Learning Partnership
(Continued from page 10)

include attention to both characteristics of process and partners (Karls et al., 1992).

Desired characteristics of the partnership process include:
1. A written statement of common goals that is clear and concise and that is recognized and developed cooperatively.
2. Assessment of the talents and resources each partner possesses and is willing to commit to the partnership.
3. Provision of sufficient time and in-service training to plan, sustain, enhance, and evaluate the partnership.
4. Cooperative effort involving all key players that utilize the talents of the partners.
5. On-going communication that is inclusive of all individuals and institutions in the partnership.
7. Periodic evaluation of the partnership process.
8. Celebration of successes.

Desired characteristics of the learning partnership include:
1. Belief in ability to bridge different cultures among partners.
2. Evidence of mutual respect and trust among partners.

3. Realistic expectations of the partnership, often built from small successes. (pp. G-47-G-48)

Partnerships thoughtfully planned and executed can raise the energy and resources for an agriculture program, no small matter in these times of funding constraints. Attention to the design features, needed intensity, motivations, and focus of the learning partnership can result in a comprehensive portfolio of hard working and productive partnerships serving the unique needs of a program. The "fourth power" in learning partnerships is gained by investing in all four of the potential partner categories—raising the benefits to improved learning by focusing on good process and partner principles.

Reference:

About the Cover
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The sciences of food, fiber, agriculture, and renewable resources have, traditionally, been viewed as applied disciplines related almost exclusively to farming. The result was the establishment of a food and fiber system unparalleled around the world. However, it has also resulted in the agricultural industry being considered the world's greatest polluter, the most irresponsible polluter, and an irresponsible use of natural resources. This belief has stemmed from a changing society that has little regard for the food and fiber system and a great deal of suspicion about agricultural products. It is time to change. The future success of the food and fiber system depends on how we, as agriculturists, collaborate with all disciplines of education. Whenever people understand the food, agriculture and renewable resource system, there is at least a chance to develop a more positive perspective of the importance of this system. The time for collaboration is now!
TABLE OF CONTENTS

THEME EDITOR'S COMMENTS

M. Sue Whittington

Managing Editor for Agriculture
Agricultural Education Association of America

"The cost of attending some of America's colleges has now soared to more than $20,000 a year."

(Anderson, 1992)

Flaunting and slick, the brochure alluring students and their parents to spend $20,000+ on colleges that "students who attend All-West College will have the reputation of being encourages in every department".

"Excellent teaching" appeals to undergraduates and their parents alike. This clientele would certainly not find the same degree of attractiveness, "you will encounter 'renewed students' or 'professors of philosophy', or 'folksy writers' or 'gifted grantees' in every department". Excellent teachers sell universities to prospective undergraduates and their parents. So just what is the quality of teaching that our students receive for $20,000?

Before I can answer that question, I have to develop a model for assessing excellence teaching. That's not easy given the numerous variables involved and the interactions of each. But, let's spend this issue zeroing in on one variable: are professors challenging students to think? Can studying this variable move us toward developing a teaching assessment model, and thus, take us closer to that $20,000 answer?

A DECADE OF QUESTIONS

In the past 10 years a heavy emphasis has been placed on the importance of effective teaching as it relates to success in school, thus, ultimately success in life. Public press articles, such as those reported in the New York Times, have stated, "public schools have discovered the importance of critical thinking, and many of them are trying to teach children how to do it" (Bechelinger, 1987, p. 27).

The power to think and solve problems should be the learner outcome desired by professors. Many educators agree with Meyers (1986), who stated, "it is increasingly important that students master the thinking and reasoning skills they need to process and use the wealth of information that is readily at hand..." (p. xii). Resnick (1987) added, research shows that many components of thinking can be effectively taught.

American educators, however, have not been singled-out as exemplary models for teaching thinking. McKeachie (cited in Joosely, 1988) contended, "Everyone agrees that students learn in college, but whether they learn to think is more controversial."

In this issue we believe we are surrounded by educators in America who do challenge students to think. Professors like Steve Cooke and Marc Klawon at the University of Idaho have earned a reputation for the challenges they offer their students. Are questioning strategies important for increasing the cognitive challenge in our classrooms? If so, Steve Cooke has a "corner of the reef" in his agricultural education program.

Is creativity an essential motivating force for encouraging students to think at higher cognitive levels? I think Marc Klawon offers keen insights concerning creativity in his horticulture classroom. Lately, we have had our students asking "Why?" It's asking "why a necessary component for developing thinking?" Sam Custer believes we should keep students hungry for "why" by capitalizing on the strengths of problem solving teaching.

Does a teacher's learning style play a role in the approach taken to challenge the students in class? Does a student's learning style limit and/or enhance the cognitive activity that can be achieved during class time? If so, what strategies can be implemented to overcome potential barriers influenced by learning styles? Authors Kritz, Harrison, and Kennedy provide a useful guide. Authors Torres and Cano share expertise concerning the relationship of learning styles and cognitive processes.

In this issue, we explore how thought and thinking through experience in teaching, let's reflect on the beauty of teaching agriculture— a subject matter concise in a schema, which, together, work cooperatively and naturally in affording students opportunities to reach the highest level of thinking. L.H. Newcomer, a colleague of mine, very succinctly re-visits the genius in the agricultural education model that captures the essence of teaching thinking skills to students.

While our understanding of the complexity of thinking is limited, and many have more questions than answers, we know enough about thinking to justify the intent to improve some aspect of it through teaching that focuses specifically on effective ways of enhancing the
The Genius of the Agricultural Education Model for Nurturing Higher Order Thinking

The need to have students graduate with the demonstrated capacity to think at the higher levels of Bloom's taxonomy is more urgent than ever. The nature of the world we live in demands it. Given the pace of technological change and the unabated explosion of knowledge, it is time to try to focus on teaching facts, for this is guaranteed to be a losing proposition.

