Bringing Academic Excellence to the Agricultural Classroom

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Foundations For Excellence In Higher Education In Agriculture

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The youth of a nation are the trustees of our posterity. Excellence we must bring to these trustees as they enter our agricultural classrooms. Excellence we must have as we rush headlong towards the next century.

WHAT IS EXCELLENCE?

Excellence is a trite, elusive term; much overused, and yet, a "curiously" powerful word about which people feel strongly and deeply. Everyone thinks he knows what it is — not to understand would indicate mediocrity or lack of ability. "People have different opinions about excellence because they see it from different vantage points.

"In history, the images of excellence are varied; Confucius teaching the feudal lords to govern wisely . . . Lincoln jotting his Gettysburg Address on a scrap of paper . . . Fairchild exploring the world for new plants . . . Churchill epitomizing statesmanship . . . Galileo dropping weights from the Tower of Pisa . . . Dewey revolutionizing education . . . Beadle studying gene function . . . Mozart composing his first oratorio at the age of eleven . . . Waksman giving antibiotics to the suffering . . . Michelangelo sculpturing the Pieta . . . Einstein developing theories of relativity . . . McCormick inventing the reaper . . . Jesus saying, 'Father, forgive them; for they know not what they do.'

"There are many kinds of excellence. There is excellence in art, in music, in craftsmanship, in technical work, in human relations, in leadership, in diplomacy, in urban planning, in group communication.

"In the academic field there are many kinds of excellence. There is the kind of intellectual activity that leads to a new theory, and the kind that leads to a new machine. There is the mind which is most effective in teaching and the mind that is most at home in research. There is the mind that works best in quantitative terms, and the mind that luxuriates in poetic imagery."[1]

There are types of excellence that involve doing something well and types that involve being a certain kind of person. There are kinds of excellence so subjective that the world cannot even observe, much less appraise them.

Excellence is all around us in everyday life and should be recognized at whatever level it occurs. There are stages, areas, and degrees of excellence from the lofty, almost unreachable concepts, to levels which may be considered by some as mediocre or insignificant.

Excellence is not something that can be experienced only in the most rarified strata of higher education. It may be experienced at every level and in every kind of higher education.

Excellence must be for you, living up to your potential, your environment, your capabilities, your goals. These goals reached only step by step — not wholly ever reached, marked ofttimes by failures and frustrations. It is up to you to give those you teach and counsel opportunities for excellence in education.

FOUNDATION FOR EXCELLENCE

Knowledge based on research is the foundation for excellence in higher education in agriculture. Research has been basic to our great technological progress in agriculture. Research is a magic word. It also is a high-hat word that scares a lot of people. It needn't. It is rather simple. Essentially, it is nothing but a state of mind — a friendly, welcoming attitude toward change. Going out to look for change instead of waiting for it to come. It is the "problem solving" mind as contrasted with the "let-well-enough-alone" mind. It is the "composer" mind instead of the "fiddler" mind. It is the "tomorrow" mind instead of the "yesterday" mind . . .

Anthropologists tell us that if we were to construct an imaginary graph of the growth of human knowledge, the bar representing everything man knew up to the steam age would be three inches high. A second bar, representing the gain in knowledge from the steam engine to the atomic bomb, would be 15 inches high. But a third bar, representing the knowledge gained from the atomic age to the present, would have to be higher than the Washington Monument! The facts of today are the products of yesterday's research.

To keep up with new knowledge, it is estimated that we would need to read 75,000 periodicals annually. But with instant retrieval, perhaps we should not be concerned. A new computer under construction is capable of storing 500,000,000 facts with no signs of saturation in sight.

And so, research past, present, and future is basic to excellence . . . research to do, research to interpret, research to appreciate and enjoy in a modern society.

The future of excellence in higher education in agriculture is limited only by the rate at which we acquire new knowledge through research and by our own ingenuity and imagination as we present this knowledge in forms and places available to others. Research in the laboratory is useless, until it is available to others — to other research scientists, or those who adapt new practices.

Destination. Where are we going? Where do we want to go? What are our objectives in higher education as we complete this century and push forward to the next?

