

# BSCS Special Materials Really Work

By WILLIAM K. COBBETT

Much has been written about program enrichment, individual student research, advanced placement, and curriculum development at all levels in the public schools. It is rather distressing and disturbing that most of these articles are concerned with those students who have average or above-average academic ability and thus should be expected to do well in a “typical” or “traditional” school situation. But what about the student who has a limited academic potential, has a reading problem, finds school boring, and is continually in trouble with school authorities because of infractions of discipline and attendance? This is the student who is an increasingly serious problem for school administrators, guidance personnel, and—most of all—classroom teachers. These are the students who lower a school’s reputation, in the eyes of the public.

It is the purpose of this article to discuss the BSCS Special Materials Program (Liebherr, 1966a), which is designed specifically for this kind of student. We are using it in the Marblehead, Mass., schools and find it most successful for the academically less able students.

## Why “Special Materials” Were Chosen

In attempting to establish in our schools a forward-looking, laboratory- and inquiry-oriented science program, we have turned to several of the newly developed science courses. Until three years ago our course offering consisted of IPS, CHEMS, CBA, PSSC, and the BSCS Yellow Version supplemented with a BSCS Laboratory Block. As it is a

regulation of our school that at least one science course be successfully completed for graduation, almost all students, whether college-oriented or terminal, take biology sometime during their high school career. While the BSCS Yellow Version and the Laboratory Blocks we offered proved more than adequate for most students, there were still many youngsters who were unable to handle either the reading material or the laboratory exercises in this kind of biology course.

This curriculum offered these students only two course choices: either BSCS biology, which was too difficult for them, or a so-called physical-science course, which had been included in the curriculum to satisfy the science requirement for graduation and did little to challenge or reward the less capable student. In an effort to provide a more interesting and enjoyable course in science for these students, we decided to offer two sections of the BSCS Special Materials. This particular program was selected for the following reasons:

1. We believed in the stated philosophy of BSCS: “science as inquiry.”
2. Our experience with other BSCS materials had been most satisfactory.
3. The instructors who would use the Special Materials were familiar with the BSCS philosophy.
4. The Special Materials had well-stated objectives.
5. The Special Materials could be no worse than the biology curriculum we were currently offering to this kind of student.

These materials were introduced into our cur-

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riculum in September 1967 under the course title "Life Science." This course awarded five credits and completed the science requirement for graduation, but it was not intended to satisfy the college-preparatory science requirement.

### Characteristics of Students and Classes

In attempting to place in this course only those students who we felt would benefit most, close cooperation between the science and guidance departments was necessary. Overall teacher evaluation was the prime factor for student selection, because the student for whom this course was designed could not be identified solely on the basis of objective data. The accompanying table gives the class distribution, based on I.Q., reading, and POST scores, for the first two years of the program. These data were tabulated only after final student selection had been made and the students were actually enrolled in the course.

The table provides indications of some of the first-year problems that were remedied the second year the Special Materials were offered. One of the major problems of the first year (1967-68) was the extremely large size of the class. It is interesting to note that in the *NABT Newsletter* of December 1968 mention was made in "Preliminary Statement of Standards for Teaching Biology" of class size for these specialized courses. In the second year (1968-69) the average class size was reduced from the preceding year's average of 25 to a most manageable average size of 19 students per class. While this number was slightly higher than might be desired, we felt that it made discussion periods and laboratory exercises much easier to supervise.

Another problem that was greatly alleviated in the second year was that of student abilities as measured on the I.Q. tests given by the guidance department the beginning of each school year. The range of I.Q. scores the first year was extremely wide; as a result many students became bored and uninterested because the materials were either too easy or too difficult for them. The first year these

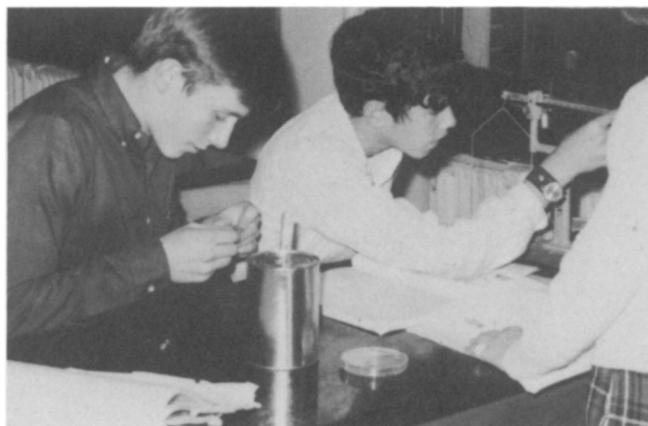


Fig. 1. Tin-can calorimeter: simple introduction to bioenergetics.

### Test scores of students in Special Materials course.

	I.Q. <sup>1</sup>		Reading <sup>2</sup> (national percentile)		POST <sup>3</sup>	
	1967-68	1968-69	1967-68	1968-69	1967-68	1968-69
Range	66-121	74-108	2-86	4-81	9-29	5-19
Median	95	94	41	42.5	15	11.6
Mean	97.8	83.9	40.2	37.7	14.7	12

(Average class size in 1967-68 was 25; in 1968-69, 19.)

<sup>1</sup>Otis-Lennon Mental Ability Test, Form J (1967; Harcourt, Brace, & World).

<sup>2</sup>Cooperative English Tests: Reading Comprehension, Form 2A (1960; Educational Testing Service).

<sup>3</sup>Processes of Science Test (1965; Psychological Corp.).

uninterested students tended to distract the students who found the materials challenging—a situation that created a few problems of discipline. Last year the range of scores on the I.Q. test was narrower than in 1968-69—a circumstance that was reflected in much greater student interest and fewer disciplinary problems.