Agricultural educators are lucky. The fundamental process which undergirds the agricultural education program is steeped in a genius which is predisposed to facilitating learning at the higher levels of cognition.

Elements of the Genius of the Agricultural Education Model

Some might ask what is meant by the assertion that agricultural education programs contain praxis which form a foundation of genius for this process. There are a number of elements of agricultural education programming which are deeply imbued with strokes of psychological genius which are so robust that they all but guarantee success if they are ever fully drawn upon.

Use of Real-Life Activities as Organizers

The agricultural education model is famous for its emphasis among the curriculum grows out of real needs of the community and the students. It is commonplace to have instruction from curriculum development, to lesson delivery, to laboratory assignments (school or home) which is organized around projects. The projects vary from animals to plants and from mechanics to business operations.

This focus on projects almost always leads to causing students to adopt a holistic approach to their learning. For example, students not only attend to learning how to select an animal but also to all the decisions which follow: budgeting, animal housing, feeding, health, and marketing. Thus, students are actually compelled to "see the big picture." They discover interactions. They must rapidly move from the lowest levels of cognition, i.e., remembering, to comprehension, application, and analysis. Essentially, if they develop sound "projects," they often must operate at the synthesis and evaluation levels of cognition.

So, the agricultural education way of packaging learning somehow automatically ensures that students will have to think at higher levels of cognition. To the extent that instruction in agricultural education moves away from the idea of real-life activities as a basis for instruction, then the genius afforded students for higher order thinking will be jeopardized.

Emphasis on Connecting Theory with Practice

A related strength of the agricultural education model is that teachers are known for the insistence on relating theory to practice. Application is a watchword. This close connection of theory with practice also enhances the likelihood that students will learn to operate at the higher levels of cognition.

Most of the approaches that teachers use to ensure application naturally require the learner to master the comprehensive level of cognition and almost certainly the application level as well. Quite often teachers design problems and other application exercises that require students to demonstrate their ability to operate at the analysis level.

Use of the Youth Organization (FFA) as an Organizer

Some would contend that the FFA is the crown jewel among the organization of getting the seemingly routine aspects of the agricultural education model. Too often, most fail to remember and value the fact that the chief reason for adding youth organization activities to the agricultural education model was to instill in the program an intentional opportunity to nurture the self-esteem of every student who enrolled. A careful analysis of the psychological constructs which undergird the FFA will reveal that the organization has enormous built-in psychological features only waiting to be harvested by skillful teachers.

The array of incentives prompt students in action. In carrying out such action, students must think—they must go beyond recall and application; they must analyze. Very often they must evaluate (e.g., program of activities planning, judging, community service projects). In carrying out goals of community service, there are a variety of leadership experiences which (Continued on page 6)

Effective Use of Discussion Method Teaching

Let me begin with a confession. I have a problem with the Socratic Method. The use of the discussion method of teaching is often referred to as the "Socratic Method." For example, as a graduate student, I had three professors who asked questions in class in order to stimulate discussion and called their approach the "Socratic Method." To explain why I think the discussion method of teaching is both different from and an improvement over the Socratic Method, I will apply Bloom's (1956) levels of cognition of analysis, synthesis, and evaluation to compare and contrast the two approaches. My goal is to make the case for the discussion method as a way of thinking rather than a technique of teaching. For me, the assumptions associated with this way of thinking are a prerequisite to effectively using the discussion method of teaching.

Plato describes a teaching method used by Socrates in which he would ask his students a series of questions. The purpose was to elicit clear and consistent thinking from the students as they reasoned from the parts to the whole. Through this process of induction, Socrates thought that his students could make explicit the "Truth" that he had assumed to be implicit in and available to all rational people.

Anytime I have used a series of leading questions to get a student to state what to me was an "obvious truth" in my agricultural instruction classes, I have found the experience to be as frustrating to me as it is numbing to the students.

Professor: "What did Lipsey and Lancaster say about the difference between economic constraints that are in the nature of things and other constraints, such as policies relating to taxes and subsidies?"

Students: (dazed silence).

Professor: "Try looking in the first paragraph in the second section." Students: (quietly reading in silence).

Professor: "A hint—look at the sentence that begins, "In general..."

Students: (searching in silence).

Professor: "Would anyone care to read that sentence?"

Students: (glancing at another, one student begins reading slowly and quietly, "In general..."

This approach reminds me of a determined call I once tried to slow at the county fair—not the staff for articles on teaching excellence, except, perhaps, by negative example.

So what is the problem? I think there are three problems with the Socratic Method. First, I think there is no such thing as the "Truth". Warren Samuel's says that the opposite of a small truth is a falsehood and the opposite of a big truth is another big truth. If I am trying to teach "big truths", then there is likely to be more than one "big truth" to consider and deduction is as useful as induction, though neither is definitive. Humm's (1967) paradox suggests that both induction and deduction require a leap of faith. In general, the leap is in the assumption that the specific holds for the general. With deduction, the leap is the assumption that the initial conditions are true.

Finally, I do not believe that a fully formed truth exists implicitly in each of us to simply be unveiled. If chance favors the prepared mind as Pasteur (1890) suggests, there is then much intellectual preparation to do first. C. Wright Mills (1955) stated that scholarship is a process he characterizes as intellectual craftsmanship. Through diligent craftsmanship, students build their own window to the world. Some individuals' windows are bigger and clearer than others, but they are self-constructed windows nonetheless. Thomas Kahn (1970) has documented the craftsmanship...
The Genius of the Ag Ed Model (Continued from page 3)

Insects in the Classroom: Using the “Creating” Level of Cognition in Teaching

It's hard to imagine any child not becoming excited about insects or insects if they have been used in classrooms for at least 65 million years, but insects can give us a foot in the door, and sometimes all it takes is a way of exciting college students and motivating their learning. The childhood fascination with insects is never really lost and can be effectively manipulated to stimulate the learning process.

