua County, Florida; Shippensburg, Maryland; Oregon; Tennessee; Texas; Jamaica; and Russia. Each school selected a study site, and the Wilson students selected their school farm to study, since it was on campus.

The major instructional components of the project included site selection; a biological and physical inventory of the site, including measuring and mapping; an ecologial profile of the site and comparison to the Minnesota site; and environmental research activities. Research activities were monitored by scientists at TERC who have academic backgrounds in various aspects of environmental science, including agriculture. Participants learned about cultural diversity, geography, math, chemistry, and computer science. This project enabled students to better understand the interdependence of these subjects.

Due to an unanticipated reassignment of the author from agriscience instructor to principal at mid-term, the Agriscience 101 students did not receive the full benefits from the Global Laboratory Project. However, under the direction of the WIFS science teacher, Ms. Janet Kuntonen, the year-long project was completed by the Environmental Science class. Their work and dedication made writing this article possible.

Implications

By integrating academic concepts and skills, including science concepts and methods, into agricultural education, the overall education of your students could be greatly enriched. The utilization of computer networks to communicate and collaborate with students and scientists from other states and countries allows students to develop technical skills and a broad awareness that will be essential in the workplace and economy of the next century.

Resources

TERC
Global Laboratory Project
2067 Massachusetts Avenue
Cambridge, MA 02140
6179643400
E-mail: gib@terc.edu

ECONET
Institute for Global Communications
18 4th Street South
Saint Petersburg, FL 33701
4154420220

AG-ED NETWORK
All Network Services, Inc.
230 E. 12th Avenue
Minneapolis, MN 55401
6123356404

A recent initiative in vocational education has focused on the integration of vocational agriculture and academic subject matter. In agricultural education, a natural connection can be made between the subject matter of the various agriculture subjects and that of the "pure" sciences of biology, chemistry, botany, and physics.

One of the new initiatives is the Agriscience Institute, which provides practical connections between their programs. This program, sponsored by the National Council for Agricultural Education, has used the emphasis on applied and "hands-on" science and the push to integrate vocational and academic programs to bring agricultural education and science education closer than ever in philosophy. Agriculture and science teachers have discovered innovative ways to cooperate with one another to strengthen agriculture and science programs and to create new combinations of the two disciplines.

This article shares some insights and ideas from agriculture and science teachers who participated in the Agriscience Institute.

Agriculture and science teachers have developed innovative ways to cooperate with one another to strengthen agriculture and science programs and to create new combinations of the two disciplines.

Tom Clayton and Peggy Clayton

After 19 years of married life and 18 years together in the teaching profession, Tom and Peggy Clayton thought they knew all there was to know about each other, personally and professionally. But after one year as participants in the Council's Agriscience Institute and outreach program, they say that their version of cooperation between agriculture and science teachers has a lot of room for growth and development.

Peggy, a chemistry, physics, and biology teacher at Northeast Landerdale High School, says that her interactions with her agriculture colleagues have helped her understand the role of agriculture in the classroom.

Lena McClellan and Sharon Reilly

Other teacher teams from the institute provide some models for this cooperation. In Charlotte Courthouse, Virginia, Lena McClellan and Sharon Reilly have successfully integrated agricultural concepts. Her science teaching partner is Sharon Reilly, who teaches biology and chemistry at the same school. Together, Lena and Sharon have been able to create a more complete understanding of the interrelationship between agriculture and science. The two teachers have found strong connections between the environmental units Peggy teachers in advanced chemistry and those in the agriculture curriculum. They both believe that science and agriculture are connected and that the two is a supplier of both practical and theoretical knowledge to support Peggy's six-week botany unit and in a high school agriculture course.

Acceptance in the Agriscience Institute gave Tom and Peggy the chance to strengthen these bridges between their programs. One result was their agriscience on plant exposure to ultraviolet radiation, the Clayton's contribution to the package of material distributed throughout the outreach workshops conducted by the original institute participants. "The materials are designed to be relevant to agriculture and to science," Peggy noted. "It is not necessary to have a cross-disciplinary course in place to use them. Teaching partners are encouraged to find ways to cooperate professionally." (Workshop participants consist of teachers from one agriculture and one science teacher from the same school district.)
developed between these two teachers. After returning from the Institute, Lena and Sharon requested the same preparation period to coordinate activities. They frequently visit one another's classrooms, often combining their classes to work on joint activities.

One recent activity was a "niche kid," teaching the biological and agricultural concept of ecological niches. The partnership has extended to cooperative grantwriting. After receiving funds to build an arborium, the two teachers involved both of their classes, as well as the Ecology Club and the FFA, in constructing, classifying, and labeling. They are working on a larger grant to do further cooperative projects.

Their shared emphasis is on making agriculture science activities belong to the students - letting them take charge of experiments and activities and produce results. McCleary said, "If you make kids think they can't do then they can't, but expect them to accomplish things, and they will!"