Objectives in education vary from the general to the specific, from the professional to the personal, and from the ultimate to the immediate. Some insist that the chief objective in education should be to uphold national integrity. Others are concerned with ideals of culture and the better life and maintain that spiritual development and harmony are the true objectives; that the "whole" man should be developed rather than a specialized producer. To some, the objective should be to teach the students the answers to a thousand questions. But in contrast, some educators insist that the primary purpose of an education is to develop the thinking power of a student and that the student's mind should be treated more as a workshop than as a storehouse. In the process, the student becomes a different, more effective, more useful, and happier person than he might otherwise have been. This objective is achieved when the student develops his intrinsic ability to perform in a creditable manner the work he wants to do and to integrate through service his life to other members of his community, state, nation, and the world.

Education must help students to help themselves, each with his particular qualities and his family, and neighborhood background; and his own inherited and acquired philosophy, in whatever particular future may be his."[2]

> "Education is essentially a thing of the spirit. It is the responsive heart and the skilled hand. It is the quickened

mind and the healthy body. It is the creative unfolding of the human life. It is the stuff from which come competent parents and responsible citizens. In its essential expression education has a fundamental spiritual quality."

This is a period of turbulent change. It includes the frightening food-population dilemma, the rise of oppressed and submerged peoples, the massive flow of peoples from rural areas to the cities, the steady growth of national wealth and income, the spread of mass education, the extension of leisure, the exciting ventures into space, and the fearsome destructiveness of military weapons.

What is our destination when the challenge to higher education is compounded by an explosion of knowledge? Most dramatically in science, but in other fields as well, the content of academic disciplines has expanded exponentially.

What is our destination when higher education is subject to increased demands for greater and more varied public service? Educational institutions are enlisted in research on national needs in defense and other fields and their capabilities are being tapped for assistance in developing countries throughout the world.

What is our destination when employment patterns are changing? Jobs now require more mental capability, fewer physical skills, a higher educational attainment at the entry level, and greater versatility or adaptability in the worker during his productive lifetime.

What is our destination when we plan our curricula? Courses must be re-examined in light of new knowledge so they do not become obsolete, and some do even in the discussion stage.

What is our destination and how can we provide opportunities and awards so that individuals at every level of ability will realize their full potentialities, perform at their best, and harbor no resentment toward any other level?

The demand for high-talent manpower is firmly rooted in the level of technological complexity of modern social organization. But it is not just technical competence which is needed. A society is dependent upon many kinds of achievement. It requires large numbers of individuals with depth of judgment, perspective and a broad comprehension of the problems facing our world.

"A student who can weave his technology into the fabric of society can claim to have a liberal education; a student who cannot weave his technology into a fabric of society cannot claim even to be a good technologist."[3]

We do not want all institutions to be alike. They should not be. Institutions must develop their individualities and keep them. "No institution should be ashamed of its distinctive features so long as it is doing something which contributes importantly to the total pattern, and so long as it is striving for excellence in performance. The junior college should recognize and be proud of its responsibilities in a community. The small agricultural college need not be afraid to remain small. The large university should not be ashamed that it is large. The technical institute should not be apologetic for its role. Each institution should pride itself on the role that it has chosen to play, and on the special contribution it brings to excellence in education."[4]

Vision. The incredible rapidity of change in our time forces us to realize the patterns of operation in 1920, 1940, 1950, or even in 1967, are completely untenable for 1968. What will they be in 2000?

But adjustments are never complete — never will be so long as civilization remains dynamic. Attitudes, values, technology, situations, and cultures are always changing.

Do we as educators have vision? Do we see America in the future as do the more optimistic phophets? Thirty-three years in the future they see . . .

"—A land of 300 million Americans living in less congestion than 200 million live in today.

"—A countryside dotted by new towns and growing rural communities where the benefits of community life are matched by the rich beauty of the countryside.

"—They see new industry and factories dotting rural America, providing the necessary economic underpinnings for the good life in the country.

"—They see urban centers free of smog and blight, with ample parklands within easy reach of all.

"—They see a land free from devastating floods, clear rivers scrubbed of pollution and silt, and sparkling air.

"—They see an agriculture fully sharing in the national prosperity—with full parity of income an accomplished fact."[5]

—They see the agriculture producer more deeply, intricately, and learnedly involved with natural resources than ever before.

—They see education for the masses based on abilities and interests.

—They see each of us more deeply involved in international affairs.

—They see an even broader and deeper subject — a world with less hunger — a world largely insulated, thereby, from the tinder of international tensions.

Do we vision a world double in population by the year 2000? Do we see a solution of today's headlines: "30,000,000 in India face starvation?"