I teach an introductory course in entomology at the University of Idaho. As one of the natural science offerings in the core curriculum, the course is taken by students across campus in majors as diverse as architecture and zoology. I strongly believe that one of the barriers to learning is the perceived relevance of the subject matter. Students think that information is simply “academic” and of no use after the course is over will not be as eager to learn as those who take it more personally. Therefore, throughout the course, I strive to demonstrate relevance of subject matter and use the excitement insects bring to both my advantage and that of the students.

I begin the course by giving each student her or his own cockroach to take home and look at during the semester. These are not your average cockroaches that are found at home, but are large, slow moving Madagascar hissing cockroaches. I have come to appreciate the potential for understanding by using the university housing office, which is now used to the yearly invasion of animals habitats. Students usually try to avoid them, but this tropical cockroach would not be able to established in buildings as far north as Idaho. Along with the insect, I give students a brief instruction sheet that describes its general behavior and how and how to tell sex is. They are first required to fabricate an escape-proof living quarters that provides it with food, water, and the proper environment. After 2 weeks of observation, they write a short paper on what they observed, such as whether it liked bananas or cereal, or when it was most active during the day. The first portion of the course describes the biology of insects in general, and I use their cockroaches as a way of personalizing the information. Now that they have a living thing on their desks, I believe the students are much more likely to see the relevance of what is presented. For example, when discussing the pinching process, there are usually several students who have watched the specimen molt and are thus able to contribute very enthusiastically to the discussion.

When we talk about temperature and adaptations to the environment, students can always add their personal observations to these activities. They bring their cockroaches back at the end of the semester but may keep them as pets after the course is over if they like. Students have come back after 5 years or more to tell me they still have a pet cockroach at home.

I have always been fascinated by the feeding behavior of insects. How is it that an animal with a brain the size of a poppy seed can distinguish different types of food? Indeed, it’s very difficult to understand how such a simple nervous system can give rise to the complex behavioral patterns that we observe, and make decisions about whether feeding behavior should be expressed. The students have observed themselves as they see that their cockroaches have certain likes and dislikes; but often tend to anthropomorphize, giving insects the same reasoning powers as humans, sometimes thinking that the food preferences of insects are conscious. I have used Hostess Twinkies, a classic example of junk food, to illustrate it's not necessary to have either intelligence or consciousness to choose food. I give each student their own Twinkie at the beginning of the class period and ask them to try not to think about their feeding decisions. Would it be possible for an animal without consciousness to take advantage of this food? I take the students through the arguments that we believe that insects have the senses to avoid predators and conceal themselves when they are detected.

(Continued on page 11)
Increasing Thinking Skill Through HOT Teaching

What can we teach students that will last not just a lifetime? Is it the content in our curriculum? Is it the technology that we introduce? Or is it the leadership skills we attempt to develop? While the answers might vary, there is consensus that no educational effort is as paramount as teaching students how to think. All you need to do is read any educational report to find references making strong arguments for developing in students the ability to think, make decisions, and solve problems.

The issue of developing thinking skills has been, and continues to be, a major concern for all those who believe in its value. Today, fifteen years after the landmark report A Nation at Risk (1983) noted students’ inability to think, we find ourselves asking the same questions we did then. Why? Do we as teachers not know the meaning of higher-order thinking (HOT)? Do we as teachers not know how to teach higher-order thinking skills? If we don’t, why not? Are our teacher education units partly falling in the same trap? Or do we just not care?

Why should we as teachers care about developing higher-order thinking skills in our students? Because as Bloom and his colleagues (1978) noted in their famous book, we have the task of preparing students for problems that cannot be foreseen in advance, and what we can do is help students develop thinking skills that will serve them well in future situations.

Higher-Order Thinking

Whether we call it critical thinking, creative thinking, problem solving, reasoning, decision making, or any other term, the end is the same—for students to be conscious of, active in, and responsible for their own thinking and learning. This requires students to do more than recall facts or “just understand concepts. Students need to engage in synthesizing and evaluating concepts and principles. So important are thinking

<table>
<thead>
<tr>
<th>Higher-Order Thinking Skills</th>
<th>Critical Thinking</th>
<th>Problem-solving</th>
<th>Reasoning</th>
<th>Decision-making</th>
<th>Creative Thinking</th>
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</thead>
<tbody>
<tr>
<td>Goal:</td>
<td>To have students be conscious of being actively involved, and take responsibility for their own thinking and learning.</td>
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| Cooperative Learning, integrating higher-order thinking skills into the curriculum, and a more concrete use of the problem-solving approach to teaching are but a few means by which we can excel at teaching higher-order thinking skills to our students. |

References:

WHY? Practices Used in Vocational Classrooms to Encourage Students to Think

By: Samuel G. Cutter
Mr. Cutter is the supervisor of agricultural education at the Moore Valley Center Technology Center, Clayson, Ohio.

THEME ARTICLE

WHY? can be such an annoying request, but we must deal with it, and we must foster its usage. How do we accomplish this, here are some of the approaches I have observed.

Use real-life examples. It will be easier to explore the why’s and how’s of students have a direct relevancy to what is being discussed.

Never leave an answer explained with "because that’s the way it is." Use the problem-solving technique in all teaching situations. This will prompt the students to identify the problem and develop a solution.

Whenever you do any activity, either explain to the students why they are doing the activity, or have the students explain why they are doing the activity.

Develop a technique that best works for the instructor, but avoid rote learning whenever possible.

Robert Sylvester (1994), recommends that schools focus more on metacognitive abilities that encourage students to talk about their emotions, listen to their classmates' feelings, and think about the motivations of people who write their curricular world. For example, the simple use of "why" in a question turns the discussion away from bare facts and toward motivations and meanings.

Why examine the way you have always taught? Because students entering your classrooms need to leave with the skills required to solve the problems that have yet to be identified.