Frank Bridges and Rob Matheson

In apex, North Carolina, agriculture teacher Frank Bridges was considering the creation of an agriscience research course and was in the beginning stages of developing the course when Rob Matheson was hired to teach science at Apex High School. Bridges invited Matheson to cooperate with him in the development of the course, and the two of them put together a new course called Research Methods in Agriscience, which has concluded a successful first year and is in place for another year. Finding the time to team-teach with Bridges required Matheson to sacrifice his planting period to be in the classroom most days the first semester and two days per week the second semester. The course content consists of agricultural topics investigated through scientific inquiry. Credited as a vocational course, Research Methods in Agriscience has attracted mostly traditional science students, many of whom had little background in agriculture. "I've had the opportunity to work with a whole new group of students," Bridges commented. "Most of these kids I would never have taught if not for this class."

Theresa Novicki and Janice Gershak

"Both curricula are more vibrant now," is how agriculture teacher Theresa Novicki described her partnership with biology-chemistry teacher Janice Gershak at Essex Agricultural and Technical Institute in Hathorne, Massachusetts. Senior floriculture students from Novicki's class were trained to present agriscience activities in Gershak's biology classes. The students and the respective programs all received a boost from the interaction. Both teachers participate in one another's classes as the expense of each teacher's planning period, team-teaching lessons that relate to science and agriculture. "Janice's programs have become more hands-on," said Novicki, "and mine have become more technical. Agriculture has always been a science, but the marriage of our two programs has improved the local perception of agriculture as a science."

Summary

The improvement in image is a common theme voiced by cooperating agriculture and science teachers. Agriculture programs are incorporating more lessons and activities grounded in scientific inquiry. Science teachers serve as resource persons and provide a depth of knowledge and experience from the "pure" sciences. Exposure to the material, the equipment, and to the science teacher is changing the perception of vocational students about the role of science in agriculture and about their own prospects in academic science.

Some additional comments made by cooperating teachers include:

"What might have been fear of science is replaced by a love of it."

"The science is theirs—they have done it themselves and seen its importance."

"Shared experiences in agriscience, in science fairs, and in student organizations have improved traditional science students' perception of agriculture."

"They (students) recognize it as real-world science."

"When the biology (or chemistry) students see the application first, they want to learn the science principles."

(Continued on page 21)

Figure 1: Model for excellence in vocational agriculture programs.

For years we have been told that a strong vocational agriculture program must have balance. The model of the three, overlapping, equal-sized circles has been a fixture of how we view our programs (see Figure 1). This model symbolizes how the ideal program should have equal emphasis on the classroom, FFA activities, and supervised agricultural experiences (SAE). It also illustrates the fact that educational experiences from each of the three areas carry over to each other.

The agriscience curriculum calls for something different. While FFA and SAE are essential parts of a total educational experience, they are of lesser importance and are more an opportunity to apply what is learned in the classroom/laboratory rather than the focus of the entire program. Figure 2 illustrates this model.

In proposing this new model, I would contend that very few vocational agriculture programs ever really fit the circles model. Most probably had major emphasis in one of the three areas. In many cases certain FFA activities, such as livestock shows and other competitive activities, might have been most...
emphasized - or even been the foundation of some programs. The greatest amount of effort and thus the greatest amount of recognition - comes from that aspect of the program. As shown in the latter model, modern agriculture programs focus upon the classroom, thus projecting a strong, academically rooted image.

**Classroom/ laboratory**

**FFA**

**SAE**

![Figure 2: A model for excellence in agriculture programs.](image)

**Projecting to the Outside**

The temple of the agriculture program is its facilities. Community members drive by them and students pass through them daily. The appearance of facilities provides information that helps to form perceptions about what you teach and how you teach.

An agriculture classroom should look more like the high school biology classroom than the vocational agriculture classroom of old.

Look around your facilities. What do you see? Does your classroom and laboratory look like a place where SCIENCE is taught? Are they clean and orderly? Do they reflect pride and progressiveness?

I have been in countless facilities for high school agriculture programs over the past few years. Unfortunately, I must say that most facilities I have seen do not look like agriculture classrooms. If science is being taught, it is hidden very well. However, in most cases, it would not take too much effort to improve the situation.

Being an agriculture teacher is not an excuse to look less professional than other teachers.

Many facilities need some "spicing up" to help reform the image they project. An agriculture classroom should look more like the high school biology classroom than the vocational agriculture classroom of old.

**Being an agriculture teacher is not an excuse to look less professional than other teachers.**

Bulletin boards should be an important visual aid to what is currently being taught. Audio-visual equipment should be in good working order. Storage areas for curriculum and reference materials should be neat and accessible.

To take things a step further, science teaching equipment could be obtained. If the vocational agriculture classroom did not have microscopes and other science lab equipment, the agriculture classroom should. Aside from purchasing new equipment, it may be possible to obtain or borrow equipment not currently being used by science teachers at the school. From time to time, there are also grants available on the federal and state level that can help teachers purchase equipment and improve facilities.

Students, parents, and other supporters could be used to help do necessary remodeling chores. Perhaps the best FFA service project that could be conducted would be one to clean up或 at least build a fence around the metal yard.

