

Teacher to Teacher

INDIVIDUALIZED INSTRUCTION IN ADVANCED PLACEMENT BIOLOGY

As an Advanced Placement biology consultant this year and a fifth-year teacher in the program, I am well aware of the struggle involved in trying to cover this extensive course of study. My first two years of teaching AP biology were so frustrating I seriously considered not continuing the course.

Students enrolled in the program have a diversity of science background, if any. To compound my problems the first two years, I taught the course in a traditional manner, with formal lectures and labs, thus losing the interest of students who had already mastered some of the concepts and needed help in other areas that could not be covered extensively in the limited time available. The results of those two years' AP exams were most discouraging.

The turning point came when I attended a workshop on individualized instruction. The course of study I developed using this technique was, and still is, time consuming. Before meeting with my third AP class, I spent most of the summer developing individualized units on the cell and biochemistry. Fortunately, the third year class readily accepted this new approach. Because they knew that not all the objectives for the course of study were developed, the class and I literally raced each other through that rewarding year! Learning concepts for the objectives involved their working in lab, listening to teacher-developed cassettes, observing a variety of audiovisual materials, and discussing difficult concepts with each other or individually with me. The exam results for that year, and the next, were exciting. Through self-instruction,

Results of AP biology exam administered before and after individualized instruction was initiated.

Year	Number enrolled in AP biology	Number taking the exam	Number of grades of	% Passing
1970-71	16	10 (64%)	0 1 6 2 1	90
1971-72	12	11 (92%)	2 2 4 1 2	64
1972-73*	12	12 (100%)	0 0 6 3 3	100
1973-74	13	13 (100%)	0 0 6 4 3	100

*Individualized instruction initiated

each student has expressed an understanding of the objectives and has also found time to do individual science projects.

This year, AP biology consultants are available to

aid and support instructors of this course. We want to encourage AP teachers to persist in their commendable work of inspiring capable students who have consistently demonstrated that the AP program is truly worthwhile.

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STUDENT ATTITUDE AS A MEASURE OF TEACHER PERFORMANCE

Regardless of my personal feelings toward our latest educational fetish, accountability, I must grant it some degree of legitimacy. Evaluating a teacher's performance or determining whether a student is getting his educational dollar's worth present such difficult problems that it is easy to play "wooden leg": since we are dealing in individual human elements with an infinite permutation, why even try? However, since my professional wares are in the acquisition and application of knowledge, I am reluctant to foster the "unsolvable problem" concept. I have to believe that somewhere, sometime a reasonable solution will be found to educational evaluation. While we are waiting for that solution there must be some things that could be tried by teachers on an individual basis to gain insight into our current educational posture.

For several years I have used the BSCS final exam as a pre- and posttest. Each time my students showed a significant gain in their scores, but I have never really felt that I was finding out anything very important. In terms of "things," very little of what is "learned" is functional by the time an individual is out of school. Much teaching of facts is justified on the basis of facts being required for higher levels of mental construction. However, when teachers test students, facts are usually the only things asked for. It seems to me that a student need only once to prove that he can memorize. Regardless of a student's mental skills, it is his attitude that determines in which direction he will use them. What a student is left with after a course is not a huge repertoire of useful facts but a memory of an experience. He will evaluate it as useful or useless, pleasant or painful.

Students seek psychological rather than academic success. Academic success may bring psychological success, but when facts pose a block to psychological success, the facts cease to be functional. Thus, I consider attitude my first priority and cognitive learning only a means.

If attitude, then, has top priority, students should be

Table 1. Teacher evaluation form used to assess student attitude.

