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Author(s): John W. Rushin, Jean De Saix, Ann Lumsden, Donald P. Streubel, Gerald Summers, Carol Bernson

Source: *The American Biology Teacher*, Vol. 59, No. 2 (Feb., 1997), pp. 86-90
Published by: University of California Press on behalf of the National Association of Biology Teachers
Stable URL: http://www.jstor.org/stable/4450255
Accessed: 25/08/2010 12:37

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A Basis for Improvement of College Biology Teaching & Faculty Development?

John W. Rushin Jean De Saix Ann Lumsden Donald P. Streubel
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THE recent growth and enhanced pedagogical activities of the Two-Year and Four-Year College Sections of the National Association of Biology Teachers (NABT) indicate a desire on the part of college faculty members to improve the quality of college biology teaching. NABT's Standards in College Biology Teaching Committee, an ad hoc committee appointed by the president of NABT in 1989, has completed a literature review regarding college biology teaching. After analyzing the literature, this committee made several recommendations and proposed a research agenda. The Standards Committee's review (Gottfried et al. 1993) provided several important questions for the research agenda in college biology teaching. Some of these questions are: Do models for faculty preparation exist? Which institutions are preparing college biology faculty to teach? What form do these programs take?

The College Faculty Preparation Committee, a standing committee of the Four-year College Section of NABT, has focused on the above questions during the past two years. Based on personal experiences of the committee members as well as information from the literature, the Faculty Preparation Committee has agreed with several authors (Lawrence et al. 1992; Ebel & McKeachie 1985; Moore 1991) that graduate teaching assistants (GTAs) are used extensively in lower division laboratories and recitation classes and that in many cases the GTAs have more direct contact with undergraduate students than do professors. The Faculty Preparation Committee also accepts the following statement published in the Iowa State University Teaching Assistant Handbook (1990): "The teaching assistant experience is an important part of training future faculty members." Improvement of GTA training is a very important way to bolster college biology teaching in general (Fifield 1993). According to Marilla Svinicki, the director of the Center for Teaching Effectiveness at the University of Texas at Austin, "It is really hard to be interested in undergraduate teaching and not be interested in training teaching assistants since they play such an important role" (Mangan 1992).

Professors generally consider themselves professionals in their disciplines but not in teaching (Light 1984). In larger institutions especially, biology professors tend to focus on original research and publication, often at the expense of innovative teaching (Fifield 1993). A report from the Association of American Colleges (1985) has appropriately stated that, "if the professional preparation of doctors was as minimal as that of college teachers, the United States would have more funeral directors than lawyers." This philosophical emphasis on research in the higher education environment does limit the development and assessment of pedagogical skills for college professors. In particular, the College Faculty Preparation Committee of NABT believes that it is important to assess the value of GTA training and other efforts directed toward college teacher training.

John W. Rushin, Ph.D., is Professor of Biology at Missouri Western State College, St. Joseph, MO 64507. **Jean De Saix**, Ph.D., is a Lecturer in Biology at the University of North Carolina at Chapel Hill, NC. **Ann Lumsden**, Ph.D., is a faculty member in the Department of Biological Science at Florida State University, Tallahassee, FL, and she was the recipient of NABT's 1992 Four-Year College Biology Teaching Award, sponsored by Harper Collins. **Donald P. Streubel**, Ph.D., is Professor of Biology at Idaho State University, Pocatello, ID, and Chair of NABT's Four-Year College Section. **Gerald Summers**, Ph.D., is Associate Professor of Biology at the University of Missouri at Columbia, MO. **Carol Bernson**, M.S., is Assistant Director for Operations, the Honors Program, University of Illinois, Urbana, IL.

A Nationwide Survey of GTA Training & Teaching Resources Available to Faculty

In 1994, the College Faculty Preparation Committee of NABT conducted a nationwide survey of teaching-related resources available to in-service college biology faculty and to graduate teaching assistants as faculty in training. Questionnaires were sent to the department chairpersons of all 312 graduate schools of biology listed in *American Universities and Colleges*, 14th ed. (1992). Forty-nine percent of the questionnaires (153 of 312) were completed and returned primarily by biology chairpersons, but in a few cases by a curriculum specialist other than the chairperson.

It is tempting to assume our survey results truly reflect the current situation in American graduate schools; however, a bias may have occurred due to the greater tendency of schools with well-established programs to complete and return the questionnaire. In spite of this bias we believe our results provide some significant baseline information about the current state of college biology faculty preparation in our country.

Listed below are some questions from the College Faculty Preparation Committee's questionnaire along with a summary of results for each question.

Are there any special programs and/or resources available on your campus that deal with the improvement of teaching skills and are they available to college biology faculty? (If "yes," explain.)