The agriculture building should be a place that administrators want to show off to visitors. It should be a drawing card to help recruit students of all backgrounds and abilities to your program. It should reflect the positive direction of your teaching.

**The Program - Personified**

One of the two best representatives of your agriculture program is you. The image you project is a window to your priorities and concerns for your program. It is important for agriculture teachers to promote their programs and take advantage of opportunities to tell others about the new direction of the curriculum.

In addition, it is vital that the teacher "look the part." I tell student teachers that a visitor to a high school campus should not be able to identify the agriculture teacher by his or her appearance, unless he or she is the most professional-looking teacher at the school. This is not to say that all technology should be avoided to attract students with diverse interests, including the college bound and those aspiring to professional and scientific careers in agriculture. Agricultural courses sufficiently upgraded in science content should be credited toward satisfying college entrance and high school graduation requirements for science courses in addition to the core curriculum.

The agreement that sponsored this study of agricultural education occurred in 1984 between the Secretary of Education, the Secretary of Agriculture, and the President of the National Academy of Sciences. That same year in Texas, a man by the name of H. Ross Perot set up a state committee on educational reform that started the changes in the Texas Vocational Agriculture Program four years prior to the National Academy of Sciences' recommendations for needed change.

The major change that started transpiring in 1984 was a rapid evolution from teaching years of traditional agricultural courses to the development and adoption of 23 agriscience semester courses. Clichés such as agriculture is more than cows, rows, and plows or seeds, feeds, and weeds were used to illustrate the point of the new agriscience curriculum with such offerings as Introduction to World Agricultural Science and Technology, Food Technology, and Energy and Environmental Technology.

The development of these courses not only helped to save the agriculture programs in Texas, it has contributed to an unbelievable growth in student enrollment of approximately 8,000 students in the time of implementation to over 86,000 students today.

The development of these courses not only helped to save the agriculture programs in Texas, it has contributed to an unbelievable growth in student enrollment of approximately $5,000 students at the time of implementation to over 86,000 students today.

Are we saying suddenly that somewhere in the 1980s we realized a need to include science in our agriculture curriculum, based on the recommendations of others? Years before the agriculture revolution, science teachers would use examples of agriculture to illustrate a scientific principle. Without a doubt, science has been the underlying strength of good agriculture teaching. What we started doing in the 1980s was to promote the concept of science and accept the fact that our profession goes beyond the training of young people to enter an agricultural career upon completing their high school requirements.

The question now may be asked: "How much science is being taught in our agriculture programs?" Many of these courses allow students enrolled in agriculture classes to receive science academic credits needed for graduation. A recent research project sponsored by the Texas Education Agency was designed to examine the content of specific agriscience courses to determine how much science, math, and other academics are being taught or reinforced in these courses.

The Texas State Board of Education has established a comprehensive set of rules for the curriculum. The mandate of the Board is that each school shall provide a well balanced curriculum containing knowledge, skills, and competencies established through the essential elements for each course. The term "essential elements" might also be referred to as objectives or outcomes. For every course offered in Texas, from kindergarten through twelfth grade, essential elements have been established. One pur...
The Texas State Board of Education Rules for Curriculum lists 10 Essential Elements to be included in the instruction of Biology I. The essential element number 2 for Biology I states: 'The student shall be provided opportunities to (A) observe plants, animals, and protists in their environment; (B) examine biological specimens; and (C) recognize patterns in nature. Agriscience courses 102, 231, 332, 334, 361, and 381 address Essential Element number 2 for Biology I. In fact, the Applied Agriscience and Technology course (102) and the Animal Science Course (332) contain all 10 essential elements required for teaching Biology I. Any student in Texas enrolled in these courses plus other courses will have been exposed to the essential elements of Biology I numerous times without ever being enrolled in the biology class.

This study found that these ten courses also taught and reinforced a majority of the essential elements for Biology II, Environmental Science, Anatomy and Physiology, Physics I, Chemistry I, Physical Science, and Geology. In answer to the question, "How much science is being taught in our agriculture curriculum?" we can say in Texas that a majority of the curriculum is science based.

In the agriscience courses, teachers' decisions about course content determine how much science is actually taught, just as it is in the biology or chemistry class. Agriculture teachers in Texas, as well as other states, can say, "Yes, we are teaching science in our agriculture curriculum. If you have the time I can show you."

References

Re-Discovering Our . . .

(continued from page 3)
on applications of science in all facets of the broad agricultural industry. If we offer agriculture courses for science credit, then one or more basic science courses should be prerequisites for agriculture courses. Students should not first study science in agriculture courses. Rather, basic science in the sciences should be followed by applications of science concepts and principles in agriculture. Student experimentation should be used as the method of teaching and learning in agriculture courses. A balanced, yet diverse, agricultural education program can clearly fill a void in today's high schools. In many ways, agriculture is applied science, but "practiced" agriscience instruction will quickly do more harm than good. Agriscience instruction must be technically accurate, scientific, and agriculturally oriented. Only then will the science connections in agriculture instructional programs be recognized and appreciated.

