graphers will be glad to answer your questions. And any good book on photography techniques will be invaluable.

The most important thing to remember when first beginning to take pictures for the classroom is to keep records of your photography attempts. Take a number of slides of various subjects, varying the lens setting and lighting each time, until you get a perfect exposure. Then use that technique for future pictures. Experience is always the best teacher, but especially so for the photographer.

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AN INQUIRY APPROACH TO BIOLOGY

The scene is a tenth grade biology class, and the students, working in groups of four, are performing a laboratory investigation. Student A is directing the team in answering discussion questions. Student B will soon lead the team in performing the experiments by delegating the work. Meanwhile, student C's responsibilities are concerned with data gathering and recording. The fourth team member, student D, is responsible for observing and recording all four students' performance of the experiment. If problems in working together or difficulties with the investigation should arise, student D will call these to the group's attention and lead a discussion to resolve these problems.

The situation described above is not unique to biology or, for that matter, to science. Group work has probably been used in many or most classes. But in biology a program has been developed in which the process of group work is very specific and detailed. Well defined responsibilities are designated four different *roles*. Student A's role is *discussion coordinator*. Student B is the *technical advisor*. Student C is the *data organizer,* and student D's role is *process advisor*. The biology program using these student assignments is called the Inquiry Role Approach (Bingman et al. 1974).

The students begin using the IRA activities at the beginning of the year—on the first day of class, if possible. Those activities will introduce them to inquiry and orient them to the processes of group work. After using IRA in the classroom for three years, we are convinced that it is a beneficial and necessary instructional procedure that meets imperative needs.

The "knowledge explosion" has made content mastery as the major goal of any discipline impractical. There is more to be learned in school than what is between two book covers, and IRA offers more than content. The program is designed to lead students toward achievement in three principal areas: (i) social skills—communicating information, making decisions, reaching agreements with peers, carrying out responsibilities, and accepting others' ideas and feelings; (ii) inquiry skills—formulating problems and hypotheses, designing studies, executing plans, interpreting data or findings, and applying and synthesizing knowledge; and (iii) attitudinal qualities—openness, curiosity, confidence, objectivity, and responsibility (Bingman 1969).

Enhancement of the attitudinal and social skills is achieved by the students' working in groups and assuming within the groups the roles described earlier. These roles should be alternated during the year to provide each student the opportunity to experience them all. Assessment forms for these two goal areas are available with the IRA program. They consist of a list of the skills on which the students are rated by their peers according to their performance. Each student is awarded points according to how often he exhibits a skill as follows: 1—rarely or never; 2—occasionally; 3—sometimes; 4—frequently; 5—very frequently.

The students use and learn inquiry skills with the IRA *inquiry guide* and the *LEIB* (Laboratory Explorations in Biology). The inquiry guide is a paper-and-pencil problem-solving activity in which the students are given a series of biological statements; for example, "Water and energy are the principal limiting factors to the life of an ecosystem." Their task is to determine if the statement is acceptable or unacceptable and to support their positions with evidence from textual references. After the inquiry guide is completed individually, team and then full class discussions take place, frequently challenging results. Greater retention and understanding of the biology content is achieved by this sequence.

The LEIBs differ greatly from traditional "cookbook" laboratories. Each team chooses its own problem to study, formulates a hypothesis for the problem, and designs experiments to prove or disprove the hypothesis. Further, the team researches related literature, gathers and interprets data from the experiments, and, finally, applies and synthesizes the knowledge. In other words, the last step of the LEIB is to relate the data and conclusions of the experiment to other situations (yeast population studies, for example, are related to man's population problem). Teams may spend as much as a month pursuing a LEIB, after which they report to the class. With the learning and execution of the inquiry skills through the LEIBs and inquiry guides, students have the opportunity to develop perhaps the single most important product of education—the ability to think and to solve problems.

Our prior research (Renner et al., in press) has shown that approximately 65% of the students enrolling in our biology classes were concrete operational thinkers. That told us that they could function and think only with concrete objects, events, or situations. We do not believe our students are atypical. Other research (Sheehan 1970) has shown that even students who are thinking at the formal level demonstrate higher levels of achievement while in school if they are taught concretely as opposed to formally. IRA is ideally suited to concrete teaching, because it is predominantly laboratory work and group discussion. The interaction with the materials of a discipline and discussion about that interaction and its results constitutes what we believe to be concrete teaching.

In the IRA plan, approximately 3% of the time is devoted to lecture, that is, listening to the abstractions of a discipline being described without interacting with the materials. When the teacher only spends 3% of his time lecturing, the remainder can be spent moderating class or team discussions, interacting with individuals or entire teams, and, in general, circulating among the various teams. We feel this situation is the epitome of the individualization of instruction. The teacher can spend time with each team or individual student discussing problems and questions unique to that group or person. This procedure combines the best of two pedagogical worlds—individual attention from the teacher and the social interaction of group discussion.

Even though content retention is not the primary goal of IRA, scores on content tests of IRA students are much higher than scores on similar tests administered in years previous to its use (Seymour et al. 1973). Tangible evidence of success with IRA is shown through more class involvement than in previous years, better attendance (14% improvement in biology classes at Norman High School in 1972–73 over 1971–72), greater content mastery, and improved grades. Before the IRA program was used at Norman High School, approximately 50% of the biology grades were C's and D's. With the IRA, 50% of the grades were B's and C's. Working in teams results in students putting pressure on their peers to become involved. That peer pressure results in involvement of the learners with the content. We hypothesize that involvement is what produces the increased content mastery.

There is no doubt that one of the major advantages of any school situation is the opportunity for students to interact in a social setting. IRA provides such experience. But as science teachers we want that social experience to be provided within the context of good, sound science content. From our perspectives—teaching high school students and teaching potential teachers—the IRA program meets both content and process needs in science, and we feel it would do so in any discipline. We recommend it.

Often when a new program such as IRA is introduced, teachers have specific questions they would like answered. What follows are four questions we have been asked; the answers have been formulated from our experience with IRA at Norman High School.

1. Does the program involve team teaching? Team teaching and team planning could be used to implement IRA, but these methods aren't mandatory. We have seen success with team planning (at Norman High School in 1972–73) and without it.

2. What about students who cannot work effectively as team members? This situation should be resolved with the student's best interests in mind, which may mean letting him work alone. This solution may be at the expense of the social skills the IRA program develops. The decision will depend on the immediate circumstances.

3. How much time is spent on laboratory work in which the student interacts with laboratory materials? About 70% of class time.

4. How much time is spent on paper-and-pencil activities? Approximately 20% of class time, and the remaining 7% is devoted to class discussions.

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reproduce. In light of this finding, plus the fact that the cells are constantly being distributed by animal activity and by passive transport in the air, it is not difficult to comprehend the abundance and universal distribution of the opportunistic *C. cucullus.*

This paper suggests but a few of the many experiments students can undertake using this easily accessible animal. Although the suggested questions have already been answered in the literature, they encourage original thought and investigation—an ideal way to turn on students to the joy of discovery.

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