Student Opinion of Science			
On a five-point scale rate your teacher on the characteristics number 1-16. The rating is to indicate how your science teacher compares with other teachers you have now and have had in the past. A rating of 5 should indicate that on the rated trait your science teacher is outstanding, as compared with all instructors you have had, that is, among the best 10%. A complete description of the five-point scale follows:			
5—Outstanding, among the best 10% of all teachers			
4—above average, among the next 20% of all teachers			
3—average, among the next 40% of all teachers			
2—below average, among the next 20% of all teachers			
1—poor, among the poorest 10% of all teachers			
Each characteristic should be rated independently. Only in rare cases will the same rating be assigned for all characteristics. After deciding on a rating, circle the appropriate number on this sheet with a soft lead pencil. When you finish, please review your ratings to make sure each item is marked.			
My science teacher:			
1. Presents material interestingly and clearly.	1. 1 2 3 4 5	7. Doesn't get mad when I disagree with him (her).	7. 1 2 3 4 5
2. Relates the subject to other areas of science and to other related subjects.	2. 1 2 3 4 5	8. Is willing to help me outside of class.	8. 1 2 3 4 5
3. Presents course material in a way that I can understand it.	3. 1 2 3 4 5	9. Uses a grading system that is fair and reasonable.	9. 1 2 3 4 5
4. Makes me feel like doing more than my required assignments.	4. 1 2 3 4 5	10. Shows personal interest in students & sensitivity to student problems.	10. 1 2 3 4 5
5. Shows interest and enthusiasm in the subject.	5. 1 2 3 4 5	11. Defines course objectives clearly. (I know what is expected of me.)	11. 1 2 3 4 5
6. Is free of distracting mannerisms. (Isn't crude, wears deodorant, etc.)	6. 1 2 3 4 5	12. Maintains a good balance between freedom and control in the classroom.	12. 1 2 3 4 5
		13. Is friendly and makes students feel welcome in class.	13. 1 2 3 4 5
		14. Is interested in students learning more than just subject matter (i.e., values, good citizenship, cooperation with others, etc.)	14. 1 2 3 4 5
		15. Makes students feel they have worth.	15. 1 2 3 4 5
		16. General rating: Compared to all other teachers you have had, how do you rate this teacher?	16. 1 2 3 4 5
		The next five statements refer to this course. As above, your rating should be a comparison, in this case with other courses you have had. Use numerical ratings the same as above, 5 outstanding and 1 poor.	
		17. Organization of course. (Teacher and students seem to know what is going on.)	17. 1 2 3 4 5
		18. Value of reading assignments, exercises, or laboratory activities.	18. 1 2 3 4 5
		19. Quality of tests. (Do they test for what you think they should be testing?)	19. 1 2 3 4 5
		20. Value of the course to you. (Is it worthwhile to you?)	20. 1 2 3 4 5
		21. Overall quality of the course. (General feeling.)	21. 1 2 3 4 5

evaluated on that basis. But students are actors. They attempt to play the role that is expected of them. If memorization is the game, then memorization is what they play. If inquiry is the game plan, then everyone tries to play inquiry. In testing, what is usually tested is a student's role-playing ability. To prevent students from playing the attitude game with me, I assess my students in some phase of cognitive production and myself on their attitudes. Even with this approach, I feel that attitude cannot be reliably assessed during the student's years of formal education. At best it will be only a rough approximation. Students' attitudes should be assessed several years after graduation, but since our district has no program of this nature, I rely on data gathered from my students while they are in my classes.

I decided to attack the problem by administering a teacher assessment form during the first week of school and again during the last week of school (table 1). The form was adapted from one used at the University of Kansas, and several of us in the department have used it for the past three years. In this study, I compared the results of teacher performance assessment during the 1971-72 academic year and the 1972-73 academic year. From the results (table 2), I con-

cluded that my performance as a teacher had probably improved.

In conjunction with the teacher assessment, I tested the students in regard to their ranking of science relative to other subjects offered at the high school. This was done at the beginning and at the end of the school year. I also tested their attitude toward different classroom activities carried out during the year. The latter instrument attempted to differentiate among three attitudes: personal usefulness of the activity, enjoyment, and usefulness in getting a better grade. The results and further discussion of these instruments are available to interested people.

Table 2. Statistical evaluation of student teacher assessment.

	1971-72	1972-73
Mean of all items	3.26	3.74
S.D.	.412	.340
t value = 7.675		
n =145.		
level of significance = .01		

This study was not government funded, it was not required as inservice growth credit, and it was not part of any college credit. It just seemed somewhat hypocritical of me to stress to my students the value of the scientific approach to problem solving and objectivity when I subjectively evaluated my own teaching. I hope that other teachers might attempt to evaluate their own classes and performance as I have tried to do. Only in this manner can we show the responsibility necessary for directing our own accountability.

