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Bernard W. Benson
University of Iowa

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BERNARD W. BENSON
Science Education
The University of Iowa

Introduction

Using scientific articles in teaching is in itself no innovation. Baumel and Berger (1965) provided an excellent approach to this task. I find no argument with the format they proposed. However, I do question their statement which follows concerning student outcomes from such experiences.

"An approach that attempts to combine the character of science with its content through the involvement of students with the research papers of scientists appears to have great potential in teaching science as a process. Among the many rewards to be gained from the student's first-hand contact with original scientific writings are the genuine excitement in seeing fundamental discoveries through the eyes of their discoverers, the humanizing enrichment in becoming acquainted with the personalities of great scientists, and the possibility that youngsters will 'catch' the climate of accuracy, the carefully detailed work, and the essential honesty of their scientific efforts."

It is not with these intentions that scientific articles are written. Such assumptions can only be labeled as "hedging" as defined by the Committee on Form and Style of the Conference of Biological Editors (1964, p. 4). The above represents assumptions not based solely upon the data. If any scientific article characterizes the personality of a "great" scientist, then that which is characterized is the personality and not the scientist. The image likely to be conveyed is that to be a scientist one must be "great."

I propose that the scientific article has but one prime purpose in the classroom. It is a tool of the scientist, and apart from its author it is only a static entity merely representative of its dynamic counterpart, the scientist. More specifically, it is a communicative tool. Its use in the classroom will be demonstrated herein by example. The following format was used in an advanced biology class at the University Schools of The University of Iowa. The class was centered around the BSCS second-level course (1965). The students were investigating heterokaryosis and complementation in *Aspergillus nidulans* as part of a unit on interaction with cell contact.

The Lesson

Two days prior to the class discussion each student was given a copy of an article by Woodward (1959). The discussion of this paper was based upon the following design.

Rationale:

The uninitiated is without exception destined to become appalled during his first entanglement with scientific literature. The student will justifiably rebel against the complicated

esoteric jargon, rhetoric, and illustrations peculiar to scientific writing.

Too often references are made to the literature by the teacher, leaving the assimilation of such research papers up to the student. I submit that casual acquaintance will seldom lead to a successful learning experience. Such unstructured activities serve in no way to augment student comprehension of the subject at hand.

Assuredly, the preparation and background prerequisite to full comprehension of such articles would be too demanding to incorporate such rigor into each unit. Expediency must be followed by relying on student background, formalizing expected outcomes which are general and far reaching, and directing discussion around major concepts encompassed in the articles.

General Objectives:

1. To develop readiness on the part of the student concerning the effective use of scientific articles.
2. To acquaint the student with the form and style of scientific articles.
3. To acquaint the student with the purpose of the organizational units in the article, i.e., Introduction, Methods and Materials.
4. To relate the content of the article to the scope of the research area.
5. To synthesize the content of the article and relate the contribution of the article to the body of scientific knowledge.
6. To demonstrate the significance of experimental design.
7. To emphasize that formulation of concepts or conclusions drawn from such articles represent the links between pure research and textbook content.

Specific Objectives:

1. To acquaint the student with the terminology unique to the area under study.
2. To show the significance of heterokaryosis in the complementation process.
3. To develop a suitable hypothesis (es) to explain non-allelic complementation.
4. To acquaint the student with the relationship between complementation and the map distance between mutations on complementation maps and to develop models to augment their explanation.

Discussion:

The discussion was introduced by relating the present status of research on complementation to the state of mendelian genetics at the turn of the century. A review of the role of the gene in enzyme formation preceded the discussion on the scientific article. An outline of the discussion follows:

1. Meaning and clarity of the title.
2. Student interpretations of the summary.
3. Comparison of the form and style used by the author with that used by the students in writing up their investigations.
4. Overview of the introduction, its purpose, and its succinct style.
5. Problems in comprehending the introduction (proceeding sentence by sentence having the students rephrase each sentence).
6. The significance of a "25 per cent wild-type activity."
7. Paragraph 2: (The above hypothesis . . .) have students identify the hypothesis.
8. Results and Discussion. Student presented capsule of the results

obtained by the author (emphasis placed on importance of experimental design.)

9. "These data"—Is this a grammatical error?
10. Interpretation of Figure I.
11. Attempt to formulate a hypothesis concerning the mechanism suggested by student interpretations of Figure I.
12. Reread summary and reevaluate.

The students, in turn, related the concepts presented in this paper to Experiment 15 (BSCS, 1965) dealing with the nature of complementation and heterokaryosis. The following day's discussion centered around the organization of the experiments dealing with *Aspergillus nidulans.*

Summary

In retrospect, I must admit that the above lesson, expedited through student discussion, was characterized by considerable student-student interaction. By hedging I might even conclude that inquiry was taking place that indirectly lead to the understanding of the scientific enterprise. Specifically, the inquiry provided a means for teaching a tool, i.e., the technology of scientific writing. The image of the scientist conveyed was that scientists are concerned with succinct communication and that once the lexicon of the scientist is understood only acceptable rhetorical skills are necessary to communicate scientifically. Teaching science as a process thus became a more immediate and meaningful goal.

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