It is said that we live in four worlds; born in one, reared in another, live in another, and on the verge of tomorrow.

Orbiting rockets and the race to put man on the moon are headline — grabbing stories indicative of the revolutionary changes in this century. But of equal significance are the revolutions in education.

Tennyson, the romanticist, said he, "dipt into the future, far as human eye can see," and, "saw the vision of the world, and all the wonders that would be." A more pragmatic poet turned his inner eye upon tomorrow and declared the future has never been — that it remains for men to make it — through education. You and I must take time to dream and to fulfill those dreams of excellence in education.

Environment. Proper environment is essential in education for the development of mind and spirit. What kind of a physical, social, and psychological environment do we create for excellence in higher education?

A favorable environment must be created so that the students in turn will create a favorable environment in which they wish to live.

Educators are committed to provide this environment — to create stability as well as to impart knowledge. These two may be of much more importance than physical environment. In this environment educators must serve as catalysts in stimulating others to excellence.

Motivation. Children are not born with motivation. It grows out of living and growing up with others — the interaction of one's self — with one's environment. "Desire" is closely related to a competitive spirit, with striving for superiority and the drive to excel. Desire makes the difference between average and superior school achievement, between passing and failing, between graduation and falling short of it. To recognize its importance, however, is one thing; to create "desire" is another. It arises out of a craving to be recognized. It blossoms in an atmosphere of success. It may even stem from a handicap, a failure, a discontent, or a lack of harmony with others. The formula for "desire" is different for each person, and it follows that the school and the teacher must find that elusive, yet unique, formula for each individual.

Motivation in one word is action. In an individual, motivation manifests itself in drive, energy, direction and purpose. For an individual, motivation means the difference between success or failure.

Deep compelling motivation does not originate in wanting, or circumstances, or people, or a company, or a job, but within the heart and mind of the individual. It does not come from the outside in; it develops from the inside out. This intangible ingredient is something in an individual which he, himself, must develop.

Students, staff members, and administrators must be motivated for excellence in education. Motivation must be nurtured and sustained.

Selection. There is so much to teach. A major problem is what to teach. We cannot teach all.

One of the natural faults of most educational systems is that we train students to meet the needs of the past and present far more than those of the future.

With the multitude of information we turn to teaching facts "cookbook style." We forget basic concepts and indulge in excessive fragmentation, specialization and obsolescence.

Concepts were invented by man for describing the world around him. They range from ideas about very simple things to high level abstractions far removed from the object level. Thinking, progress and development in all fields of human endeavor rest upon the accuracy of concepts. Science for example, does not aim simply at a description of particular events; it looks for general principles to permit their explanation and prediction. And, if a scientific discipline entirely lacks principles, then it cannot establish any connection between different phenomena; it is unable to foresee future occurrences.

Simple definitions of a concept include: (1) A concept is a defined idea or meaning fixed by, and as extensive as, the term used to designate it. (2) A concept is the amount of meaning a person has for anything, person or process. (3) A concept is a suggested meaning which has been detached from the many specific situations giving rise to it and provided with a name. (4) A concept is a word or other symbol which stands for the common property of a number of objects or situations.

Concepts are generalized insights, and the stuff of which principles are made. Concepts give us a relatively stable, relatively permanent system of knowledge; enable us to generalize; provide a guidepost for thinking.

All fields have systems of basic concepts which have been verified to a greater or less degree. The most important thing to be learned in any field is the system of concepts on which a field rests. Are there basic concepts specific for agriculture, or is the field only a combination of basic concepts in the biological, physical, and social sciences? Basic concepts are subject to change. If there are basic concepts in agriculture, have we recognized them?

Why waste time with facts and figures when eventually electronic multimedia information networks will make material in many forms instantly available to scholars wherever they may be. Idealized, such a system should impose no constraints in time or geography. A user would gain access to it from a typewriter-like terminal. He might confer over voice channel with distant colleagues, peruse documents on a TV screen and, if he wishes, obtain documents by long-distance xerography.

With proper selection we will improve our teaching, attract superior students, better prepare them for the future, increase our prestige, and bring a higher degree of excellence to education.

Execution. How do we "follow through" once we have determined our destination with vision; created the proper environment with motivation and selection? We follow through with good teaching — the quality of our teaching limits our success in excellence in higher education. There are too many "sterile" teachers and "sterile" courses; too much "sterile" teaching and "sterile" thinking — with "sterile" results. As someone remarked to me recently, "If we could make teachers out of instructors all our problems in teaching would be solved." There is no room for the pleasant but ineffectual professor.