References


Insects in the Classroom (Continued from page 7)

blood, which is what the insects are really after. I emphasize that the insect must have evolved sensory receptors that will detect the "warp'sentinels" but blood-stocking insects are attracted to emissions of carbon dioxide and other odors from our skin. Other factors come into play that cause the insect to continue feeding on the human. The warpsurgeon is penetrated and the food is simplified. To explain why some insects show feeding preferences, we discuss the absolutely shocking admission by some students that they act and don't like to be twirled. Over the course of the hour, we slowly devour the Twinkie, just as an insect might do.

Humans tend to overeat when faced with large quantities of tasty food, even though we know it's not always good for us. Do insects have the same problem in terminating their feeding? Mosquitoes ingest huge blood meals, often 5 times their empty weight. How do they know it's time to stop feeding before they eat too much and burst? To demonstrate how the termination of feeding might occur without requiring consciousness, I show the students a mosquito on a large screen TV as it feeds on my arm under a microscope. It normally withdraws its mouthparts from my skin when its abdomen reaches a certain size. In a short while, it统战es the brain that tells the mosquito to pull out. However, in the surgically operated mosquitoes, this message never reaches the brain. Before its systolic blood pressure greatly expands and finally bursts. The mosquito continues to feed and blood drips steadily from its ruptured abdomen because the information from these stretch receptors to the brain is lacking.

Many insects recognize individuals of the opposite sex for mating by the use of pheromones, which often depends on one individual that changes the behavior of another. Other insects use visual or auditory cues to identify potential mates. House fly males recognize females by their general shape, and secondarily by chemicals in their integument. I demonstrate mating behavior by the house fly in the classroom using showcards. When the males hover directly in front of the females, their elytra are visually appealing to males, but it is only when their "pseudoflies" are treated with simple extracts of females do the insects become stimulated and the beginnings of their characteristic mating behavior. Similarly, male mosquitoes respond to females by the characteristic wing frequency they employ during flight. When I insert a tuning fork into a cage of male mosquitoes under a video camera, I can show the way they vigorously respond when the tuning fork is set to the correct frequency.

It would be difficult to demonstrate any of these phenomena in the classroom with any other animal besides the insect and not only to say how the responses of living things in a biology course, but they can "pass the bug's" in our students, generating a great deal of enthusiasm and interest in the topic of insect behavior without the paining of learning some important biological principles.
Thinking Skills: Is There a Relationship to Learning Styles?

Anyone can learn without thinking, i.e., rote memory. One can put the key in the ignition and start without even looking over it first (or until the car is running). Learning may be a change of behavior to recognize behavior that has changed. Learning may be the change of behavior that has taken place. It may be a change of the person's understanding of the change of behavior. Learning is the result of the interaction between the key, lock, and door knob as ones process.

Learning, Learning Styles, and Thinking Skills

Learning is the gaining of knowledge, information, comprehension, or skill, which is reflected in attention, processes, experiences, or behavior modifications. Developing and implementing an instructional system most appropriate for each student to learn to involve time and effort. It requires thinking. Henry Ford is quoted as saying, “Thinking is the hardest work there is, which is probably why so few engage in it.”

Implementation of a system incorporating thinking skills into a teaching-learning system does support the goals of education. Those goals include changing attitudes, increasing knowledge, and improving skills. The learning styles of students and the teaching styles of teachers must be in agreement most of the time for a maximum impact on attitudes, gain in knowledge and improved skills.

One of the main elements supporting learning styles is that learning should be a pleasant and successful experience for all students. To do this, the preferred learning styles of students cannot be allowed to dominate all other considerations, consideration for differences should be accommodated. If indeed one's perception, processing, decision-making, and behavior are all unique to each individual, then it is essential that the instructional plan accommodate differences.

Just as there are individual differences in how one perceives and processes information (learning styles), there are also different patterns, paths, or methods for addressing thinking skills. According to Harrison & Bramson (1982), “Most people, most of the time, think about something only one way. Some people occasionally use two ways of thinking. Very few people ever approach a situation in more than two ways. Each of us has a preference for a limited set of thinking strategies” (p.1).

The six thinking skills are: (1) analyzing, (2) synthesizing, (3) evaluating, (4) interpreting, (5) creating, and (6) understanding. Based on the work and writings of Gardner (1983), at least seven kinds of intelligences are known. These multiple intelligences are not in competition with each other, but are present in different degrees for each person in the peculiarity of the combinations and in ways believed most comfortably for the person.

Thinking skills are those ways used to make learning meaningful in useful contexts from random information; often they are operationalized as a path, a pattern, or an order. Some of the many ways to describe thinking skills include: observing, questioning, visualizing, diverging, ordering, prioritizing, classifying, identifying parts, experimenting, memorizing, predicting, thinking, explaining, summarizing, synthesizing, and refocusing.

According to Gardner (1983), “In her schema of active role-scored thinking and organized them into four groups: focusing and generating skills; patternizing, organizing, and analyzing skills; inquiring, exploring, and problem-solving skills; and, integrating and evaluating skills.”

Learning any one of these skills adds new insights to what one already knows. When a person sees something that connects something that is recognized as an emotional, common, or current understanding, “learning happens.”

Learning styles is a generic term referring to the way people engage in learning. It may refer to differences in the way people perceive and gain knowledge (cognition); in the way people form ideas and think (conceptualization); in the way people feel and respond (emotional); in the way people act (behavior) (Leach & Mariner, 1990), as cited in McCarthy, 1981. Often, it refers to the perceived processing of information. It is a function which may be imbedded in theories from fields of psychology, and medicine, economics, education, business, arts, and social sciences (brain dominance, personality, learning, curriculum and instruction, leadership, management, dance and movement and exercise). For years people have explored, labeled, and theorized about learning, and in the last decade the publications related to thinking and learning have escalated. Some of the people whose work in theory, research, and applications are reflected in higher-order learning include Jung, Myers-Briggs, Mok, Keirsey and Bateses, Wilkin, Kete, Gregor, Rudif, Bob, McCartney, Barbs and Sassing, Dunn and Dunn, Sherry, Bogar, et al., Bandone, Gardner, Harrison, and Bronson.