Another important factor that made the 1968-69 classes more effective was the lowering of the mean I.Q. score. The reduction in the mean score, combined with a lowering of the range of I.Q. scores, resulted in classes that were more homogeneous as to ability and interest. This "uniforming" of classes enabled the teacher to present materials that challenged almost all members of the class; as a result, student interest was much higher and the discipline problems were fewer than in the preceding year.

The Processes of Science Test (POST) results indicated the guidance department was not only assigning to this course students who were more uniform in their understanding of science processes, but that these students also had a poorer understanding of the methods of science as measured by this test. The results of the reading tests indicated little if any improvement in grouping during the two years. However, due to a schoolwide program in remedial reading there was a substantial increase in reading scores at all grade levels. Thus, the apparent lack of progress in grouping based on reading levels was more than compensated for by the general schoolwide increase in reading scores.

While the above data indicate substantial progress had been made in the grouping for this course, much remains to be done, not only in identifying the academically unsuccessful students but in assigning them to narrow-range ability groups as well.

### Features of Particular Value

There are several features of the Special Materials that make them adaptable to a wide range of student abilities. One of these is the increasing difficulty of the reading materials from the beginning to the end of the course, while yet remaining at a reading level that almost all students can handle with very little difficulty. As the year progresses,

not only does the difficulty of the reading assignments increase, but the length of reading exercises increases as well: the initial reading assignment is less than one page in length and the last assignment is six pages long. The teacher has the options of reading to the class, having the reading done by the students themselves in class, or giving it to the students as a home assignment.

Another innovation is the introduction of programmed instruction. These are linear programs in microscopy, graphing, energy relationships, DNA, and reproduction. We consider the program on reproduction so well done that it is used in all our biology courses, both college-preparatory and terminal. Besides providing a novel way of learning, these programs are used by the students in reviewing for quizzes.

Special Materials engage the students actively in laboratory exercises (fig. 1). These exercises are not the so-called cookbook or canned activities so often concocted for this kind of student; rather, they are the inquiry-based, open-ended laboratories that are the backbone of all BSCS programs. These labs deal with genetics, classification, energy relationships, and development—subjects that, before the advent of Special Materials, had been reserved for the college-oriented student. The exercises go beyond involving the students in data-collecting: they also enable them to work and discuss in small groups. In our particular situation these small laboratory groups have worked out quite well. Not only do they afford the students a chance to do some kind of lab work, as their college-bound classmates do; they also give the instructor an opportunity for full-scale class discussion of the data collected. It is these class discussions that make the course so appealing to the student and so challenging to the instructor.

The sealed ecosystem (fig. 2), a very simple and inexpensive set-up, has given rise to several periods of spirited discussion. Besides bringing out several biologic concepts and facts, the discussions enable each student to express his own opinions and have these opinions weighed by his classmates—a chance they are not always afforded in other courses.

### Student and Teacher Reactions

In attempting to evaluate the success of the Special Materials course we have relied heavily on nonobjective information, such as student and teacher reactions. Both have been most favorable. The students enjoy the laboratory exercises and the discussions that follow each lab. They are pleased that they are being allowed to use the same equipment and materials that had formerly been reserved for their “favored” classmates. There is also favorable reaction to the fact that each student is given a chance to express his opinion in class and to have this opinion evaluated and discussed by his class-

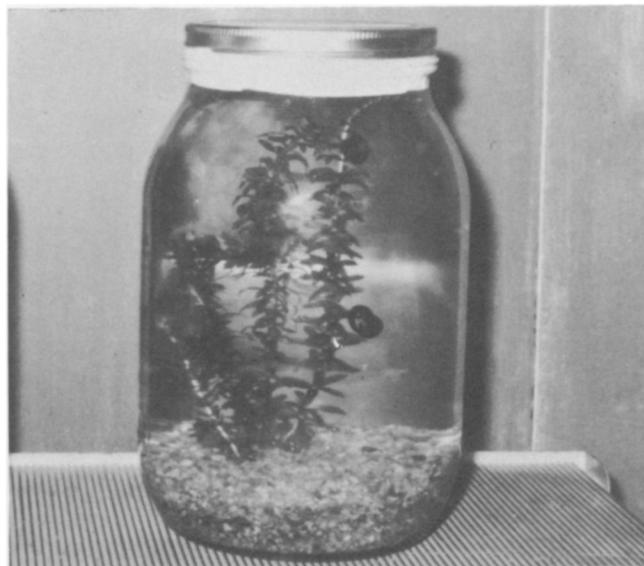


Fig. 2. Sealed ecosystem: six weeks old and still going strong.

mates. Teacher reaction to these materials has been equally favorable. From the outset there is a great deal of satisfaction in working with this kind of student: the task is both challenging and, if carried out successfully, rewarding. The students seem to be most responsive and, in this course, much less of a disciplinary problem than in any of their other classes.

While the Special Materials are far from being the ultimate answer, we have found them to be superior to anything else we have tried. With modifications and adjustments, I feel, this program could be adapted to almost any class or school situation. Most of the modifications can be worked out by close cooperation among the science, guidance, and reading departments of the school.

Indeed, as more and more schools begin to use these materials they may well be adjudged the most important contribution of BSCS to science education. But, as is the case in all instruction, the teacher is the key to the success of this program. If the teacher is in sympathy with his students, understands the philosophy behind the Special Materials, and is willing to try new, different, and varied instructional techniques, he is sure to find that the Special Materials really work.

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