Teaching must be recognized as an art, something that expresses the personal qualities of the teacher, something that inspires as well as informs, something dependent upon the interplay of both intelligence and spirit between the student and the teacher. There is no single best way to teach. For any individual teacher, the best way is the one that provides him the richest set of contacts with the minds of his students. Good teaching can be done only by those who feel that their work is significant; that something of importance is being accomplished.

I do not agree with George Bernard Shaw who said, "He who can does; he who cannot teaches." Good teachers are not born good teachers. They achieve this recognition only through preparation and experience.

A good teacher not only has knowledge but also has acquired techniques or skills; a "showman" in his classroom.

Education probably is inferior to most sciences in organizing knowledge in the coherent principles. There is a great need for recognizing and applying principles to be able to deal intelligently with the diverse problems in teaching. If the principles of education are today relatively unknown, it is because they are not sought. Education tends to concentrate on techniques, rather than upon the quest for understanding. Techniques are important but he who uses them without understanding them is proceeding blindly.

New facilities, new projects, new forms of scheduling, new gimmicks of every sort, either fed into or imposed upon the education programs, quite likely will overshadow the routine of a dedicated teacher. Yet, there is no substitute for the human element in successful teaching.

Teachers should take every opportunity to upgrade themselves, lest they "die on the vine."

Administrators are notorious for their lack of contact with classroom realities despite vigorous denial when such accusations are made. It is unfortunate that administrators tend to forget that the really important business of a school is what happens in the individual classroom, day by day, hour by hour. It isn't planned that way. Someone must look after such items as budgets, politics, building programs, curricula, and student problems.

Frequently the last person to be singled out for recognition is the faithful teacher who is teaching in an unordinary manner. The last deserving ability to receive public acclaim, either within the school or anywhere else, is a well-executed bit of classroom instruction.

Visual aids are necessary for the execution of excellence in teaching whether they be an ant cage, a bulletin board, a Kodachrome slide, a small plastic greenhouse, a fertilizer plot, a piece of colored chalk, or an expensive collection of equipment. A lecture without a visual aid is a wasted opportunity.

Visual aids are now considered an integral part of the teaching-learning process in the total instruction system. Instructors must be given adequate time to prepare visual aids. New classrooms should be equipped for the use and storage of visual aids. Visual aid centers may be complex and sophisticated. At one institution audio-visual self-instructional methods are used to help present research findings to agriculture students. A system, integrated into the agricultural library program, uses individual study carrels equipped with audio-tape decks, rear-screen slide projectors, and rear-screen continuous-loop film projectors. The individual student checks out the packages of reference materials — audio tapes, slides, and cartridge films — from the library and uses them at his convenience.

At another institution, the first year of operation for a self-instruction system was an unqualified success, judging from the response of students and faculty. Students dialed as many as 40,000 times per week at peak usage, and the amount of program material provided by university departments taxed the capacity of the system. It operates over high-fidelity circuits by means of which students in various campus buildings can receive the recorded material transmitted from the University's Listening Center. From carrel-like stations, the students dial a three-digit number to get the desired recording, which they hear through special headphones. The complex switching arrangements for the system are handled by a solid-state, stored-program computer. When a student dials into the system, the computer interprets the numbers and connects the caller almost instantly with the proper program material. It starts, stops, rewinds and cues the tape, repeats the tape as long as any student is on the line, and eventually turns off the playback and performs other tasks. The students learn what numbers to dial from their instructors or from published lists. Such resource centers for visual aids may be as large as a double gymnasium with "teaching areas" surrounding them. At the same time, we must keep in mind that intricate gadgetry is only an aid to good teaching, not a substitute for it.

Evaluation. Periodically, we must stop and evaluate. We must ask ourselves whether our goals have been reached. — to what degree we have attained excellence or, at least, made progress?

It is regrettable that in the minds of all too many teaching becomes evaluated in numbers taught, student-faculty ratios, lack of student unrest, absence of unfavorable newspaper publicity, and not actually whether or not good teaching was done.

Teaching is perhaps the most complex, intricate, and subtle of human enterprises, which can have a favorable, significant impact on the developing mind.