Reflection, Thinking, Action, and Learning Application

Strategies for enhancing the opportunity for learning through reflection, thinking, action, and application may be no different for people of different learning styles. However, when used by teachers these strategies are less adequate than they might be if the perception, process, and products were more thoroughly considered for each learner. Exercises for determining learning styles of individuals are available from the literature and commercial sources. The analysis of learning styles is an attempt to identify how individuals learn more easily and most efficiently. Some individuals learn better by listening, some by action, some by reading, and others by visualization. Some need field independence, some need field dependence, some need to talk things out, some want to know what experts think, some want to take action, and others want to explore the possibilities. Some learners need to have the teacher take the more direct role (directly whereas others prefer the teacher to be less directive, facilitator, or guide) in the learning process. Concrete experiences provide more opportunities for creative teaching and learning. Abstract and conceptualization experiences allow for the intellectual and organizational part of teaching.

The relationship of what happens on the structured (informal) and what happens in school (formal, rules, regulations) incorporates thinking and makes learning meaningful. Choices are often divided into four categories: Perceptions, cognition, or memory. Focus on “How do I know,” i.e., whole or part, idea or contexts, abstractions or concretes, field dependent or independent. Perceptions may be imbedded in theories from fields of psychology, and medicine, economics, education, business, arts, and social sciences (brain dominance, personality, learning, curriculum, and instruction, leadership, management, dance and movement, and exercise). For years people have explored, labeled, and theorized about learning, and in the last decade the publications related to thinking and learning have escalated. Some of the people whose work is reflected in higher-order learning include Jung, Myers-Briggs, Mok, Keirsey and Bateses, Wilkin, Kete, Gregor, Rudif, Bob, McCartney, Barbs and Sassing, Dunn and Dunn, Sherry, Bogar, et al., Bandone, Gardner, Harrison, and Bronson.

Sample Implementation Strategies

Sample strategies are listed below to assist teachers as they incorporate varied learning styles into their instructional plans. Some strategies may already be included in similar strategies, in whole or in part. Each teaching strategy is offered only as a guide and is designed to focus on a specific learning style group. Keep in mind, however, that one cannot ignore the child of the student when selecting strategies appropriate for the learner.

Strategy: Discussion. Using the book of a specific topic or area of instruction as the base from which to work, ask students to determine why the curriculum is important to a segment of the population, the country, the world. Ask students to determine the most important concepts and topics to consider for study over a specified period of time and to identify as many reasons to defend their choices as possible. Group students, combining groups, into groups of varying individuals from different topics or current events; to discuss individual listings to reach a group consensus. Combine groups, into groups of varying individuals, so that the entire class is one group and the class agrees (with sound reason) on the critical concepts. The teacher is involved as the facilitator of the process because reasons why the students believe certain concepts are needed. It has been said people cannot decide the value of something if they have said it and do not understand what they have been part of the process. This activity does not mean turning everything over to the student nor is it the way to address every aspect of a problem. However, it does mean that the teacher values the individual's intellectual and morals, as well as extending opportunities for those whose learning style requires an answer as to why "one" needs to know certain information.

Strategy: Outlining. Individuals will engage both left- and right-side thinking. Use the process of outlining the whole passage to be outlined from the thinking and right-side thinking to break it into parts of the outline total, as well as to process the parts of the outline. This reflects how one analyzes, how one thinks, and the incorporation of both left- and right-brain thinking within whole brain activity. The brain is a system which works best when thinking in relationships (McCarthy, 1993). This activity provides the student with information related to the concept and, emphasizes the importance of cataloging data that can be found in this concept in an organized, organic manner. It draws attention to important, detailed specifics. The teacher is involved to ensure that the important information is gained from the text or other materials.
The Agriscience Connections Institute

For the past decade, agricultural education has responded to various legislative and political agendas. These agendas surfaced as a result of several reports on the status of education in the United States. Starting with A Nation at Risk: The Imperative for Educational Reform published by the National Commission on Excellence in Education (1983), several other significant reports followed in the mid and late 1980s, including Science for All Americans: A Project 2061 Report (American Association for the Advancement of Science, 1989), Biological and Health Sciences: A Project 2061 Report (American Association for the Advancement of Science, 1989), High School: A Report on Secondary Education in American (Boyce, 1983), and Understanding Agriculture: New Directions for Education (National Research Council, 1988).

These reports pointed out that science instruction in our schools needed strengthening and that our high school graduates were lagging in scientific literacy. Subsequently, science content is being strengthened in many of our high school agriscience programs.

More recently, the Carl D. Perkins Applied Technology Education Act (1990) promoted the integration of academic and vocational education and the new vocational education legislation, tentatively titled the Carl D. Perkins Career Preparation Education Reform Act of 1995 (also known as the U.S. Senate’s Workforce Development Act by Nancy Kassebaum), which also mandates that programs supported by the new law must give priority to integrating academic and vocational instruction.

Interest From Science Teachers

Science education is working hard to standardize these core subjects. Although they probably wouldn’t use this terminology, much of the current thrust is aimed at installing traditional agriscience education principles into science curricula. For example, a recent article by Joseph Krajcik titled “Learning Science by Doing Science” may sound very familiar to the “Learning by Doing” philosophy espoused by agriscience education throughout this century. In this article, Krajcik promotes what he calls project-based science, which has been known as the project method in agriscience education, and which indicates that it “…allows students to learn science by doing science and, as a consequence, actively construct their understanding of science by working with and using their ideas” (p. 54).

The connection to agriscience education is obvious. Science teachers are now very interested in teaching science in a format that emphasizes the applications of science in the real world. The funding of the project described later in this article is also proof of this assertion.