When is a Rabbit a Horse?

When teaching the anatomy and physiology of the digestive system of a horse, that's what it is. Both are monogastrics, and both have a functional cecum. Obviously, doing the post-mortem of an eight-pound rabbit instead of a 1200 lb. horse is much easier, cheaper, and more feasible. The cecum of both species will be located at the same anatomical spot (junction of small and large intestine) (Ensinger, 1990) and will basically have the same function (physiology). Not to mention along the way, teaching the other common gross anatomy of the monogastric digestive system, such as pharynx, esophagus, stomach, small intestine (duodenum, jejunum, and ileum), large intestine (colon), and the accessory digestive structures (salivary glands, pancreas, liver, gall bladder) (excluding the horse) (Ensinger, et al, 1990). With the exception of the size difference of the two species systems, the rabbit digestive system is an excellent replacement for that of the horse, especially in the high school agricultural science class setting.

The beauty here is that this approach does not make imparting this knowledge less "hands-on" in nature, but more so. As described previously, this exercise could easily include actual rabbits, or it could teach the specifics of poultry digestion in chickens instead. If not on a one per student basis or in pairs, the teacher could at least demonstrate on a real specimen. We would be better off teaching soil texture or structure without hands-on sampling and comparison by the student? I think not.

Collegiate Influence
If we think back, did not many of us do something similar to this in our basic potted or "animal science" courses in college? I know at San Houston State University in Huntsville, Texas, under the toilage of Dr. Perry Little, this was part and parcel of one of our laboratory experiences. It worked for many of us in imparting this knowledge, it can and should work in our high school classrooms.

How Does It Compare?
How different is this from what is going on in our high school biology labs with fetal pigs? Perhaps with the level of student interest high or in our classrooms (if we can believe what we are told about student interest and elective selection) the learning experience should be intensified, and therefore learner outcomes greater.

Bridging Theory and Practice
What about when teaching the reproductive systems of livestock? At the very least, a preserved cow tract can be used to facilitate instruction. This tract can be given double duty when teaching the principles of palpation and artificial insemination breeding passage. These tracts can be purchased from a well known apiary-supply company for less than $40.00. I doubt many veterinarians could find fault with this kind of instructional aid purchase. In fact, if used properly, the teacher should be commended.

During the 1990-91 school year, I taught for the first time in a rural farming/ranching area. Prior to this I had spent eight years teaching in a town of 60,000 plus. My new locale gave me the opportunity to "bridge the gap" (for lack of a better description) between scientific part of the curriculum and the more "hands-on" production end. At the conclusion of our animal reproduction A.L.I.P. unit in Animal Science 332, we took a field trip to a student's farm. The student family has a small beef cattle herd from which we selected several cows to palpate and determine if open or bred, and if
Integrating Agriscience Programs in Rural & Suburban Schools

I have been accepted by educators that getting students to accomplish a task means that a student has been taught. Those who are interested in higher learning concepts hoped to get their students to achieve an understanding about why something is done. True leaders of education today would insist that real learning takes place when students ask questions, inquire about ways to discover the answers, then find the answers themselves. When my father graduated from high school in 1936, his competition set next to him in his class. Skills he learned included repairing a leather harness, making rope halters, mixing rations, and when and how to plant and harvest crops. College was an option only for the rich. When I graduated from high school in 1970, my competition was regional to statewide to scope. Skills I learned included arc welding, selecting live stock, and using chemicals such as 2,4-D and Amazer. Higher thinking problem solving skills included selecting hybrid seed corn varieties, balancing rations with soybean meal, and analyzing yield between selecting gas versus diesel tractors for the farm (done without the aid of a hand-held calculator). In 1996, when my daughter graduated from high school, her competition will be in a worldwide marketplace. Skills that she may learn include marketing, formation of seed companies via satellite communication, computer modeling and analysis, micropropagation of plants, developing plants that are more disease resistant, hybridization, and many other life skills which may have not even been thought of yet. Things have certainly changed in the last 60 years or have they?

Education must be designed to create an environment where students are deeply involved in the learning process.

Many of the skills that were taught then, and certainly those taught now, are often done through the environment of various hands-on learning programs. Today, with the explosion of technology, education must address scientif ic principles as they apply to agriculture. Education must be designed to create an environment where students are deeply involved in the learning process. The National Agriscience Institute is at heart a Proven Track model of teaching approach that increases student creative thinking and problem solving. The primary purpose of the project is to integrate the teaching of agriculture and science. The program has brought more science education into the Wellington-Youngstown system and has certainly enlightened many Grandview sci- ence students with the rich, practical application of agriculture.