It was encouraging that a substantial majority (62%) of graduate schools have some type of center for teaching and learning located on the campus. However, the nature of the "center" varies considerably from a faculty committee that occasionally arranges special seminars or presentations dealing with pedagogy to an actual paid staff with a director, support personnel, and teaching resource materials.

One of the more well-known examples of a formal type of "center" is a program called the Center for Teaching Effectiveness that has been in operation at the University of Texas in Austin since 1974 (Weimer 1990). This program has a director, an associate director, a faculty development specialist, and a secretary—all of whom serve the teaching needs of 2200 faculty and 1500 GTAs through workshops, dissemination of teaching-related written materials, a videotaping service, and individual consultations. Although the vast majority (80%) of the Center's activities are directed at instruction, there is considerable attention given to professional development activities such as "getting published" and "getting promoted."

Are teaching assistants used in labs or lectures in your biology department?

As expected, almost all (97%) of the biology graduate schools surveyed utilize graduate teaching assistants in laboratories and/or lectures.

Besides the teaching assistant experience, are there any other formal opportunities for your graduate students to develop teaching skills? (Examples are college teaching seminars, workshops, courses or internships in college teaching.)

Although the answers to this question were very diverse, an attempt was made to categorize the various approaches to GTA training into five basic models described in the following table (Table 1).

According to our survey results, Model I (no formal training required) is by far the most common approach at both graduate schools where the masters is the terminal degree and at graduate schools where the doctorate is the terminal degree. It should be pointed out that Model I could involve some interaction among GTAs or between GTAs and professors, but such meetings would not be a required part of the program. The second most commonly used approach to GTA training was Model III (pre-academic year workshop in college biology teaching), followed by Model IV (seminar in college biology teaching during the GTA teaching semester), then Model V (a formal college biology teaching course), and finally Model II (training by an assigned professor).

Table 1. Graduate teaching assistant training models.

	No. of Graduate Schools	
	masters terminal	*doctorate terminal*
Model I. No formal training required by GTAs.	(45)	(30)
Model II. Individualized GTA training by professor. Occasional college teaching seminars, lectures, etc. available or required.	(9)	(1)
Model III. Pre-academic year workshop in college teaching required or strongly recommended. Occasional and periodic group meetings.	(9)	(25)
Model IV. Seminar in college teaching required during the T.A. teaching semester. Other workshops required or recommended.	(7)	(14)
Model V. A formal college teaching course required of all GTAs.	(3)	(10)

Four of the graduate schools reported having college teaching internships in biology. Mankato State University has a community college internship as part of their masters program in biology. Ball State University, Idaho State University, and Emory University all offer the option of teaching internships as part of their doctoral program in biology.

Some Examples of Workable Programs

One example of a well-established GTA training program for biology is the one in operation at Florida State University at Tallahassee. This program requires that every masters or doctoral candidate teach in at least two different courses during his/her program. All new biology graduate students must complete a week-long workshop presented by the Department of Biological Science just prior to the beginning of classes in the fall. The workshop curriculum is based on current educational literature dealing with effective teaching and characteristics of effective teachers. The topics covered during the workshop include the first day of teaching, methods of instruction, learning styles, preparation, challenges by students, time and stress management, ethics, and evaluation. In addition, several professors and/or experienced teaching assistants provide teaching examples of the above topics as well as the use of humor, running a student laboratory, leading discussion, and professionalism. Each GTA is given a packet of materials, a Biological Science Handbook, and a Florida State University Teaching Handbook.

Each student attending the week-long GTA training workshop at Florida State University is videotaped during a self-introduction and during the presentation of a mini-lesson. Students preview their tapes with input from an experienced GTA. Once the fall semester is underway, a videotape is made of each GTA in an actual teaching situation. An experienced faculty member then reviews the tape and provides input in order to help and encourage the GTA. In addition, GTAs have a required weekly meeting that includes a "trial run" and discussion of the next regularly scheduled lab. Recently, a separate semester-long graduate teaching course has been developed and is optional for biology GTAs working on masters and doctoral degrees at Florida State University.

The GTA training program in the Biology Department at the University of North Carolina at Chapel Hill begins with an intensive three-day, pre-semester training workshop. The first day and a half of the workshop is only for the new GTAs. The last day and a half is required of all GTAs. In addition to the workshop, GTAs have weekly meetings that focus on solutions to current problems and include a "run through" of next week's laboratory exercise. Also, a videotape of an actual teaching session is made and critiqued using a formal written assessment instrument.