Why Work with Academic Teachers

There are several reasons why agriscience teachers should consider working with science, math, English, and other teachers to integrate academic and vocational instruction. First, this integration permits teachers to share scarce resources, which makes them “stretch a little further” and ultimately improve the quality of education for all students. Second, this partnership with academic teachers can also serve as a powerful public relations and recruiting tool for agriscience programs.

Third, and probably most important, this integration can result in the strengthening of agriscience instruction because academic teachers could teach more of the foundations now being taught by agriscience teachers. If some of the content currently taught in agriscience classes could be taught in academic classes, these teachers would add another channel that would allow agricultural teachers to teach at a more advanced content level.

Where Do We Start

With regard to integration of academic and vocational education, Bettina Lankard (1994) wrote that, “No matter how enthusiastic and committed teachers are to the concept of academic and vocational integration, their success demands that they acquire new skills and expand their knowledge to include information across the disciplines” (1). Certainly, teachers cannot teach what they do not know. If we expect academic teachers to provide foundational instruction for agriscience teachers, then they must have some fundamental understanding of the academics needed in agriscience education.

One Solution

Two projects are currently under way in...
Agricultural Education In The United States: Types Of Teaching Positions By Region

Since 1965, researchers from the Agricultural Education Division of the American Vocational Association have conducted an annual National Survey of the Supply and Demand for Teachers of Agricultural Education in the United States. The annual surveys were conducted from 1965 until 1979 by Dr. Ralph Woodin, initially of the Ohio State University and later from the University of Tennessee, Knoxville. The study was continued by Dr. David Craig of the University of Tennessee from 1974 until 1984. Since 1985, Dr. William G. Camp from Virginia Tech has conducted the study except for 2 years when Dr. J. Dale Oliver, also of Virginia Tech, was responsible for the research.

This is the fifth in a series of reports on the profession on the results of the annual supply and demand study. For more details about the background of this ongoing study, and on the sources of the data, see the first article in this series, in the May, 1995 issue of The Agricultural Education Magazine.

**Types of Teaching Positions**

There were 10,119 teachers of Agricultural Education in the United States in September, 1993. An examination of the table below reveals that the vast majority of these teachers worked exclusively in high school programs (n = 7,878). Most of the remaining teachers (n = 1,125) taught in combination high school and junior high or middle school settings. When the small number of teachers reported as teaching in two separate schools (n = 200) is considered, it appears that most of the “combination” teachers must be on adjacent or single campuses. Most teachers were in single school departments (n = 5,753). Based on the findings of this study, a typical Agricultural Education teacher in the United States works in a general or comprehensive high school, in a single-teacher department, and has no adult or Young Farmer responsibilities.

**Numbers of Agricultural Education Teachers by Grade Level and Department Sizes on September 1, 1993**

<table>
<thead>
<tr>
<th>GRADE LEVEL</th>
<th>Central</th>
<th>Eastern</th>
<th>Southern</th>
<th>Western</th>
<th>US Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>High school only</td>
<td>2,093</td>
<td>802</td>
<td>4,062</td>
<td>841</td>
<td>7,878</td>
</tr>
<tr>
<td>Junior high or middle school only</td>
<td>6</td>
<td>12</td>
<td>287</td>
<td>11</td>
<td>316</td>
</tr>
<tr>
<td>Correlation high school and junior high or middle school</td>
<td>581</td>
<td>62</td>
<td>334</td>
<td>148</td>
<td>1,125</td>
</tr>
<tr>
<td>Adult and/or Young Farmer only</td>
<td>52</td>
<td>36</td>
<td>100</td>
<td>0</td>
<td>188</td>
</tr>
<tr>
<td>Grade level not reported</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ADULT EDUCATION**

Teachers with at least some adult and/or Young Farmer responsibilities: 513 (139) 1,669 (74) 2,392

**MULTIPLE SCHOOLS:**

Teachers teaching in more than one school: 77 (19) 67 (37) 200

**DEPARTMENT SIZE:**

- Single teacher dept: 1,943 (321) 2,804 (685) 5,753
- Multi teacher dept: 773 (563) 1,869 (315) 3,521
- Dept. size not reported: 320

*Actual reported numbers included fractions since some teachers are employed part time. The data reported here are rounded off to whole numbers for ease in interpretation.
Agricultural Education Still Holding True to “Old Ways”

T
times are changing, people are changing, and agricultural education is changing, too. However, the problem-solving method used to teach agriculture is not changing as it should. Problem solving involves the evaluation of information by students to equip them in solving problems. Newcomb, et al, demonstrates this when he states:

Consider the fact that every day people learn on their own, without the presence of teachers. How is it that people go about learning on their own? What process do people follow daily as they encounter problems, questions, or obstacles that require them to think, ponder and study in order to solve the problems confronting them (65)?

Problem solving has long been advocated as a fundamental method in agricultural education, whereas other disciplines are realizing how advantageous it can be to teach problem-solving techniques. In agricultural education it’s essential to learn how to solve problems due to new trends and technological advances. A teacher could teach students how to run a computer program, but by the end of the school year, that same program may be obsolete. If the students had previously learned how to solve problems, the basic steps to run a software program wouldn’t be as difficult. For a student who never learned problem-solving, running the same software could become much more complex. The student may even lag significantly behind others in technological advances.

In today’s agricultural education departments, the problem-solving approach should continue to be advocated as a crucial method of teaching. Trends in agriculture change rapidly and cannot always be taught individually; thus this method has many advantages over other methods of teaching and the problem-solving approach should remain student, Osborne and Phillips state:

Those who pass by problem-solving in teaching assume that they are able to select the essentials in agriculture which students need to know and that students will retain what they are taught. But true agricultural education means a different thing. The changes in agriculture are rapid. The problems of the future will not be the same as the problems we face or the problems our ancestors faced in agriculture. If public school departments of agriculture cannot not give their students the ability to solve the problems they meet, they are not providing agricultural education (152).