The approach is a single one - combine sci- ence education with agricultural education. Rather than a lecture/story/experience format, students are immediately challenged to become involved in the actual process of science. Instead of giving answers to all questions, or providing a discussion outline, the science teachers are asked to observe a problem, develop questions from their observations for a hypothesis, then develop and complete an experiment that will test their hypothesis. The research process is taught, demonstrated, and explored by each student, with students collecting their own data, analyzing the results, and forming their own conclusions based on their own results. As a result of this approach, students are encouraged to learn from their failures and make the necessary corrections to cause the experiment to work properly. By designing and conducting their own experiments, students often find they have uncovered more questions than they have answered, encouraging further investigation. This process has an ultimate result of students actually discovering and learning from them, instead of memorizing information or mechanically performing specific tasks.

Students at Wellington-Youngstown had the unique opportunity of having a diverse series of experiments developed for them from both the 1991 and 1992 classes of the Agriscience Institute. I was able to fit most of my year's experiments into one or more of my classes during the school year. Under the funding of Environmental Sciences, Horticulture, Natural Resources, and Junior High Exploring Agriculture, students explored the effects of acid rain, ozone depletion, salt build-up on irrigated land, and plant responses to chemicals or pollutants. Students also studied the response of plants to various levels of fertilizer, genetic diversity, crossbreeding, evolution, and gravity. They also investigated the many properties of soil. Food science students learned of the many ways to preserve food, from making Korean Kimchi to how to grow alfalfa slugs using genetically engineered lac- tocillinas bacteria from Pioneer Hybrid.
This process has an ultimate result to students actually doing critical thinking, analyzing and understanding from the context of meat.

Then, the Outreach Program is developing a student group, making connections with other organizations, and collaborating with other programs to enhance their learning experience.

On the Outreach Program's website, the students can find various resources and opportunities to explore the field of agriculture and meat science.

The Outreach Program is also providing a platform for students to connect with professionals in the field, offering mentorship opportunities and networking events.

The Outreach Program is committed to empowering students to make informed decisions about their future careers in agriculture and meat science.

Thanks to the Outreach Program, students can explore the exciting opportunities available in the field of agriculture and meat science.

The Outreach Program is a valuable resource for students interested in pursuing a career in agriculture and meat science.
Influence on FFA and SAE

Agribusiness has already had a major influence upon the FFA. Many states have developed Agriscience Fair competitions, and the National Agriscience Project Recognition Program promotes scholarships to students involved in agriscience research. In addition, many students are utilizing topics in agriscience in the prepared and extemporaneous public speaking contests. The national FFA organization also sponsors an Agriscience Teacher of the Year award. In terms of SAE, exploratory agriscience programs can be utilized to enrich the classroom experiences of students.

Big Picture Awareness

Fortunately, most agriculture teachers have a very broad background in terms of academic disciplines. They have had numerous courses in the sciences, animal sciences, agricultural engineering, entomology, agricultural business, and economics. In addition, most teachers have been very masterful in incorporating such disciplines into the secondary curriculum. However, a need may exist to broaden the interdisciplinary base of their programs even further through an infusion of science-curricular ideas.

Emerging societal issues, such as environmental concerns, global issues, and challenges in technology transfer, lend themselves to new and innovative curricular changes that have the opportunity to broaden the base of potential students. Such courses should be both developed and taught on an interdisciplinary basis. Imagine the potential of such courses taught with your local science educator and home economics instructors.

Summary

When attempting something new, there is an inherent risk that it is not going to work. The prospective agriscience teacher has to deal with this issue before ever preparing the first agriscience lesson. To be successful with an agriscience program, the teacher must be willing to try new things, and therefore, be willing to fail.

One thing to consider in the field of science is the lack of the success and failure of science programs as a whole. There have been many studies to show the deficiencies of science education in the United States (American Association for the Advancement of Science 1989; Bishop, 1989; National Research Council 1995; NRC). According to Haun (1992), one of the main reasons for this failure is that students are turned off to science at an early age due to the lack of resources of memorization and "cookbook" laboratory work. Current trends in science education leave little room for true experimentation and connectivity between the classroom and real work experiences.

Students may complain that science is boring and has no relevance to their lives. Agriscience offers an answer to this dilemma. It offers the chance to apply science to real-life situations and to see usable results. For example, instead of learning pH as litmus paper and a secret solution, it can be learned as the pH of soil and its effects upon the ability of that soil to produce various crops.

The bottom line is that you are the best judge as to the balance between teaching production and teaching agriscience in your local community. Based upon student interest, advisory committee input, your depth of knowledge, and interest in expanding your knowledge base, only you can determine the best curriculum for your school.

References


Integrating Agriscience... (continued from page 16)

with agriculture, a synergistic effect. As students and teachers begin to see the way that various pieces of the puzzle that we call education fit together, the puzzle becomes easier to teach and much more practical and fun to learn. When agriculture and science education curricula share similar goals and students learn to accomplish their goals, students will be better prepared to solve the problems they will encounter in the future.