In both the workshop and the weekly meetings, the following skills are stressed:

- *Planning introductory comments to a lab.* Emphasis is on how to say as little as possible and to see one's role as more motivational than informational.
- *Planning and implementing the use of visual materials.* GTAs are asked to make transparencies by hand or to use computer graphics, plus experiment with design and content. They learn to turn their own notes into transparencies for the class, thus increasing their confidence as well as student's access to information.
- *Negotiating with others.* The GTAs must grade lab reports and develop tests as part of a teaching team. This means that they have to negotiate with their colleagues to arrive at an agreed set of test questions or a particular grade on a lab report. This process helps GTAs converge in their expectations (hard-nosed ones become less so and the ones who would give everyone A's are kept from doing so) and teaches the very difficult art of negotiation. GTAs generally do not like this aspect but understand that this endeavor results in a more equitable system for the students.

The current program of GTA training in operation in the Division of Biological Sciences at the University of Missouri represents an example of institutional and divisional cooperation in the training of the future professoriate. The campus-wide component of this program began in 1987 as a program to ensure that international teaching assistants were fluent in English pronunciation and grammar, but it quickly developed into a comprehensive training program for all GTAs. Since 1989, all new GTAs have been required to attend a one-day session offered by the Program for Excellence in Teaching at the University of Missouri. This session includes a motivational speaker and break out sessions dealing with laboratory instruction, stimulating discussion, asking questions, and promoting student participation. One of the most popular components of this program is a panel discussion by "veteran" GTAs on the things teaching assistants need to know to survive.

The department orientation is a three-hour workshop in which all new GTAs are introduced to departmental policies and procedures. The department policy manual and a copy of McKeachie's (1994) "Teaching Tips" are provided for all GTAs. A substantial portion of the departmental orientation is devoted to laboratory teaching behaviors. This includes a brief review of the research literature of science education as well as practical tips on the sort of things that GTAs should do to enhance student learning in the laboratory. In recent years, GTAs have also viewed the video, "A Private Universe" (Pyramid Films & Videos 1990) and have discussed the implications of misconceptions on student learning in

science. The departmental orientation also includes follow-up sessions on test-item writing about three to four weeks into the semester. Additional activities occur in weekly staff meetings for GTAs assigned to general biology laboratory courses.

The overall results of the GTA training program at the University of Missouri have been very encouraging. In a five-year period preceding the implementation of required training, student evaluations of GTA performance averaged about 71%. Student evaluations of GTAs who have participated in the training program presently average 87% and both GTAs and students express more satisfaction in their experience than was true in the past. Evaluation forms are modified from models developed at the University of Washington, one of the longest-running student ratings programs in the country (Wulff et al. 1991).

The Doctor of Arts (DA) degree at Idaho State University is a comprehensive program to prepare students for a career in college biology teaching. The DA program was initiated in 1971 with support from a Carnegie Foundation grant. This program requires 48 semester credits beyond the masters, an intensive supervised teaching internship, several courses in college science teaching, plus a research requirement called the "scholarly activity." The teaching internship component of the DA program is typically done at the Idaho State University campus or at another college or university that stresses the importance of undergraduate teaching and provides a stimulating teaching/learning environment for the graduate student intern. The internship is supervised and evaluated by a biology professor at the host school.

Table 2. A comparison of structured and unstructured GTA training models.

	No. of Graduate Programs	
	masters	*doctoral*
Model I (unstructured GTA training)	(45) 62%	(30) 37.5%
Models II–V (structured GTA training)	(28) 38%	(50) 62.5%

Graduates from the Doctor of Arts program at Idaho State have been well received as college teachers by the professional community. Over 60 students have graduated from this program and over 90% of the graduates have acquired teaching positions at either community colleges, four-year colleges, or universities. Several of these graduates have also moved into administrative positions.

Comparisons of GTA Training Models

An interesting comparison (Table 2) can be made between the unstructured approach (Model I) and the structured approaches (Models II–V) to training GTAs.

Clearly, a high percentage of graduate training programs in biology lack formal structure. However,

it should be noted that unstructured GTA training predominates in masters programs while more structured teacher training is the dominant model in the doctoral programs. Greater structure at the doctoral level might reflect a higher level of commitment to GTA training in programs that are more likely to produce the professoriate.

In Summary

Even when there is some formal structure in the GTA training program such as workshops, seminars and courses, these experiences are often brief and follow-up activities are loosely defined or non-existent. Many biology professors in colleges and universities have had limited opportunities to develop their teaching skills during their graduate programs. They also find limited opportunities in their current teaching situations. If Ernst Boyer (1990) is correct that teaching should be considered an important part of scholarship on par with original research, application and integration at all college teaching institutions, then it seems that we are falling far short of the kinds of meaningful pedagogical experiences that should be made available by graduate schools for the future biology professoriate. Post-secondary education in the United States is considered outstanding throughout the world, but there is a need for improvement in the preparation of college biology teachers. Biology graduate schools must strive to develop programs that produce graduates competent in both teaching and research in the biological sciences.

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