A problem-solving approach to learning facilitates in promoting democratic ideas and opinions. As teachers, we desire that our students learn by thinking. Problem solving is one of the major methods by which students can do this. According to Newcomb, et al, the problem-solving approach to teaching involves six key elements, which are interest approach, group objectives, questions to be answered, problem solution, testing solutions through application and evaluation of solutions (87).

By using these key elements, problem solving encourages creative thinking, motivation and allows students to develop and expand their thinking abilities. According to Newcomb, et al, several essential principles are utilized in the problem-solving approach. Problem solving allows students to think and formulate solutions when they encounter an obstacle or challenging situation. Using this approach allows for an active learner rather than a passive learner. Learning also becomes more directed. This approach enables students to put into practice what they’ve learned previously. This problem-solving approach also leads to improve learning. As Newcomb, et al, states “…students should ‘inquire into’ rather than be ‘instructed in’ the subject matter” (71). Thus, learning can be maximized to its fullest potential (Newcomb, 71).

Other methods of teaching, such as questioning and memorization, are not as effective as problem solving. While questioning could lead to problem solving, it may only ask for an answer and fail to probe for solutions to problems. Memorization merely requires regurgitating information, thus leaving students unprepared to deal with varying situations. Problem solving ensures the students will not have inadequate responses to problems because it enables students to adjust their solutions to the problems by using various steps. Some steps suggested by Strausquide are experiencing a provocative situation, defining the problem, seeking data and information, formulating possible solutions, testing proposed solutions, and evaluating the results (22).

Problem solving encourages a higher level of thinking because students actually have to apply what they’ve learned rather than just answer basic questions. This method allows thinking beyond the knowledge level of the cognitive domain.

Life involves many problems, from deciding what to wear, buying a car, or determining the answer to a complex problem. Furthermore, to become successful individuals and leaders, students need to solve problems while they progress through life. Therefore problem solving is an effective method, not only in agriculture, but in life and should continue to be taught.

References


Where To From Here?
This project has the potential to elevate the level of science-based instruction in Louisiana’s agriscience education programs. The next step will be to encourage agriscience teachers to seek opportunities to forge partnerships with science teachers in their schools. The nice thing about this effort is that everyone—agriculture and science teachers and their students—truly can be winners!


Lundberg, B. (1992). Integration of agriculture and vocational education: Myths and realities. Columbus, OH: ERIC Clearinghouse on Adult, Career and Vocational Education.


Monitoring the Plant Environment: An Electronic Instrumentation Learning Activity

Introduction

Electronic instrumentation is the process of measuring phenomena electronically. Agricultural applications of electronic instrumentation are virtually limitless, ranging from planter monitors to global positioning systems and from digital weight scales to machine vision systems. Because of the widespread and growing use of electronic instrumentation in agriculture, students should be provided with learning experiences that teach basic principles and applications of these electronic devices.

By: Donald M. Johnson

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Purpose

This article describes a classroom activity that allows students to learn basic principles of electronic instrumentation by building instrumentation modules that monitor the plant growth environment (Figure 1). Specifically, the instrumentation modules measure relative temperature, light intensity, and soil moisture and then represent these values as readings on a digital multimeter (DMM). Circuit schematics and operating principles for each instrumentation module are described. Finally, circuit assembly methods are briefly discussed.

Instrumentation Modules

Temperature, light, and moisture are three primary environmental factors affecting plant growth. In artificial environments (such as greenhouses), these factors are carefully monitored using sophisticated electronic instrumentation devices. The three modules described in this section, while less sophisticated than commercial devices, should help students understand the basic principles of electronic instrumentation.

Temperature

The temperature instrumentation module is a voltage divider circuit built around a thermistor and a 10,000 ohm (10K) potentiometer. A thermistor is an electronic device having an electrical resistance that varies inversely with temperature (resistance increases with a decrease in temperature; resistance decreases with an increase in temperature). A potentiometer is a variable resistor that can be adjusted manually to a specified resistance value within its operating range. A schematic drawing of the temperature instrumentation circuit is shown in Figure 2.

As shown here in Figure 2, the two circuit loads (thermistor and potentiometer) are connected in a series. The circuit (source) voltage is supplied by a 6 volt battery. The DMM is set to read Direct Current (DC) voltage. The meter leads are connected across the terminals of the potentiometer.

According to Kirchhoff's Voltage Law, the sum of the voltage drops in a series circuit will be equal to the source voltage. Furthermore, the voltage drop across each load in a series circuit will be directly proportional to the load's resistance.

Kirchhoff's Voltage Law explains how the temperature instrumentation circuit works. As temperature increases, the resistance of the thermistor decreases. This, the voltage dropped across the thermistor also decreases (since the voltage drop across a load is proportional to the load's resistance). Since the sum of the voltage drops in the circuit must equal to the source voltage, the voltage drop across the potentiometer must increase as the voltage drop across the thermistor decreases. Since the DMM is set to measure the voltage across the potentiometer, an increase in temperature is digitally displayed as an increased voltage reading on the meter.

Lighting Intensity

The light intensity instrumentation module is also a voltage divider circuit. The circuit is built around a cadmium sulfide photocell and a 10K potentiometer. A photocell is an electronic device having a resistance that varies in inverse proportion to light intensity (resistance increases as light intensity decreases; resistance decreases as light intensity increases). Figure 3 is a schematic drawing of the light intensity instrumentation circuit.

As shown in Figure 3, the light intensity module uses the same basic circuit as does the temperature module, except that the thermistor

Figure 1. Instrumentation for Monitoring the Plant Environment.

Figure 2. Temperature Instrumentation Circuit.

Figure 3. Light Intensity Instrumentation Circuit.
is replaced by a photocell. As before, the source voltage is supplied by a 6 volt battery and the DMM is connected to measure the voltage across the potentiometer.

As light intensity increases, the resistance of the photocell decreases. This decreased resistance reduces the voltage dropped across the photocell. Thus, according to Kirchhoff's Voltage Law, the voltage drop across the potentiometer must increase. Since the DMM is set to measure the voltage across the potentiometer, an increase in light intensity is displayed as an increased voltage reading on the meter.