The many state Agriculture in the Classroom programs, the California Foundation for Agriculture in the Classroom believes it is very important to provide opportunities for all teachers to learn about agriculture. Teachers are no different than any other adult—they are reluctant to talk about a subject they know little about. Because so many people today are two or three generations removed from the land, it is important for us to help teachers become informed and aware of the food and fiber system and career opportunities in agriculture. Clare Rosander and Pam Mossman created excellent examples of teachers who participated in an Agriculture in the Classroom program and returned to the classroom with creative ideas to teach their students about agriculture. Their innovative project, Crazy Crops Farm, consists of 17 lesson plans and involves 550 elementary students. It is a good model of how teachers can easily integrate the study of agriculture into several curricular areas. Through the study of agriculture, learning is enjoyable and students develop various skills, including critical thinking, cooperative learning, and problem solving.

The partnerships we form with teachers enable the study of agriculture to expand far beyond what we could do alone. Our experience in addressing the agricultural awareness challenge since 1980 clearly demonstrates the positive results of Ag in the Classroom's proactive education activities. It's a win-win effort for both agriculture and education, as students of all ages in every grade level learn from their teachers about the agriculture community's contributions to our economy and society.

Crazy Crops Farm

Crazy Crops Farm - the name certainly was not my choice. After all, a school farm needed a much more sophisticated title, like Sandhill School Farm. But my students didn't agree, and since I did want this experience to have student ownership, I had to settle for the name they selected. As it turned out though, the name became very appropriate. Crazy Crops Farm produced everything from carrots to zucchini. In fact, 22 different crops were grown and harvested that first year.

The idea for the school farm developed after using agriculture as a yearlong theme in my fourth grade classroom the previous year. I completed the year having been able to integrate agriculture into all major subject areas.

The satisfaction and enthusiasm I felt after such a fun, successful year was hard to contain. That's when I decided to share my discovery with my staff, and before the farm project came about, My class became the Crazy Crops Consulting Corp., and we invited all other classes to join our farm, offering them a four-plot plat of land. Twenty classes accepted the offer.

Having no previous formal agricultural background, I immediately contacted the Kern County Farm Bureau. They connected me with a farmer, and my class officially adopted Russ Carter.

Mr. Carter took us step-by-step through the process of preparing the soil, digging furrows, planting, and thinning. Once our plot was ready, students then helped with the other classes by passing on the knowledge they gained.

My class participated in Mrs. Rosander's Crazy Crops in a different way. Instead of being farmers, we became two important support services for those classes who were growing crops.

The first service we provided was a bank. Mrs. Rosander created a "farm bucks" economy in her class. She had produced play money (farm bucks), which students could use to purchase students in different amounts for various reasons. Farm bucks were also made available to other teachers who wanted to use them. Any class with farm bucks could deposit them in our First Federal GoBucks Bank. We kept their money safe and provided statements of account balances. We were not a lending institution, however. If we had been a fifth or sixth grade class, we might have attempted to pay interest, but percentages are not a part of our fourth grade curriculum.

The other service my class provided was water. None of the students who grow crops at home or in school classes wanted to water their crops they would come to Mostrom's Moisture Monopoly. I would send a Water Marshall from my class, equipped with a big, yellow water can and a cloudbank. The water marshal would count on the cloudbank the number of canfuls of water the class used to water their crops. They were billed at a later time for their water usage. When Mostrom's Moisture Monopoly was first established, all classes participating were taxed a one-time fee.

(continued on page 21)
Improving Your Teaching: Set Induction

We have probably all learned at one time or another that in a good speech you "tell" em what you’re going to tell ‘em, tell ‘em, and then tell ‘em what you told ‘em." In some ways, a good lesson is like that, too. It consists of a set induction phase, an instruction phase, and a closure phase. All three phases of a lesson are critical, but far too many teachers pay little attention to set induction.

There are many things that are essential to effective learning: class order, clear directions, student motivation, and the list goes on. One factor without which nothing else will work is student attention (Borich, 1992). The steps that we use to get students oriented to and interested in a lesson have often been referred to as set induction. "When you begin a lesson, unit, or activity, try to induce in your students an appropriate set, that is, a predisposition or receptive mood that will generate interest and attention, and, it is hoped, spur students to attend to the work enthusiastically and diligently" (Callahan & Clark, 1988, p. 140).

In fact, no lesson should be attempted until at least some thought has been given to set induction; it is essential. Generally, there are three basic things that need to be accomplished at the very beginning of any lesson in the set induction phase:

* use a preview activity;  
* put the lesson in context; and  
* provide advance organizers.

Interest Approach

Even with students who are motivated to learn, it is necessary to gain their interest in the lesson. The students come to class from some other class, or they may have been involved in some other activity in your class. Regardless, they are not thinking about the upcoming lesson, and you must do something to get their interest. Effective interest approaches should create a need on the part of the students to learn the material in the lesson (Newcorn, McCracken, and Wurmbrud, 1986). Examples of effective interest approaches might include:

- Raising perplexing questions;
- Showing specimens or samples, such as a dead animal or a broken part;
- Presenting a case study in which a job to be done is outlined and students are asked to explain how to do it;
- Showing pictures of success and failure, good and bad;
- Giving a skillful demonstration (Newcorn, et al., 1986, p. 69).