What are the characteristics of good teaching and teachers and what impact does excellence have on students? "The steps in becoming a good

teacher are: (1) To realize and accept individual variability and limitations. Improvement of teaching quality must be predicated on a willingness to change — a change of attitude. (2) To know the students and be able to identify early the gifted student and the laggard. To know the students embraces an understanding of the learning concepts. (3) To have extensive knowledge of the subject matter to be taught and the means by which knowledge can be transmitted with clarity and dispatch. The good teacher should be in a constant state of evolution, evaluation, and growth.

"Teaching — real teaching, and learning — real learning, are neither matters of talking at students or listening to instructors. Both are matters of keeping constantly open a two-way communication channel, and of making sure that the messages going each way are intelligible. An effective evaluation ought to carry a considerable part of the teacher's message to the students in that it should convey what is expected of them in attainment of the stated goals, what facts and principles they ought to know and understand and what kinds of thinking they should be learning to do with these facts and principles. By the same token, the process of evaluation will effectively carry the students' messages to the teacher."[6]

Good counseling is vital for excellence in education. Counseling should be considered everyone's responsibility and should be recognized and rewarded. Do counselors know how to advise in view of rapid progress? Do they have the vision? Do they take the time? Do they consider student recruitment for careers in agriculture as a part of the total counseling program?

Evaluation of teaching is defined as the process of judging the effectiveness of the learning experiences being directed by the teacher. Evaluation is not only necessary for instruction, but it should be one of the goals of instruction. Students should become involved in evaluating their own progress. Teachers, themselves, should evaluate their own effectiveness. Evaluation is not separate from good teaching — it is an integral part of it; neither is it apart from learning, but it is both a measure of and a motive for learning.

In the final analyses, the teacher is the key to achieving excellence. Effective teaching depends upon the relationship between the teacher on one end of the log and the student on the other. There is no substitute!

IN CONCLUSION

Having been for 200 years primarily concerned with establishing a form of government, proving that democracy can be made to work, and bringing an age of plenty within sight, we are now called upon through excellence in higher education to create a society that honors the good, the true and the beautiful . . . to create in this country and as an example to the world, the first modern technological, prosperous, humane, and reverent civilization.

Excellence in higher education in agriculture may be achieved. The vast accumulation of knowledge is yours. How well will you lay the blocks; DESTINATION, VISION, ENVIRONMENT, MOTIVATION, SELECTION, EXECUTION, and EVALUATION?

Whether or not excellence is achieved — the specifics are up to you. Will you accept the challenge?

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1 Gardner, John W., Excellence, Can We Be Equal and Excellent, Too? Harper & Rowe, New York & Evanston, 1961. (Adapted)

2Metcalfe, Darrel S., Can Teachers Be Evaluated? Agron. Jour. 47: No. 7, July, 1955.

3Ashby, Sir Eric., Technology and the Academies, MacMillan & Co., Ltd., London, 1959.

4Gardner, John W., Excellence, Can We Be Equal and Excellent, Too? Harper & Rowe, New York & Evanston, 1961.

5Freeman, Orville L., Secretary of Agriculture, Agriculture/2000; Resources. Speech at National Association of Soil and Water Conservation Districts, Cincinnati, Ohio. Feb. 6, 1967. (Adapted)

6Maier, Robert H., Evaluation of Faculty Teaching Performance, (ACE Fellow, Academic Administration), University of North Carolina, Chapel Hill, March 15, 1966.

Instructional Techniques

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During the last few years technological improvements in communications have provided new educational tools. Efforts to exploit these devices have fallen into two major categories: (1) The focus of attention on the device itself with little or no change in pedagogical procedures, and (2) The focus of attention on the learning process and the utilization of the devices to assist in its accomplishment. While most educational experiments contain some measure of each of the two approaches, many have involved far too much of the first category. Several fine educational devices have received unfavorable reception in the educational community simply because the early experiments exposed students to teaching situations for which the device was poorly adapted. Television and teaching machines are cases in point where indiscriminate and premature utilization by inept and poorly informed personnel produced disastrous results.

The scientific method demands that one define the problem first. The problem in education defined in the simplest terms is "learning must be done by the learner". While it is highly desirable to know more about the learning process, it is not necessary to delay the utilization of technological improvements until this information is available. We are already well aware of certain situations and activities which contribute to learning. It is logical then that we identify these conditions and structure an educational program to permit students to exploit these learning principles. A few of these include repetition, concentration, association, unitized steps, the use of communication devices adapted to the nature of the objective, multisensory access to subject matter, and integration of learning experiences. Most conventional educational schemes have not taken into account these learning procedures. Much of our current structuring evolved through the efforts of teachers and administrators to accommodate their own problems with little or no regard for individual student's needs. Effective utilization of modern technology may require a total revamping of conventional administrative and teaching procedures.