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A TECHNIQUE TO INTRODUCE DICHOTOMOUS KEYS

I have found that working with and constructing dichotomous keys usually presents some difficulty for beginning biology students. Thus, I have adopted the following techniques to introduce the concepts involved. I construct a "key" to an assortment of keys. Door keys, house keys, and car keys are "keyed out" by the use of this scheme. Following is a copy of my introductory key. The structural characteristics utilized in this key are presented in fig. 1 and the individual keys in fig. 2.

Dichotomous Key to Keys

- 1a. Key head with curved edges (A and B) .. go to 2
- 1b. Key head with straight edges (C, D, E) . go to 3
- 2a. Key head circular shaped (see fig. 2A) Key A
- 2b. Key head oval shaped (see fig. 2B) Key B
- 3a. Key head triangular shaped (see fig. 2C) . Key C
- 3b. Key head with more than 3 sides go to 4
- 4a. Key head pentagon shaped (see fig. 2D) . Key D
- 4b. Key head triangular shaped (see fig. 2E) . Key E

Although this key is specific only for my particular key chain, it is very adaptable and does illustrate the important concepts involved in using and construct-

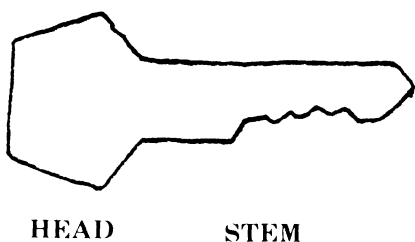


Fig. 1. Structural characteristics of keys.

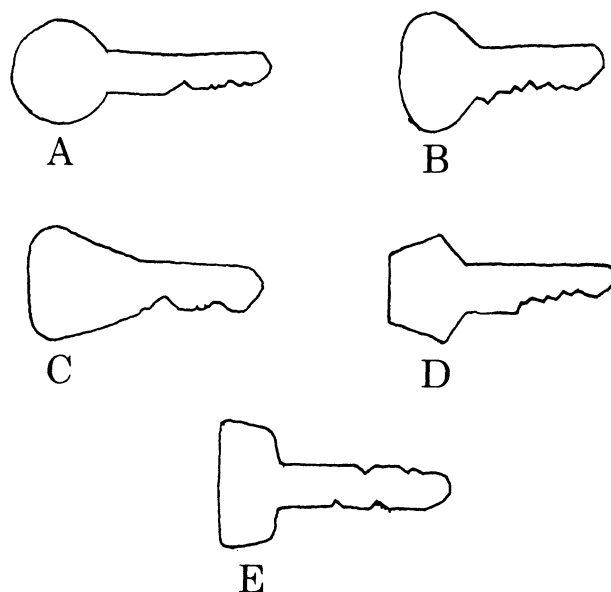


Fig. 2. Specific keys.

ing keys. First, it is based on structural characteristics as are most biological keys. Then, also, this key demonstrates the principle of elimination inherent in dichotomous keys.

After being exposed to this key, my students are asked to construct a key of their own for the purpose of keying out the contents of their purses (girls) or pockets (boys). Diagnostic characteristics to separate a comb from lipstick, or a coin from chewing gum, soon become apparent. The students test the effectiveness of their keys by trying them out on their classmates.

I teach from BSCS "Green Version" in my classes. This textbook presents keys in chapters 4 ("Animals") and 5 ("Plants"). Investigation 4.2, "Structural Characteristics in the Identification of Animals," presents keys to distinguish classes of various animal phyla. Investigation 5.1, "Diversity in Angiosperm Leaves," requires the writing of a key to distinguish a set (usually 10) of leaves. I have found that these investigations run more smoothly after the introduction described above.

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PREPARATION OF SMALL ANIMAL SKELETONS USING BEETLE CORROSION

As a biology instructor I have often wished for a convenient method of preparing skeletons of small mammals, rodents, reptiles, and amphibians in the classroom. The conventional boiling technique is difficult because of the destruction of bone, cartilage, and ligaments resulting in the disarticulation of the skeleton. Students become frustrated and lose interest in trying to glue the skeleton back together. I believe that a solution to this problem lies in the use of beetles to remove the flesh during skeletal preparation.

The leather beetle, *Dermestes vulpinus*, is a beetle