In short, an interest approach is anything that you can do to get the students' attention and interest in a lesson. An interest approach should be used at the beginning of every unit, every lesson, and every class. During a lesson, when you change from one topic to another or initiate some new activity, such as a film or a practical exercise, you should plan some sort of attention-getting and focusing device to facilitate the transition.

Putting the Lesson in Context

Where does this lesson fit in the flow of the unit or the course? What have we learned in the past that applies to today's lesson? What leads us to this topic? These are the kinds of questions that should be answered during the set induction phase.

A brief review of previous lessons as they apply to the current lesson is appropriate and helpful. Such an activity reinforces previous instruction to improve retention. But just as importantly, it helps students to understand the links between past and present learning.

Advance Organizers

"An advance organizer gives learners a conceptual preview of what is to come and helps them store, label, and package the content for retention and later use" (Borich, 1992, p. 221). There are a number of legitimate ways to accomplish this.

In most discussions of competency-based education, the teacher is advised to write the performance objectives on the board before class and then announce them to the class. In a problem-solving lesson, probing for student questions to discuss can provide structure for the lesson. In less structured classes, teachers may find it adequate to simply tell the students something like, "Today we are going to discuss . . ."

Regardless of how you do it, be sure that your students know early in the lesson what they are expected to learn that period. Then as you change from one topic to another or from one activity to another, provide additional advance organizers. Students who know what you want them to learn are more likely to learn it.

In Conclusion

At the beginning of any new lesson, and for multiple day lessons at the beginning of each class, the effective teacher attempts to ensure that the students are all "on the same train," thinking about the same subject and going in the same direction. The steps involved in accomplishing this are collectively referred to as set induction.

There are generally three things that you need to do in terms of set induction:

* Use an interest approach to get attention;
* Put the instruction in context with previous instruction; and
* Provide advance organizers to give direction.

At the beginning of a course or a major new unit of instruction, set induction activities may involve extensive activities and time - perhaps as much as a full class period. At the beginning of a daily lesson, it may involve only a minute or two. Regardless, it is very important that a planned effort at student set induction be included in every unit plan and in every lesson plan.

References


Agriculture & Science . . .

Coming in November . . .

Theme: Effective Teaching
- Student Learning Styles
- Teaching in the Ag Mech Lab
- Motivating Students
- Teacher Commitment
- Questioning Strategies
- Knowing Your Learners

Note: Since 1988, the California Foundation for Agriculture in the Classroom has provided teacher training, student programs, and resource materials for the public and private education system in California.

Ag Ed in Elementary . . .

(continued from page 19)

This was done so the students would understand that real farmers must pay fees to their water district above and beyond their payments for the water they use. In addition, Mosmann's Moisture Monopoly offered for classroom viewing a professionally produced video about water usage and water conservation. It was interesting for the students to learn that it takes more water to produce a few potatoes than a meal of a hamburger, fries, and soda.

While the crops and weeds were growing, arrangements were made for 13 classes to be visited by the "Plant Doctor," a Pest Control Advisor, trained by the California Agricultural Production Consultants Association. The Plant Doctor visited classrooms and talked about pest control, weed control, disease control, and fertilization. We were able to take the Plant Doctor right out to the farm for a hands-on application.

The year culminated with the Breadsake program, in which 120 students made bread, all at one time! What better way to see what happens to some of the farm products once they are harvested.

Note: Since 1988, the California Foundation for Agriculture in the Classroom has provided teacher training, student programs, and resource materials for the public and private education system in California.
Community Awareness Programs: A Role for Agriculture Teachers

How often have you heard the comment, "Agriculture isn't important to us," or "Why do we need agriculture instruction?" Typically, people in the agricultural community respond to those questions with more questions directed back to the general public: "Do you eat?" or "Where does your food come from?"

The reality is that the general public does not know what role agriculture plays in our society and in each individual's life. Many younger consumers have an even more inaccurate understanding regarding agriculture. Ask them where their food comes from, and the most frequent response is "the grocery store." Too often our children assume that because we buy our food in a grocery store, it's grown there. As educational leaders, we have an opportunity to play an important role in educating the general public through avenues other than the formal education system.

As agriculture teachers or 4-H volunteer leaders, we have dealt with young FFA or 4-H members who raise animals for the local livestock for show and sale. The young people go into the project knowing that the animals they are working with will be shown and then sold to the highest bidder, if it's a market animal. After devoting months of intense care and love to a steer, pig, or lamb raised from infancy, youth often become attached to the animal(s). Parting with them at sale time, something they know is going to happen but for which they have not been prepared to do, is often a fairly traumatic experience.

Looking for ways to help children deal with the emotional stress of this experience brought us to the realization that many times younger students in our programs and the general public only see an animal as a meat product. The general public, including our youth enrolled in agricultural education and 4-H programs, is really unaware that many consumers, from pharmaceuticals to footballs, are by-products or derivatives of livestock and poultry processing. This article describes one approach we have used by the authors to inform and make people outside the formal school setting more aware of the role of animal agriculture.