Television, audio tape players, 8 mm loop film projectors, computers, dial access systems, and telephone amplification are a few of the devices which appear to possess considerable promise for enhancement of the educational process. Experimentation in many schools involves one or more of these devices in various ways. A few schools at which relatively major investigations are underway include: Penn State, University of Wisconsin, Purdue University, Antioch College, Oklahoma Christian College, Oakland Community College, Stevens College, and Harvard University. The results thus far support the philosophy that each device can make a major contribution to the learning process when the device is properly inserted in a sequence of learning events which have relevance to the educational objectives.

Since time will not permit a thorough discussion of each of these experiments, I will confine my discussion to a description of the Purdue audio-tutorial system.

The system was begun in 1961 in an attempt to adjust for the diversity of student backgrounds in a freshman botany course. Initially the program consisted of a series of supplemental lectures on audio tape but evolved to a completely restructured course composed of three major study sessions:

1. A General Assembly Session (GAS), scheduled one hour per week and involving all students.
2. An Integrated Quiz Session (IQS), scheduled one-half hour per week and involving eight students.
3. An Independent Study Session (ISS), unscheduled but the equivalent to four hours of conventional instruction and involving all students in an audio tutorial study.

The General Assembly Session (GAS) provides an opportunity for motivation, orientation, guest lecturers, viewing long films, announcements, and other activities which can best be accomplished in a large group assembly. It is conducted by the senior instructor in the course and makes use of common audio visual devices such as 2x2 slides, 16 mm movie film, overhead projector, blackboard and television when available.

The Integrated Quiz Session (IQS) involves eight students and one instructor seated informally around a table. The instructor is provided with those items included in the learning center the preceding week and uses them as a device for quizzing and discussion of the week's subject matter. Each student receives, in his turn, one of the items and is expected to identify the item, its role in the week's work, and discuss how it fulfills this role. The items are delivered in a programmed fashion to a student selected at random and all students may contribute to the discussion when appropriate. A student is subjectively placed in one of three grade categories based on his performance. If the instructor is favorably impressed, he is placed in a category of excellent and is assigned a score of 9. If the instructor is not much impressed, the student is placed in the category of mediocre and is given a score of 7. If the instructor is depressed, the student is placed in the category of poor and is assigned a score of 5 or less. Grades may be raised or lowered by the student's further contribution during the discussion.

The Independent Study Session (ISS) is at the convenience of the student in a Learning Center. The Learning Center is provided with individual booths equipped with tape players and other materials appropriate

to the week's work. Equipment and other materials too bulky for inclusion in the booths are placed on an experiment table. The student checks in on arrival and checks out on departure on a specially prepared card. The card is used for booth assignment and as a record of the student's participation. There are thirty booths to serve up to 600 students. Within the booth the student is tutored by the senior instructor through a complete series of learning experiences. These may include a lecture introducing the subject for the week, reading paragraphs from the text or Scientific American articles, doing laboratory exercises and experiments from their Study Guide, viewing of 8 mm films, discussions with fellow students and instructors, study of microscopic specimens, and any other kind of learning experiences appropriate to the nature of the week's objectives. Any or all learning events may be repeated or omitted commensurate with the student's needs. Each student proceeds at his own pace and studies until he has mastered the subject matter for the week. An instructor is available to give assistance at all times. The Learning Center is open from 7:30 AM until 10:30 PM Monday through Friday.

Results of the audio-tutorial system have been encouraging. Grades have improved at all levels. It has been estimated that it has been possible to include 50% more subject matter and personal contact has been enhanced. Student interest has improved and more students have been accommodated in less space.

The Development Of An Audio-Tutorial System of Instruction In Agronomy 114A At Iowa State

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Laboratory instruction was added to Agronomy 114A, a beginning course in Agronomy, for the first time in the fall quarter of the 1965-1966 school year. Subject matter involves crop plant and seed anatomy, identification and importance of some major crop plants and forage plants, crop physiology exercises, seed quality and grain grading, weed identification and control principles, insect identification and control principles, crop diseases and control principles.