**Soil Moisture**

The circuit schematic for the soil moisture instrumentation module is shown in Figure 4. The circuit contains a fixed resistor (sized to limit maximum current flow to slightly less than the meter's capacity), a 10K potentiometer, and a DMM (set to measure DC amperage). The positive terminal of the 6 volt battery is connected through the fixed resistor and the potentiometer to the positive lead of the DMM. The negative lead of the DMM serves as one soil probe, and the second soil probe consists of a separate lead connected to the negative terminal of the battery. Placement of the two probes in the soil completed the electrical circuit.

The operation of the soil moisture circuit is based on Ohm's Law. According to Ohm's Law, the amount of current flow (amperage) through a circuit is determined by the total resistance of the circuit. Amperage = Voltage / Resistance. In this circuit, the total resistance is the sum of the resistances of the fixed resistor, the potentiometer, and of the soil between the two probes.

As the water content of a soil increases, the soil's electrical resistance decreases. If the potentiometer's resistance remains constant, the total circuit resistance will decrease as soil moisture increases. Since current flow is inversely related to resistance the current flow through the circuit will increase as soil moisture increases. Thus, an increase in soil moisture is displayed as an increased amperage reading on the DMM.

**Circuit Assembly**

The circuits described in this article are easy to assemble using any one of three methods. The first method is to simply make the circuit connections using insulated leads fitted with alligator clip connectors. This method has the advantage of allowing students to see the actual wiring connections. The second method is to use inexpensive breadboards with plug-in sockets to assemble the circuits. While the actual wiring connections will be less visible, this assemble method is nearer than the first method. Finally, if permanent versions of the circuits are desired, students can make the necessary connections and solder the components to a circuit board.

**Summary**

Electronic instrumentation devices are widely used in the agricultural industry. Agricultural educators should provide their students with active, hands-on learning experiences that teach the basic principles and applications of this technology. If students have an understanding of these basics, they will be in the position to adapt to new developments in this rapidly emerging field. Hopefully, the learning activity described in this article will assist teachers with this important task.

**References**


Agricultural Entrepreneurship Recognized, Celebrated

Kansas City, Missouri—Ten of the nation’s top student agricultural entrepreneurs received $1,000 awards in recognition of their entrepreneurial accomplishments. The students were recognized during the National Agri-Entrepreneurship Education Development Forum held recently in Kansas City, Missouri, in conjunction with the 68th National FFA Convention.

During the forum, participants heard from several agriculture and entrepreneurial leaders. Mike Jackson, president and owner of Agri Business Group, Inc., of Indianapolis, moderated the event and provided entrepreneurial insight. Jackson focused his opening remarks on the changing picture of American business.

“We often tend to think about the creation of jobs as something that only large corporations can do. When, in fact, 75 percent of the American labor force works in companies with fewer than 100 employees. Fully 60 percent of Americans work for companies with fewer than 20 employees, Jackson explained. “In 1995, Americans started three million companies, the vast majority of which had fewer than 20 employees. Entrepreneurship is the engine that drives our economy.”

Bob Rogers, chairman and chief executive officer of the Ewing Marion Kauffman Foundation in Kansas City, the program’s primary sponsor, echoed Jackson’s remarks. “Entrepreneurship is the key to wealth and job creation in our country,” Rogers told forum participants. “It is critically important to develop entrepreneurial skills and mindsets early in life. I salute your efforts and entrepreneurial endeavors.”


The National Agri-Entrepreneur Award Program recognizes students who start their own businesses and encourages students to consider careers as entrepreneurs instead of employees. To qualify for national recognition, each student’s application had to be accompanied by a chapter application containing his or her instructor’s entrepreneurship teaching strategies. Each of the top ten chapters also received a National Agri-Entrepreneur Award and $1,000. The winning students and chapters are as follows:

**Student**  
**School**  
Paul Baker  
Sanger High School, Sanger, CA  
Michael Case  
Brenda Smith  
Norborne R-VIII High School, Norborne, MO  
Johnathan Clough  
Richard Schmidt  
Lindon High School, Lindon, CA  
Chuck Hayslip  
J. Corbett Phipps  
Ohio Valley Vocational School, West Union, OK  
Michael Jackson  
Keith Kolpack  
Barron High School, Barron, WI  
Michael McIntyre  
Bud Postma  
Madison High School, Madison, SD  
Charles Pearce  
Lisa Mullen  
Big Foot Union High School, Walworth, WI  
Nathan Shaffer  
Channing Slowell  
Smith Center High School, Smith Center, KS  
Chris Stephens  
Mike Stephens  
Chickasha High School, Chickasha, OK  
Jere Stewart  
Shawn Dygert  
Kuna High School, Kuna, ID

The forum was part of the Agri-Entrepreneurship Education Program which is sponsored by the Center for Entrepreneurial Leadership Inc. of the Ewing Marion Kauffman Foundation in Kansas City, Missouri. Agri-entrepreneurship is a new initiative for agricultural education and is one of the profession’s top priorities. The National Agri-Entrepreneurship Education Development Forum was conducted as a joint activity of the Center for Entrepreneurial Leadership, the National Council for Agricultural Education, the National Vocational Agriculture Teachers’ Association, the National FFA Organization, the National FFA Alumni Association, the National FFA Foundation and the U.S. Department of Education.

The Ewing Marion Kauffman Foundation’s vision is self-sufficient people in healthy communities. To accomplish this vision, the Foundation operates programs and provides grants in entrepreneurship education, entrepreneurship training and youth development. The Foundation develops collaborative relationships with other organizations to work toward common goals. Due to agricultural education’s long-standing focus on youth development, self-sufficiency and its Kansas City heritage, the partnership is a natural.

Established in 1984 and representing the entire agricultural education community, the National Council for Agricultural Education fosters creative and innovative leadership for the improvement and further development of agricultural education.