We believe agricultural educators play an important role in educating the general public about agriculture through community-oriented information and awareness. These exhibits may be the products of our in-school instructional program. To that end, an animal by-products or co-products display for informing the general public was developed. The co-products display was used to inform the general public about animal co-products, but it is also helpful for educating the youth enrolled in our programs.

Animal Co-Products Display

The exhibit or display has been used on several occasions in various Pennsylvania settings, including shopping malls and state- and national-level agricultural shows. The exhibit has received very positive reviews from the general public and agricultural commodity groups, and has been the topic of several newspaper articles. People of all ages have made comments such as, "I never knew that" or "This is really informative and educational." The display has helped young people deal with their animals for processing, because they can see that such things as insulin and other pharmaceutical products important to the treatment of a variety of illnesses are derivatives of animal products.

One of the most interesting and extensive areas included in the exhibit is the fats, both edible and inedible, derived from animals. Edible fats, kept for human consumption through processing, are rendered to make hard or tallow and eventually are used in spreads, pastries, candy, and other food items as shortening. The proportion of fat handled this way has increased with the trend toward boxed beef and pork. Inedible fats, generally gathered from various sources where trimming occurs, are used for biodiesel, flotation agents, candles, plastics, glycerins, other chemicals, lubricating oils, and hundreds of other materials. They are also used in livestock feeds, because of their extremely high energy value.

The production of fatty acids from the inedible fats and greases is another area that is included, because the uses for fatty acids in manufacturing products are enormous. Common products derived from fatty acids include surfactants, soaps, plastics, resins, rubbers, paper, plastics, lubricants, textiles, and cosmetics. Fatty acid nitrogen derivatives include amides, which is used in the manufacture of water repellents; synthetic detergents; nonionic surface active agents; printing inks; and plastics. Fatty acid amimes are extremely water soluble and are used in the rubber and textile industries and as corrosion inhibitors, liquid detergents, and nonionic surface active agents. Fatty acids esters are used in the manufacture of emulsifiers, coating agents, textile sizes, lubricants, plasticizers, and defoaming agents.

Interestingly, in the United States, Canada, and Europe, tallow fat from cattle provides the largest single contribution to the manufacture of bar soap. A typical bar of soap would contain approximately 80% tallow soap and 20% coconut soap. Beef tallow is widely used in soap formulations for a number of reasons. For meat-eating countries it is available in abundant supply, is relatively inexpensive, and it imparts some excellent characteristics to both soap and soap/synthetic combination bars. If the formula for bar soap contained all coconut soap, it would be extremely soluble, lather poorly, and strip oil from the skin so aggressively that irritation of the epidermis would result very quickly. The tallow used in soap formulations imparts mildness, acts as a binder, adds lubricity to the bar, and helps control cost, since tallow has a history of being considerably less expensive than coconut oil. It should be noted that in other parts of the world where beef tallow is not readily available or not used for religious reasons, other materials are used. For example, in Australia a considerable amount of readily available margarine is used to make soap. Modern countries would probably make vegetable oil soaps. Palm oil is a reasonably good substitute for beef tallow where it is available at a reasonable cost.

In addition, dozens of drugs or pharmaceuticals are purified from glands and organs removed during and after livestock and poultry slaughter. ACH, thyroid extract, and insulin are common to all. Others include epinephrine, used to relieve symptoms of hay fever and allergies; thrombin, which helps blood coagulate following injury or surgery; and heparin, which is an anticoagulant used to prevent undue coagulation during surgery. Trypsin, a protein-digesting enzyme from the pancreas, is used to liquefy pus and debris in wounds. The liver yields an extract for treatment of anemia. There are many other examples which could be given.

Other Uses for the Animal Co-Products Display

Although the animal co-products exhibit was developed as a way for agricultural educators to assume an educational role external to the formal school setting, we believe it has potential for use within the school setting as part of an agricultural awareness or literacy program. Depending upon the students you teach, there is an animal by-products unit which can be adapted to your curriculum for the formal school setting. Learning activities, including student research into by-products, give students opportunities to learn how to make various products and how these animal co-products evolved. If one is interested in hands-on learning, there are several activities, such as candle making and soap making, which can be used to walk students through a simplified process so they may experience for themselves the process of converting animal products into products seen in use today. The display of current events may lead to the discovery of new products being made with animal by-products. Animal by-products is an area that can provide many challenging and interesting lessons.

Note: The display described in the article is part of a joint effort involving personnel in the Departments of Agricultural & Extension Education, Dairy & Animal Science, and Agricultural Economics & Rural Sociology at Penn State University.

Upcoming Themes

December -- Teaching Academically Disadvantaged Students
January -- Tech Prep
February -- Distance Education
March -- The New Financial Records and Management Information Curriculum
April -- Land Laboratories
Stories In Pictures

Basic laboratory facilities are needed for good agriscience instruction. (Information Services, University of Illinois)

Potatoes growing in a sand culture hydroponic system.

Checking the effects of different rations on weight gain. (Information Services, University of Illinois)

Effects of porcine somatotrophin (PST) on carcass quality. (Information Services, University of Illinois)