We were not satisfied with the results of conventional laboratory instruction so changed to a "station type of instruction" during the winter quarter of the 1965-1966 school year. This station type of instruction approximated a self study situation for the student. Each station emphasized a single concept or idea. Appropriate written instructions, pictures, drawings, diagrams, and specimen were available at each station so the student could learn the subject matter with very little or no help from the laboratory instructor. At the beginning of each laboratory period the students were given brief instructions concerning the arrangement of materials to be studied. After about one hour of the two hour laboratory period had elapsed the laboratory instructor conducted a very brief discussion period during which the students asked questions for clarification and enrichment. After this discussion period, the students were free to leave the laboratory when they desired. The laboratory material was left exhibited for one week following the formal presentation. The students could return for further study when the classroom was not being used for other laboratory sections. Success of this station type of instruction depends upon the following:

1. Brief concise instructions at each station.
2. Good study materials at each station.
3. Enough stations so the students can have ample space for study.
4. Classrooms which can be kept open all day and possibly evenings.
5. Laboratory instructors who are willing to give up the lecture method of presentation and walk several miles during each laboratory period "nipping" at the lazy students, challenging the fast students, and answering questions as needed.

Weekly test scores of students in station type instruction average 84% and test scores of students in conventional instruction average 80%. However, this may not be a valid comparison since the conventional instruction was during the fall quarter and station instruction was during the winter quarter of the 1965-1966 school year.

After being exposed to the audio-tutorial system of instruction as described by Dr. S. N. Postlethwait of Purdue University, the instructors in Agronomy 114A were quite interested in comparing an A-T system of instruction to the previously described station type instruction. During the fall quarter of the 1963-67 school year, two laboratory sections having 41 students were taught using an A-T method and twelve sections having 264 students were taught using the station type of instruction. Similar weekly examinations were given to all students. The students in the A-T sections average 77.1% and the students in the station type instruction average 71.7% on these weekly examinations. The variation in student performance was less in the A-T sections with a variance of 4.7 (based on 15 points) as compared to a variance of 5.7 in the station type instruction. This lower variance in the A-T sections appeared to be primarily due to fewer low scores. The slower students were better able to make passing grades in the A-T sections.

The students in station type instruction scored 4% higher on the final examination which included subject matter covered during the entire quarter. However, I do not feel that this was a fair comparison. The review material for the final examination was placed on exhibit in the laboratory with station type instruction. The A-T students spent very little time reviewing for the final examination even though they had been told to use the station-type laboratory.

Considering weekly and final examinations, the A-T students scored almost 3% higher. Besides higher overall scores in the A-T sections, there were fewer students who "dropped" the course. Probable reasons for the fewer drops include the freedom of time and rate of study resulting in higher scores on weekly examinations at the beginning of the quarter. The study time per student was approximately the same for both types of instruction.

The instructors in Agronomy 114A are quite impressed with the overall success of the A-T system of instruction. We plan to expand the A-T instruction to include all laboratory sections during the fall quarter of the 1967-68 school year. If preparation time permits we also plan to integrate lecture and laboratory and present them by the A-T method by the 1967-1968 fall quarter. We are sure that we can better emphasize improved student learning under the A-T system of instruction.

Our A-T equipment is very similar to that used by Dr. S. N. Postlethwait. The cost per booth, for 21 booths, which should allow us to handle up to 225 students per quarter, will be approximately 425 dollars. This cost includes the following items:

1. Peg board booths constructed to be used on existing tables.
2. Wollensak model 5150 tape recorder-players with headphones, recording tape, and multiple recording set-up.
3. Technicolor Super 8 mm projectors and 14 film cartridges of each of seven single concept subjects. Most of these single concept films were made by the Film Production Unit at Iowa State University by taking excerpts from existing 16 mm films.
4. Photography — Color photographs to emphasize plant parts, disease symptoms, etc.
5. Miscellaneous supplies.

Our experience with the A-T equipment and student use of the equipment has been very good. Very little "booth time" has been lost due to equipment failures. Students have learned to use the equipment quite rapidly.

I would like to add the following advantages of the A-T system of instruction to those given in "An Integrated Experience Approach To Learning" by Dr. Postlethwait et al.

1. Fewer students perform poorly and "drop" the course.
2. More time is available for the teaching staff to improve teaching materials and methods.
3. The instructor in the A-T laboratory is available to help the student when a problem arises rather than discussing the laboratory subject matter before the student is fully aware of its importance.